VOLUME 1 MAIN REPORT JULY 2011

AGL Dalton Power Project Environmental Assessment

MP10-0035

URS

AGL

Switched on Business.

Statement of Validity

Submission of Environmental Assessment

Prepared under Part 3A of the *Environmental Planning and Assessment Act* 1979

Environmental Assessment prepared by

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Address URS Australia Pty Ltd
Level 4
407 Pacific Highway
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Application No. **MP10-0035**

In respect of

Applicant & Land Details

Applicant AGL Energy Limited
Level 22, 101 Miller St
NORTH SYDNEY NSW 2060

Subject Site Approximately 508 hectare site located off Walshs Road, approximately 4km north of the town of Dalton, in the Upper Lachlan Shire Council local government area

Lot & DP Lot 115,249,252,253,305,307 in DP754111,
Lot 14, 183,184,187,200,283,306 in DP 754111;
Lots 1 & 2, DP 126122,
Lot 116, 321, 322, 162, 317, 318 in DP754111
Lots 21,186 and 251 in DP754111;
Lot 1 DP 126119, Walshs Road easement
Lots 30 and 31 in DP754111

Project Summary Construction of a gas fired power station, in stages, with the initial stage comprising between two and four open cycle gas turbines with a capacity of between 250 and 750 megawatts and the ultimate stage comprising a facility with a capacity of up to 1,500 megawatts. Construction of gas pipeline, access road and transmission line connection.

Environmental Assessment

An Environmental Assessment is attached.

Declaration

I certify that I have prepared the contents of the Environmental Assessment in accordance with the requirements of the *Environmental Planning and Assessment Act* 1979 and Regulation and that, to the best of my knowledge, the information contained in this report is not false or misleading.

Signature

Name **Kathryn Tinker** Nicole Brewer

Date July 2011

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Study Team

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Volume 2 – Appendices

Volume 2 Part 1

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Appendix D Plume Rise Assessment
Appendix E Greenhouse Gas Assessment
Appendix F Transport Impact Assessment
Appendix G Noise Impact Assessment

Volume 2 Part 2

Appendix H Flora and Fauna
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Appendix J PHA
Appendix K Landscape and Visual

Notes on Text

As a determination of the project will only be made after the Environmental Assessment has been on public display and submissions considered, the future conditional tense is used throughout this Environmental Assessment when describing the project, alternatives and assessing impacts. “Would” is, therefore, used throughout the text in preference to “will”.

If all approvals are given for the project to proceed, all “would” references should be interpreted as “will”, subject to final conditions of consent.

Making a Submission

Submissions from members of the public, government agencies and interest groups are invited and sought in response to this Environmental Assessment. This submission should include:

- your name and address;
- the name and application reference number (MP 10_0035) of the proposal;
- a statement on whether you support or object to the proposal; and
- the reasons why you support or object to the proposal.

Your submission should be addressed to:

Director, Major Infrastructure Assessment
Department of Planning
GPO Box 39
SYDNEY NSW 2001

Fax: (02) 9228 6355
Email: Ingrid.Ilias@planning.nsw.gov.au

Under section 75H of the EP&A Act, the Director-General is required to provide copies of submissions received during the exhibition period, or a report of the issues raised in those submissions, to the Proponent and other interested public authorities. If you do not want your contact details to be made available to the Proponent or these public authorities, please state this in your submission.

Abbreviations

AADT	Annual Average Daily Traffic
ABS	Australian Bureau of Statistics
AEMO	Australian Energy Market Operator
AGL	Australian Gas Light Company
AGO	Australian Greenhouse Office
AHIMS	Australian Heritage Information Management System
AHC	Australian Heritage Commission
AHD	Australian Height Datum
ANEPM	National Environment Protection Measure for Ambient Air Quality
ANZECC	Australia and New Zealand Environment and Conservation Council
APZ	Asset Protection Zone
ARI	Annual Recurrence Interval
AWS	Automatic Weather Station
BCA	Building Code of Australia
BoM	Bureau of Meterology
CASA	Civil Aviation and Safety Authority
CBNTCG	Cubbitch Barta Native Title Claimant Group
CCGT	Combined Cycle Gas Turbine
CEMP	Construction Environmental Management Plan
CFC	Chloro-Fluorocarbons
CO_2	Carbon dioxide
CO_2-e	Carbon dioxide equivalent
DA	Development Application
DCP	Development Control Plan
DEC	Department of Environment and Conservation (now known as Office of Environment and Heritage)
DECC	Department of Environment and Climate Change (now known as Office of Environment and Heritage)
DECCW	Department of Environment, Climate Change and Water (now known as Office of Environment and Heritage)
DoP	Department of Planning (now known as the Department of Planning and Infrastructure (DoPI))
DP	Deposited Plan
DoPI	Department of Planning and Infrastructure
EA	Environmental Assessment
ECMT	European Conference of Ministers of Transport
ECRTN	Environmental Criteria for Road Traffic Noise
EMF	Electric and Magnetic Field
EMP	Environmental Management Plan
EMS	Environmental Management Systems
ENCM	Environmental Noise Control Manual

Abbreviations

EP&A Act	NSW *Environmental Planning and Assessment Act* 1979
EPA	NSW Environment Protection Authority
EPBC Act	Commonwealth *Environment Protection and Biodiversity Conservation Act* 1999
EPI	Environmental Planning Instrument
ERC	Emission Reduction Credits
ESD	Ecologically Sustainable Development
FDI	Fire Danger Index
GT	Gas Turbine
HAZID	Hazard Identification
HIPAP	Department of Planning's Hazardous Industry Planning Advisory Paper
HHV	Higher Heating Value
INP	Industrial Noise Policy (EPA, 2000)
IPA	Inner Protection Area (*Planning for Bush fire Protection* RFS (2006))
IPCC	International Panel on Climate Change
ISO	International Standards Organisation
LALC	Local Aboriginal Land Council
LEP	Local Environmental Plan
LGA	Local Government Area
LHV	Lower Heating Value
LoS	Level of Service
MSDS	Material Safety Data Sheet
MSL	Mean Sea Level
NA	Not Applicable
NEM	National Electricity Market
NEMMCO	National Electricity Market Management Company
NEPC	National Environment Protection Council
NEPM	National Environment Protection Measure
NGRS	National Greenhouse Response Strategy
NHMRC	National Health and Medical Research Council
NO_2	Nitrogen Dioxide
NO_x	Oxides of Nitrogen
NP&W Act	NSW *National Parks and Wildlife Act* 1974
NSW	New South Wales
O_3	Ozone
OCGT	Open Cycle Gas Turbine
OEMP	Operation Environmental Management Plan
OLALC	Onerwal Local Aboriginal Land Council
OPA	Outer Protection Area *(Planning for Bush fire Protection* RFS (2006))
PAD	potential archaeological deposit
PAH	Polycyclic Aromatic Hydrocarbons
PASS	Potential Acid Sulphate Soils

Abbreviations

PBP	*Planning for Bush fire Protection* RFS (2006)
PFM	Planning Focus Meeting
PHA	Preliminary Hazard Analysis
PM_{10}	Particles effectively less than 10μm diameter
$PM_{2.5}$	Particles effectively less than 2.5μm diameter
POEO Act	NSW *Protection of the Environment Operations Act* 1997
REP	Regional Environmental Plan
RET	Renewable Energy Target
RFI Act	NSW *Rivers and Foreshores Improvements Act* 1948
RNE	Register of the National Estate
ROTAP	Rare or Threatened Australian Plants
RPM	Revolutions per Minute
RTA	NSW Roads and Traffic Authority
SCAQMD	South Coast Air Quality Management District
SCR	Selective Catalytic Reduction
SEDA	Sustainable Energy Development Authority
SEPP	State Environmental Planning Policy
SEWPAC	The Australian Government Department of Sustainability, Environment, Water, Population and Communities
SIS	Species Impact Statement
SO_2	Sulphur dioxide
SO_2	Sulphur Oxides
TAPM	The Air Pollution Model
TOC	Total Organic Carbon
TPH	Total Petroleum Hydrocarbons
TSC Act	NSW *Threatened Species Conservation Act* 1995
TSP	Total suspended particulate
TSP Act	NSW Threatened Species Act 1995
TSS	total suspended sediment
VOC	Volatile Organic Compound
WM Act	Water Management Act 2000

Abbreviations

UNITS	
µm	Microns
Cm	centimetres
G	Grams
GL	Gigalitre (10^9 L or 10^6 m^3)
GWh	Gigawatt Hour
ha	hectare
Hr	Hour
Hz	Hertz
Kg	Kilograms
KJ	Kilojoules
KL	Kilolitre (10^3 L or 1 m^3)
Km	Kilometre
Km/hr	Kilometres per hour
KPa	Kilopascals
KV	Kilovolts
KW	Kilowatts
M	Metres
Mg	Milligrams
m^2	square metres
m^3	cubic metres
MHz	Megahertz
ML	Meglitre (10^6 L or 10^3 m^3)
MW	Megawatts
Pa	per annum
Ppm	Parts per million
Pmpy	per million per year
S	second
Sg	Density
T	Tonne
Yr	Year

Glossary

Aboriginal archaeological site (Aboriginal site)	A place where physical remains or modification of the natural environment indicate past and 'traditional' activities by Aboriginal people. Site types include artefact scatters, isolated artefacts, burials, shell middens, scarred trees, quarries and contact sites.
acid sulphate soils (ASS)	Soils containing pyrite which produces sulphuric acid when exposed to oxygen.
ambient	Surrounding environment.
ambient noise	The all-encompassing sound at a site comprising all sources such as industry, traffic, domestic, and natural noises. This is represented as the L_{Aeq} noise level in environmental noise assessment. (See also L_{Aeq})
Approved Methods	*Approved Methods and Guidance for the Modelling and Assessment of Air Pollutants in NSW* (DEC, 2005)
aquifer	Rock formation containing water in recoverable quantities.
background scatter	Aboriginal artefacts that cannot be usefully related to a place or focus of past activity.
biodiversity	First coined in 1988 as a contraction of biological diversity; diversity traditionally referring to species richness and species abundance. Biodiversity has been defined subsequently as encompassing biological variety at genetic, species and ecosystem scales (DASETT 1992). The maintenance of biodiversity, at all levels, is acknowledged internationally as a high conservation priority, and is protected by the International Convention on Biological Diversity 1992.
Biobanking	The NSW Government is introducing the Biodiversity Banking and Offsets Scheme (or 'BioBanking') to help address the loss of biodiversity values, including threatened species. BioBanking is a market-based scheme that provides a streamlined biodiversity assessment process, a rigorous and credible offsetting scheme. BioBanking enables 'biodiversity credits' to be generated by landowners who commit to enhance and protect biodiversity values on their land through a biobanking agreement. The details of the scheme have not yet been finalised.
bunds	An earthwork or wall to contain and control spillages, normally associated with tank farms, fuelling and chemical storage facilities.
burial site	Usually a sub-surface pit containing human remains and sometimes associated artefacts.
Bush fire Guideline	*Planning for Bush fire Protection (RFS 2006)*
CO_2-e	The carbon dioxide equivalent relates to the greenhouse warming potential (GWP) of a certain gas compared to that of carbon dioxide where carbon dioxide has a GWP of 1. For example, methane (CH_4) has a GWP of 21, meaning that a release of 100 tonnes of CH_4 would be the equivalent to releasing 2100 tonnes of CO_2 in terms of global warming.
Construction Environmental Management Plan	An element of an Environmental Management Plan that addresses the control, training and monitoring measures to be implemented during the construction phase of a project in order to avoid, minimise or ameliorate potentially adverse impacts identified during environmental assessments.
conservation	The management of natural resources in a way that will benefit both present and future generations.
cumulative effect	Refers to the accumulation of effects over time.

Glossary

dB(A)	The A-weighting has a frequency response corresponding approximately to that of human hearing. People's hearing is most sensitive to sounds at mid frequencies (500 Hz to 4000 Hz), and less sensitive at lower and higher frequencies. Thus, the level of a sound in dBA is a good measure of the "loudness" of that sound. Different sources having the same dBA level generally sound about equally as loud, although the perceived loudness can also be affected by the character of the sound (eg the loudness of human speech and a distant motorbike may be perceived differently, although they are of the same dBA level).
dB(C)	The C-Weighting has a relatively flat response. C- weighting is used in evaluating annoying community noises such as low frequency sound.
Ecologically Sustainable Development	Using, conserving and enhancing the community's resources so that ecological processes, on which life depends, are maintained and the total quality of life, now and in the future can be increased.
ecosystem	An interdependent system of interacting plants, animals and other organisms together with the non-living (physical and chemical) components of their surroundings.
effluent	The outflow of liquid e.g. from sewage or an industrial process.
emergency response	The reaction by emergency services such as Fire, Police, Ambulance, Industrial Fire Brigades, etc., to an emergency.
endangered species	Those plants and animal species likely to become extinct unless action is taken to remove or control the factors that threaten their survival.
environment	The physical, biological, cultural, economic and social characteristics of an area, region or site.
Environmental Assessment	The orderly and systematic evaluation of a proposal, including alternatives and objectives, and its effects on the environment, including the mitigation and management of these effects.
environmental management	That part of the overall management system which includes organisational structure, planning activities, responsibilities, procedures, processes and resources for developing, implementing, achieving, reviewing and maintaining environmental policy. (Refer to related term Environmental Management System).
Environmental Management Plan	The control, training and monitoring measures to be implemented during the design, construction and operation phases of a project in order to avoid, minimise or ameliorate potentially adverse impacts identified during environmental (being socio-economic, cultural, physical, biological) assessments. Prepared within the framework of Defence policies, objectives, strategies and actions.
Environmental Management System	The concept and major components of an Environmental Management System (EMS) are set out in the Australian/New Zealand Standard (AS/NZS) ISO 1400l. An EMS has several key components as set out below: organisational commitment, corporate environmental policy, environmental aspects register, objectives and performance indicators, environmental management program documentation (often called an Environmental Management Plan or EMP), operational and emergency procedures, responsibility and reporting structure, training and awareness program, environmental impact, regulatory and legal compliance, and environmental performance review audits performance monitoring and measurement.

Glossary

fauna	Animals.
fire fence	A gap in vegetation or fuels which prevents or hinders the spread of fire.
flora	Plants.
floristic composition	The plant species present in a particular community, sub-community or site.
free ammonia	The toxic fraction of ammonia (NH_3) that is undissociated and therefore available for uptake by organisms. The usual source of ammonia to waterways is domestic sewage and industrial effluents.
geotechnical	Relating to the form, arrangement and structure of the geology.
GGAS	The Greenhouse Gas Reduction Scheme (GGAS) commenced on 1 January 2003. It is one of the first mandatory GHG emissions trading schemes in the world and is specifically associated with the electricity generation sector. GGAS aims to reduce GHG emissions in NSW by 5% per capita below 1989/90 levels by 2007, by encouraging project based activities to offset the production of GHG emissions.
geotechnical	Relating to the form, arrangement and structure of the geology.
Greenhouse Gas	A gas which has an effect on the radioactive absorptivity of the earth's atmosphere and the atmosphere's temperature.
Greenhouse Challenge Plus	The programme integrates the Generator Efficiency Standards and the Greenhouse Friendly TM initiative into a single industry programme, focused on reducing greenhouse gas, promoting energy efficiency, integrating greenhouse issues into decision making and allowing for a consistent manner for reporting greenhouse gas emissions.
Greenhouse Effect	Predicted global climatic change (e.g. global warming) associated with build up of certain gases (such as water vapour, carbon dioxide, methane, chloroflurocarbons, ozone, nitrous oxide, etc.) within the atmospheric environment of the earth. These are known as Greenhouse Gases.
Greenhouse gas intensity	the amount of greenhouse gases per unit of energy produced from a power station (eg in units of kg CO_2-e/MWh)
groundwater	Subsurface water contained within the saturated zone.
heritage (cultural heritage)	A term which encompasses Aboriginal and post-contact archaeological sites and material remains (cultural resources).
higher heating value	The heat content of fuel, measured in a bomb calorimeter when the products of combustion are cooled to the initial temperature and all of the water vapour formed during combustion is condensed to liquid. This gives the gross, or higher heat content of the fuel, which includes in the reported value the heat of vaporisation of the water produced from combustion of hydrogen atoms in the fuel. The lower heating value excludes the heat of vaporisation of the water produced from combustion of hydrogen atoms in the fuel.
Hydrocarbons	A class or compounds containing only carbon and hydrogen in various structures. Both naturally occurring and from anthropogenic sources.
Hydrology	Surface water and groundwater and their interaction with earth materials.
Hydrogeology	The study of subsurface water in its geological context.
INTANAL	Specialist traffic model for intersection analysis
Invertebrate	An animal without a backbone.
Isolated find	Single stone artefact, not located within a rock shelter which occurs without any associated evidence of Aboriginal occupation within a radius of 60 m.

Glossary

L_{A1}	The noise level exceeded for 1% of the 15 minute interval.
L_{A10}	The noise level exceeded for 10% of the 15 minute interval. This is commonly referred to as the average maximum noise level.
L_{A90}	The LA90 level is the noise level which is exceeded for 90% of the sample period. During the sample period, the noise level is below the LA90 level for 10% of the time. This measure is commonly referred to as the background noise level.
L_{Aeq}	The equivalent continuous sound level (LAeq) is the energy average of the varying noise over the sample period and is equivalent to the level of a constant noise which contains the same energy as the varying noise environment. This measure is also a common measure of environmental noise and road traffic noise.
$L_{Aeq\ (1hr)}$	The LAeq noise level for a one hour period.
$L_{Aeq\ (15\ hr)}$	The LAeq noise level for the period 7am to 10pm.
$L_{Aeq\ (9\ hr)}$	The LAeq noise level for the period 10pm to 7am.
L_{eq}	The equivalent continuous sound level in dB(A); that is, the constant sound level which has the same acoustic energy as the original fluctuating noise for the same period of time.
Level of Service	A description of the operating performance of a road or intersection as defined in Austroads 'Guide to Traffic Engineering Practice, Pt 2 – Road Capacity.'
Lithologies	Rock types
Lower heating value	The heat content of fuel, measured in a bomb calorimeter when the products of combustion are cooled to the initial temperature and all of the water vapour formed during combustion is condensed to liquid. The lower heating value excludes the heat of vaporisation of the water produced from combustion of hydrogen atoms in the fuel.
mean	The sum of n values divided by n.
median	The middle value of a set of values.
middens	Evidence of Aboriginal occupation of an area.
monitoring	The checking of impacts of a proposal or an existing activity in order to improve or evaluate environmental management practices. To check the efficiency and effectiveness of the environmental impact assessment process. To determine if the requirements of environmental legislation and associated regulations are being met.
native vegetation	A broad term for vegetation comprised of plant species which occur naturally in Australia (but which are not necessarily indigenous).
natural gas	Combustible gas formed naturally in the earth.
Organochlorines	A group or organic chemicals used in pesticides. Most organochlorine pesticides have low water-solubility, but high chemical and biological stability. They are fat soluble and tend to accumulate in the fat tissue of organisms.
Operation Environmental Management Plan	An element of an Environmental Management Plan that addresses the control, training and monitoring measures to be implemented during the construction phase of a project in order to avoid, minimise or ameliorate potentially adverse impacts identified during environmental assessments.
Ozone	A form of oxygen having three atoms to the molecule. Ozone is a powerful oxidising agent.

Glossary

Particulate	Small particles, usually in suspension.
Petroleum hydrocarbons [total petroleum hydrocarbons (TPH)]	A class of organic compounds arising from unburnt fuel sources.
Piles	Type of foundation using columns of concrete, steel or timber.
Plume	Area of impact extending from a source.
Polycyclic aromatic hydrocarbons (PAH)	A class of organic chemicals, PAHs are formed by incomplete combustion or organic material, diagenesis (during or throughout generation) and biosynthesis. PAHs are naturally occurring, however, a significant proportion are the result of anthropogenic combustion.
potable water	Water suitable for drinking.
potential acid sulphate soil (PASS)	Soil material which is waterlogged and contains oxidisable sulphur compounds, usually iron sulphide (pyrite) that has a field pH of 4 or more (1:5 soil:water).
Rating Background Level (RBL)	A single number representing the median value of the ABL values of each assessment period over all of the monitoring days.
Register of the National Estate	A list of the National Estate developed under the provisions of the Commonwealth's Australian Heritage Commission Act 1975.
risk	Likelihood of a specific undesirable event occurring within a specified period or in specified circumstances. Listed as a frequency or probability.
risk assessment	A process used to determine whether people and the environment are at risk (e.g. health and safety) from exposure to hazardous substances used or produced (mainly in an industrial or work place) so that appropriate control measures or management practices can be introduced to prevent or minimise the risk.
security fence	A fence designed to prevent unlawful intrusion to a prohibited area.
sediment/detention pond	Artificial earthen depression to retain water runoff for a period of time so as to control high intensity runoff.
sustainable use	Use of organism, ecosystem or their renewable resource at a rate within its capacity for renewal.
TAPM	The Air Pollution Model is an air quality dispersion model developed by the Commonwealth Scientific Investigation & Research Organisation.
terrestrial	Of or pertaining to the land as distinct from the water.
thermal efficiency	The proportion of energy converted from the fuel to electricity in the generation process is an indication of CO_2 emissions.
total aromatic hydrocarbons	A class of organic chemicals which contain an aromatic ring (e.g. benzene, anthracene, naphthalene and their derivatives). Used in chemical and pharmaceutical industries.
total organic carbon (TOC)	The amount of carbon in the organic form contained in a sample, measured as a percentage.
total suspended solids (TSS)	Total load of particulates in water, measured in mg/L.
turbidity	Liquid's ability to intercept light. Measured in nephelometric turbidity units (NTU). Cannot be consistently correlated with the concentration of suspended matter.
visibility	Measure of extent to which particular components of a development may be visible from surrounding areas.
visual absorption capacity	An estimation of the capacity of the landscape to absorb development without creating a significant change in visual character or producing a reduction in scenic quality.

Glossary

volatiles	Any chemical compound which will evaporate quickly due to its low boiling point.
vulnerable species	Those that may soon become endangered unless action is taken.
waders	Synonymous with shorebirds.
weed	Naturalised, non-indigenous plant species which may be noxious weeds (or agriculture), environmental weeds or any other generally undesirable introduced species.
wetlands	Areas largely inundated with water, yet offering elevated land as a habitat for wildlife, notably waterfowl. Can be landlocked.
wind climate	A description of the meteorological conditions created by the wind involving measurements of wind speed, direction and frequency of gusts for average, seasonal and annual conditions.

Executive Summary

Introduction

AGL is seeking Project Approval to construct and operate a gas turbine power plant up to a nominal 1500 megawatt (MW) capacity on a site near Dalton. The proposal is referred to as the 'Dalton Power Project'. The Dalton Power Project would be constructed in two stages, and would involve the installation of up to six gas turbines. AGL are seeking approval for both stages of the Project as part of this current application.

It is envisaged that the power station would operate in open cycle mode during times of peak electricity demand, typically for less than 15 % of the year. The gas turbines would burn natural gas only. The Project also includes construction and operation of a gas pipeline connecting the Moomba to Sydney Gas Pipeline, access road for the Facility and transmission connection within the site.

The Dalton Power Project is proposed by AGL to address the rising peak demand for electricity in NSW and complement the introduction of renewable energy sources such as wind, which often have intermittent output. The objective of the proposal is to generate electricity at peak demand periods, times of reduced renewable energy generation and to allow AGL to manage supply of electricity to its large number of retail, commercial and industrial customers. The Dalton area is favourably suited for gas-fired generation as it has superior transmission access and access to the Moomba to Sydney Gas Pipeline.

The Minister for Planning is the consent authority for the Dalton Power Project as determined by the relevant legislation. This Environmental Assessment has been prepared in accordance with the requirements of Part 3A of the *Environmental Planning and Assessment Act 1979* (*EP&A Act*) to provide the Minister for Planning with the required information to determine the environmental impacts and benefits of the Dalton Power Project. As Environmental Assessment Requirements were notified for the Project on 19 April 2010, the Project is a transitional Part 3A Project for the purpose of the Part 3A Repeal Act and Part 3A will continue to apply.

This Executive Summary provides a brief description of the key outcomes of the environmental assessment as detailed in each of the chapters.

Project Need and Justification

The Dalton Power Project is consistent with NSW Government policy indicating a preference for private investment in electricity generation. Peaking power generation enables AGL to manage its cost of electricity sold to consumers and minimises market exposure along with providing rapid start up generation capacity at times of reduced supply or generation capability from other plants or sources.

The NSW Government's *Energy Directions Green Paper* (2004) and Australian Energy Market Operator (AEMO) *Statement of Opportunities* (2010) predict that over the next decade rising electricity demand from the whole of NSW will exceed existing generation capacity. To meet the immediate growth in demand for electricity, a number of additional power plants will be required.

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The proposed Dalton Power Project would contribute positively to the NSW electricity market by providing a peaking plant to service demand in addition to minimising AGL's market exposure and complementing the introduction of intermittent renewable generation sources into the NSW electricity market.

Other factors that determine the project need and timing include the wholesale supply position of AGL. This is influenced by AGL's ability to hedge market exposure through contracting. As the time approaches where demand equals supply, the wholesale price of electricity to AGL potentially rises, sometimes dramatically, while sales to consumers remain at a fixed, regulated price. This affects the contract market and increases the cost of electricity for AGL that it supplies to consumers. The Dalton Power Project is fundamental to allowing AGL to continue to supply electricity to consumers at a competitive price.

In order to reduce its exposure to electricity price volatility, AGL seeks to construct and operate a gas fired power station to mitigate against potential substantial losses during times of high price. The operating cost of gas peaking generation plant is higher than the other technologies such as coal fuelled power stations meaning that it will be less economic to run at times when prices are not high. For this reason, more cost efficient power plants will be constructed to meet intermediate and base load electricity demand.

The expansion of the Federal Governments Renewable Energy Target (RET) is resulting in increased penetration of renewable energy sources such as wind and solar generation. Most of these renewable sources rely on a variable and uncontrollable natural resource (ie wind and solar energy) and are not assured to be available at times of high electricity demand or price. Complementary and controllable generation sources are needed to support the renewable energy generation sources. Gas fuelled turbines operating in open cycle arrangement are the most efficient and environmentally friendly method of complementing uncontrollable renewable generation sources.

Open cycle gas turbines are able to be quickly started and stopped (typically less than 30 minutes from off to full output) meaning they are not required to operate constantly like thermal power stations, which typically take up to eight hours to start from cold and as a result are rarely turned completely off.

This form of generation allows AGL to meet times of high demand and manage commercial risks associated with high price. If AGL's generation portfolio had only renewable energy sources of electricity and there was a high electricity price, then AGL could be exposed to paying the high prices. The development of the Dalton Power Station is part of AGL's strategy to mitigate commercial risk, so that AGL can supply it's customers at time of high prices.

AGL has demonstrated that it is prepared to invest in low emissions and renewable energy technology through its previous generation activities involving:

- the acquisition of hydro assets from Southern Hydro in Victoria;
- acquisition of the 1280 MW natural gas fired Torrens Island Power Station;
- construction of the 95 MW Hallett wind farm in South Australia;
- construction of the 71.4 MW Hallett II wind farm in South Australia;

- construction of the 63 MW Oaklands Hill windfarm in Victoria; and
- construction of the 130 MW Bogong Hydro Project in Victoria;
- construction of the 420 MW Macarthur wind farm in Victoria; and
- development of the approximately 150 MW Ben Lomond wind farm in NSW (Site under option; permitting ongoing).

Project Alternatives

A range of alternatives for plant, proposed location and water sources were considered. Operation of gas turbines in open cycle mode was found to be preferable to combined cycle gas turbines and coal fired generation for meeting peak electricity demand while renewable technologies are not conducive to meeting peak demand requirements. Natural gas is a clean burning fuel and has comparatively low greenhouse gas emissions. In terms of alternate power generation technologies, open cycle gas turbines present the best balance of outcomes between the imperatives of climate change mitigation and meeting peak electricity demand while managing the price of electricity for end use consumers.

NO_x emissions would be controlled through implementation of Dry Low NO_x technology, reducing NO_x emissions by about 88 %. Alternative NO_x emission control technologies such as catalytic combustion and selective catalytic reactor are not suitable for this application due to technology constraints. Other viable mechanisms for NO_x offset and reductions would be regulatory policy, namely a NO_x cap and trade scheme. Given the anticipated introduction of the Emission Trading Scheme to reduce greenhouse gas emissions, a similar framework for NO_x emissions would allow a consistent approach in addressing emissions reduction and also provide a 'level playing field' for all emission sources.

AGL has undertaken a comprehensive review of existing gas turbine developments in Australia and has also reviewed more than 12 alternative sites for the proposed development in NSW. Network connections, existing land uses and environmental constraints were reviewed as part of the Project's siting investigation, and the Dalton area remains the preferred region due to the proximity of the Site to demand, the existing concentration of infrastructure, and the appropriate site setback from neighbouring properties and communities. Following additional analysis of alternate sites in NSW and existing facilities in Australia, locating a gas turbine peaking power plant in the Dalton region is acceptable based on predicted environmental impacts. Strategically, the Site provides a location for reliable electricity generation at peak times to the key demand centre of NSW.

A number of locations within the AGL Site Boundary were reviewed before a specific location was selected based on providing a balanced outcome mitigating the impact on surrounding landowners and the environment. The Development Site has a rural zoning and the Dalton Power Project is permissible within this land use zone.

The location of the proposed footprint (about 26 ha in size within a total Site area of 508 ha) was determined as a balanced outcome between competing interests of various landowners, environmental considerations and cost considerations. Alternatives were also considered for the location of the access road and gas pipeline, as well as for the communications tower and related hut,

access track and services easement connecting these elements to the Facility. The proposed location of this infrastructure balances the ecological and engineering constraints.

A number of options are being considered for water sources and water treatment, and as described throughout the Environmental Assessment, further approvals would be sought by AGL as appropriate for any component not fully addressed at this time..

Project Description

AGL proposes to construct and operate a gas turbine power station with a nominal generating capacity of up to 1500 MW. Each gas turbine unit includes the gas turbine, a generator and a high voltage transformer with air coolers and filters on the inlet. A gas receiving and conditioning station (within the Site) would be required to ensure flow and pressure control, isolation and filtration.

Stage 1 would initially result in the construction of a gas turbine power station with a nominal generation capacity of between 250 and 780 MW. The first stage would consist of the installation of two to four “E” class turbines, or two to three “F” class units. Each “E” class turbine would have a capacity of between 125 and 200 MW each run in open cycle mode, and each “F” class turbine would have a nominal generation capacity range between 200 and 320 MW.

At a later stage (likely to be initiated by the proposed upgrade by TransGrid of the 330 kV transmission line from the Bannaby substation to Yass), Stage 2 of the Project would involve the incorporation of additional open cycle gas turbine units into the power station to bring the maximum number of turbines to six, and the total maximum generating capacity to 1500 MW for the complete Dalton Power Project for which AGL is seeking approval.

The Facility may be operated remotely with staff working during day shifts and on call at other times. During operation, between five and ten staff would be employed. Construction for each stage would occur over a 24 month period. Each gas turbine unit comprises the turbine itself, a generator and a high voltage transformer with air filters on the inlet. A gas receiving and conditioning station would be required for pipeline connection to ensure flow, temperature and pressure control and filtration.

The constituent elements of the Dalton Power Project would include the proposed power station; an approximately 3 km lateral gas pipeline connection from the power station to an existing natural gas supply pipeline located to the south of the Site; access road to the Site, a communications tower and related hut, connected to the Facility via underground services, and an access track and a connection between the power station and the existing high voltage transmission system on Site requiring one or two transmission towers within the existing 330 kV transmission line easement.

The Project would involve the construction and operation of the following infrastructure:

Gas Pipeline (northern portion) and Access Road

The Facility would be fuelled by natural gas from a lateral gas pipeline connection to the Moomba to Sydney Gas Pipeline to the south of the Site. The northern portion of this pipeline into the Facility would be developed within a shared easement with a new road to be constructed from the intersection

of Walshs Road where the road makes a right angle turn west. The length of the gas pipeline (northern portion) and access road would be 1.9 km (to the edge of the Facility footprint) and the maximum area of the easement footprint would be approximately 4.2 ha. The width of this shared easement and ranges between 10 and 45 m in width, and would require the permanent removal of some vegetation.

Gas Pipeline (southern portion) and Valve Station

The southern portion of the gas pipeline would be constructed within the easement of the existing Walshs Road reserve. The southern portion of the gas pipeline would extend from a proposed valve station adjacent to the Walshs Road easement to the Moomba to Sydney Gas Pipeline, and would connect with the northern portion of the gas pipeline into the Facility where the proposed new road meets Walshs Road. The length of the gas pipeline (southern portion) would be 1.1 km and the maximum area of the easement footprint would be 0.6 ha (or 0.8 ha including the valve station).

The gas pipeline (northern and southern portions) would be an underground line (except at entry and exit points) and would be located within an easement of approximately 5 m.

AGL proposes the construction of a valve station as the connection point from the Moomba to Sydney Gas Pipeline. The valve station would be set back 25 m from Walshs Road and would occupy and area of approximately 0.22 ha. The area would be fenced off from public access.

Communications Tower Infrastructure

A communications tower would require construction and establishment beyond the Facility footprint. The tower would be approximately 60 m in height, and would be located on an elevated area approximately 1.5 km to the east of the Facility. The tower would be connected to the Facility via underground services and a new access track.

Electrical Infrastructure

The electricity generated by the Facility would be fed into the high voltage transmission network located within the Site via a new connection facility built in stages. To facilitate this connection, one or two additional transmission towers would require construction within the existing 330 kV transmission line easement. The positioning of the tower(s) would be determined during the detailed design stage. The structure(s) would be in the height range of 30 – 40 m and would be located within the existing transmission line easement which forms part of the southern boundary of the Development Footprint.

Other Project Components

Some small amounts of chemicals and oil would be required on-site for use in the Dalton Power Project. Chemical storage would comply with statutory requirements. Water would be stored on-site in tanks for process, domestic and fire fighting uses.

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Water and Wastewater Management

The Facility has a small essential water demand, comprising domestic water, utility water and firewater water. In addition it has a discretionary process water demand to improve turbine efficiency. While the Facility can run without process water, it is desirable that it be supplied to allow the turbines to operate significantly more efficiently.

Water for the Project will be sourced through a number of options including tankering of water to the Site (by road); groundwater extraction; and via the augmentation of the Dalton or Gunning supply and/or from the Gunning Sewerage Treatment Plant if the water quality is suitable and sufficient water quantities are available. It is currently proposed that the site water supply will be offsite tankering to meet the essential base domestic and utility water demands, and some or all of the process water demands (depending upon the development option adopted). AGL also proposes to obtain water from on site groundwater extraction to meet the full nominated site water supply requirements. Water may also be obtained from Upper Lachlan Shire Council water supplies.

During further design and development of the power station, further investigations will be conducted on the additional water supply options, with on-site groundwater extraction and/or Upper Lachlan Shire Council water supplies the current preferred options, to meet the full nominated site water supply requirements. The final arrangements would be subject to further feasibility assessment.

Statutory Planning

The Dalton Power Project is subject to the development and assessment processes and requirements of Part 3A of the *Environmental Planning and Assessment 1979* (EP&A Act) and is also considered to be a "critical infrastructure project" under Part 3A of the EP&A Act. A Project Application was accepted by the DoP on 25 March 2010, including a revised Preliminary Environmental Assessment. On 19 April 2010 the Environmental Assessment Requirements were issued.

The Project also triggers the Commonwealth EPBC Act. The potential impacts to Endangered Ecological Communities were the focus of an EPBC referral submitted for determination by the Commonwealth Minister for Sustainability, Environment, Water, Population and Communities. On 15 June 2010, the Project was determined to be a Controlled Action by the Minister for Sustainability, Environment, Water, Population and Communities. (EPBC 2010/5484). Supplementary Director-General Requirements for the Project were provided on 5 July 2010.

Other licences and approvals required for the Project include:

- Environment Protection Licence under the provisions of the *Protection of the Environment Operations Act 1997*;
- Notification to WorkCover to Keep Dangerous Goods under the *Occupational Health and Safety Regulation 2001* for the storage and handling of notifiable quantities of dangerous goods; and
- Pipeline licence under the *Pipelines Act 1967*.

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The Development footprint encompasses and traverses land which is zoned RU2 Rural landscape and RU1 Primary Production under the Upper Lachlan Local Environment Plan 2010. The Dalton Power Project is permissible within these zones with development consent.

Consultation

Throughout the development of the Dalton Power Project, AGL has been committed to meaningful community and stakeholder engagement. AGL has worked in collaboration with relevant government agencies, Upper Lachlan Council, local landowners and the community since late 2008.

In accordance with the DGRs, consultation for the Project has targeted the following groups:

- State government agencies;
- Upper Lachlan Shire Council;
- Local Aboriginal Land Council;
- affected land owners; and
- other community stakeholders.

AGL is committed to maintaining regular contact with the regulatory authorities, neighbouring land owners, the Dalton community and other interested parties during the exhibition and assessment of the Project. Issues that have been raised by stakeholders to date have been taken into account where possible in the preparation of this Environmental Assessment.

Air Quality and Greenhouse Gas

Air Quality

The potential impact on air quality of the Project has been assessed using a largely conservative approach, in accordance with the DECCW (2005) *Approved Methods and Guidance for the Modelling and Assessment of Air Pollutants in NSW*. The pollutants assessed included nitrogen dioxide (NO_2), carbon monoxide (CO), sulphur dioxide (SO_2), particulate matter (PM_{10}) and formaldehyde. The dispersion modelling has. In order to assess the cumulative impact of the plant emissions on the local air quality, background concentrations of the criteria pollutants were obtained from the relevant OEH and TMS monitoring stations. The assessment used the Calpuff dispersion modelling package.

Given the quantity, velocity and temperature of the exhaust gases emitted from the exhaust stacks, open cycle gas turbine plumes can travel at high velocities through the atmosphere. Exhaust temperatures upwards of 500 degrees Celsius and exit velocities of around 40 metres per second enhance the dispersion characteristics of the plume and reduce the ground level impacts of pollutants.

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The results of the dispersion modelling showed that the predicted impacts on ground level concentrations of NO_2, PM_{10}, CO and SO_2, when added to peak background concentrations, were within the OEH regulatory criteria. In addition, the predicted incremental concentrations of formaldehyde were found to be within OEH criteria. This analysis has also assumed that all oxides of nitrogen (NO_x) exist as nitrogen dioxide.

Greenhouse Gas

A greenhouse gas assessment has been performed for the Facility, and has included scope 1, scope 2 and scope 3 emissions associated with natural gas combustion in the open cycle gas turbine generators, and the consumption of electricity from the electricity grid. The principal greenhouse gas emission from the Facility is carbon dioxide (CO_2), which is a product of natural gas combustion. Minor quantities of other greenhouse gases may be emitted and have been represented in this assessment, as carbon dioxide equivalent (CO_2-e). The assessment has considered four potential plant configurations, each with an average of operational time of 15 % of the year.

Total annual emissions were estimated to be in the range of 0.66 to 1.47 Million tonnes of carbon dioxide equivalent (Mt CO_2-e). The associated emissions intensity of generation was calculated to be approximately 800 kilograms of carbon dioxide equivalent per megawatt hour of electricity generated (kg CO_2-e/MWh).

Based on a project life of 30 years, the total lifetime emissions were estimated to be between 20.1 and 44.0 Mt CO_2-e.

A comparison of emissions from the Facility to state and national greenhouse gas inventories was also made. Emissions from the project were estimated to be in the range of 0.41-0.90 % and 0.11-0.25 % of the state and national inventories, respectively. In addition, emissions from the project were estimated to be in the range of 0.85-1.85 % and 0.23-0.49 % of stationary energy emissions from the state and national inventories, respectively.

A plume rise assessment was performed which showed that the peaking power plant would produce exhaust plumes with vertical velocities that exceed 4.3 m/s above the Obstacle Limitation Surface. Due to the predicted plume rise from the stack emissions, an aviation hazard analysis was also conducted. The aviation hazard analysis was compiled in accordance with the Civil Aviation Safety Authority's (CASA) Advisory Circular *"Guidelines for Conducting Plume Rise Assessments"* (June, 2004). A search of CASA registered aerodromes and unregistered landing strips indicated that there are no known landing strips within a 15 km radius of the Project site.

Whilst this assessment is considered conservative with respect to the modelled operating times and operating conditions, the Civil Aviation Safety Authority (CASA) may choose to designate this to be a potential hazard to aircraft operators in the area. Further consultation with CASA would be undertaken to ensure the Project is appropriately recognised as a potential aviation hazard.

Executive Summary

Soils, Geology and Groundwater

The Site lies within the Lachlan Fold Belt, and the Dalton area falls under the Lachlan Fold Belt Groundwater Management Unit. Previous sampling has indicated that the water table would be at some depth and below the proposed depth of excavation.

There is variation in soil depth and characteristics across the Site. Variations relate to the underlying geology, slope, position on the slope and ground water level and variations in ground water levels. Soils should be regarded as erodible and management measures would be implemented to limit erosion and off site sedimentation.

At present the Site is unmined. In the past the area around Gunning has been mined for gold, however the last recorded mining activity was in 1956. Therefore it is deemed unlikely that mine subsidence would affect the Site. However, Commissioners Gold hold an exploration permit over the area. No issues were raised by Commissioners Gold during consultation with them.

The mitigation measures and safeguards would ensure that soils and groundwater are satisfactorily managed using suitable design, construction and management.

Landscape and Visual Assessment

For the proposed Power Station layout, an assessment of the visibility rating for each potential view location indicated the following:

- a **NIL** visibility rating for 16 of the 34 view locations has been determined, while a **LOW** visibility rating has been determined for 18 view locations;

For the proposed Communication Tower infrastructure, an assessment of the visibility rating for each potential view location indicated the following:

- a **NIL** visibility rating for 15 of the 34 view locations has been determined, while a **LOW** visibility rating has been determined for 19 view locations; and

For the proposed Valve Station:

- a **NIL** visibility rating for 22 of the 34 view locations has been determined, while a **LOW** visibility rating has been determined for 12 view locations.

Given the extent and combination of existing natural and cultural character surrounding the Project, the capability of the landscape to absorb the key components of the Project is considered to be high.

Executive Summary

There are unlikely to be any significant views toward the power station from local roads or access tracks. Views are likely to be restricted to portions of the exhaust stacks and would be generally for a short duration where visible. All 19 view locations likely to be impacted by views towards the communications tower have been determined as having a low visibility rating for this feature. A significant consideration in the assessment has been that distant views toward the tower are likely to be influenced by atmospheric conditions which would tend to reduce the visibility of the tower.

External to the AGL Site boundary, the proposed valve station would be set back approximately 25m from Walshs Road. The assessment has concluded that the valve station is unlikely to result in significant visual impacts due to its location within an area of low density population as well as the small number of motorists travelling along Walshs Road on a daily basis. Appropriate mitigation measures would reduce the visual contrast of the infrastructure and therefore reduce the visual impact of this infrastructure from passing traffic and the nearest residential view locations.

The access road, control building, ancillary infrastructure and constructed gas pipeline would generally not be visible from most view locations.

Appropriate mitigation measures would reduce the visual contrast of the Project and associated infrastructure and therefore reduce the visual impact upon passing traffic and the nearest residential view locations.

Traffic and Transport

Access to the Site would be via a new access road to be developed from Walshs Road where the road takes a 90 degree turn west. The 1.9 km access road would extend from Walshs Road in a north east direction to the Site, and would be a shared easement with the northern portion of the proposed gas pipeline. The road would be built to comply with requirements for the purposes of constructing and operating the proposed power plant.

The traffic and transport assessment found that the arterial road network could satisfactorily and safely accept the additional traffic generated by the development during the construction, operational and maintenance phases.

Over-mass and over-dimensional loads such as the gas turbines, towers, generators and transformers would be transported to site under RTA and NSW Police permit conditions and along approved routes. Further assessment and planning is required during the detailed design phase to identify and cater for any necessary temporary remedial treatments to facilitate passage of over-mass and over-dimensional loads once the actual weight and dimensions of the proposed plant equipment is known.

Management by experienced haulage contractors and liaison with the permit section of the RTA, NSW Police and local governments would be undertaken to ensure the safety and amenity of the greater community. AGL would continue liaison and engagement with the RTA and relevant Councils responsible for the infrastructure that may require upgrade. Once details are confirmed about widening and re-grading works required to facilitate the movement of over-mass, over-dimension vehicles, AGL would implement or pay for required temporary improvements, pending project approval.

Executive Summary

Noise Assessment

The noise assessment for operation of the Facility addressed general continuous operations, potential for sleep disturbance and low frequency and tonal noise. The noise assessment for construction addressed construction activities for the Facility, gas pipeline and access road, communications tower infrastructure and off site traffic noise on public roads generated during construction. Vibration impacts of the proposed construction and operation have not been assessed in detail given the substantial distances from the Facility to the nearest residential receptors.

The predicted noise impacts of the proposed development upon the nearest potentially affected noise sensitive receptor locations have been assessed with consideration of the following guidelines:

- NSW Office of Environment and Heritage (OEH) *Industrial Noise Policy* (INP, EPA 1999) for the assessment of the operational noise of the proposed development;
- NSW OEH *Environmental Criteria for Road Traffic Noise* (ECRTN, EPA 1999) for the assessment of the off-site traffic noise on public roads; and
- NSW OEH *Interim Construction Noise Guidelines* (ICNG, DECC, 2009) for the assessment of the noise from construction of the proposed development.

The adopted noise limits are the lowest permissible noise limits as specified in the NSW *Industrial Noise Policy*.

The following provides a summary of the outcomes of the assessment of potential acoustic impacts:

- Operation:
  - Noise levels generated by the proposed operation would be within the established noise limits at all receptor locations under neutral and the prevailing meteorological conditions at the Site.
- Sleep Disturbance:
  - Predicted noise levels are within the sleep disturbance noise limits established taking into consideration in accordance with the INP, ECRTN and WHO guidelines.
- Low Frequency and Tonal Noise:
  - The assessment indicates that low frequency noise may exceed the INP Low Frequency Noise criteria at three residences.
  - An alternative assessment of low frequency and tonal noise impacts based on international research suggests that the predicted low frequency noise would not be at a level to cause annoyance to residential receptors. Accordingly, no adjustment to the A-weighted predicted operational noise levels would be required.
  - Notwithstanding this, AGL will commence discussions with receptors B, C and D regarding this assessment as consistent with other developments.

- Con struction Noise:
  - No exceedance of the noise limit is expected at any residential locations during the proposed construction phase of the power station.
  - During pipeline construction, some exceedances may be experienced at Receptor D.
- Off-Site Traffic Noise:
  - Construction: The predicted increases in road traffic noise levels are up to 2 dB at the most potentially affected dwellings. The resulting levels remain within the off-site traffic noise criteria.

On the basis of this assessment, it is concluded that noise impacts of the proposed construction and operation of the plant and proposed gas pipeline and access road are not expected to degrade the existing acoustic environment nor create annoyance to the residential receptor locations surrounding the Facility.

Flora and Fauna

The Flora and Fauna assessment found that there are important ecological values on the site. Preliminary surveys indicated that the Project had the potential to result in a significant impact to two Commonwealth listed Endangered Ecological Communities (EECs); Natural Temperate Grassland and Box Gum Woodland.

The Project was the subject of an EPBC Referral to the Minister of the Department of Environment, Water, Heritage and the Arts (DEWHA, now the Department of Sustainability, Environment, Water, Population and Communities (SEWPAC)). As a result of the Referral, the Project was declared a Controlled Action under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Since this declaration, subsequent surveys have determined that Commonwealth listed Box Gum Woodland would not be impacted by the Project. A revised Commonwealth Significant Impact Criteria assessment suggests that there would only be a significant impact on the EEC Natural Temperate Grassland.

The proposed works would involve the clearing of approximately 5.94 ha of Box-Gum Woodland as listed under the New South Wales *Threatened Species and Conservation Act 1995* and 9.07 ha of Natural Temperate Grassland listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*.

The results of the NSW Assessments of Significance indicate that the Dalton Power Project has the potential to result in a significant impact to the TSC Act listed EEC Box Gum Woodland, but would not result in a significant impact to any other threatened species or populations listed under the TSC Act assessed within the Flora and Fauna Assessment.

Executive Summary

To minimise the potential impact of this project, detailed recommended mitigation measures would be implemented. These measures include management plans for the construction and operational stages of the project, clearing strategies, habitat replacement plans and rehabilitation and land management strategies. In addition to these measures, in order to offset the potential impact of the Project on Box Gum Woodland and Natural Temperate Grassland, AGL propose an offset area within the AGL owned lands adjoining the development footprint comprising:

- 77.57 ha of Box Gum Woodland,
- 80.71 ha of Native Temperate Grassland; and
- 24.97 ha of exotic pasture which has the potential to become Natural Temperate Grassland within the AGL owned lands adjoining the development footprint if managed appropriately.

The Flora and Fauna assessment has detailed the potential impacts and mitigation measures for each matter of NES as well as State (TSC Act) listed species that have been identified, or are considered as having the potential to occur within the Project Area. With AGL's commitment to the biodiversity offset strategy and mitigation measures for the project, it is considered that the overall biodiversity of the local area would be 'maintained or improved' as is required under biodiversity assessment guidelines under Part 3A of the EP&A Act. The offset arrangements are also consistent with the Commonwealth's principles for environmental offsets established under the EPBC Act.

Water Management

The water requirements, wastewater production, stormwater management and flooding potential have been assessed for both construction and operation of the Dalton Power Project. The Facility has a small essential water demand, comprising domestic water, utility water and firewater water. In addition it has a discretionary process water demand to improve turbine efficiency.

Site water will be sourced from a range of sources including via the augmentation of the Dalton or Gunning supply and/or from the Gunning Sewerage Treatment Plant if the water quality is suitable and sufficient water quantities are available; tankering (by road) water to the Site, and groundwater extraction. Further investigations will be undertaken to confirm the final water supply arrangement, and AGL will progress additional approval for the final supply option.

The main water demand for the Facility is process water, for supply of gas turbine inlet air evaporative cooling and, if installed, high fogging systems. Deionised water is required for the high fogging demand, and deionised water or high quality (low salinity) potable water can be used to supply the evaporative coolers. A process water treatment plant would be expected to be required on site, regardless of the water supply source, although the level of complexity would change depending upon the source(s) water quality. A potable water supply would be required for domestic purpose, as well as a utility water supply for miscellaneous plant uses. Fire fighting water requires dedicated storage tanks. Landscaping water would be sourced from rainwater, although this may need to be supplemented during flora establishment. There would be provision on site for the delivery of bulk water via tanker trucks.

Executive Summary

Process wastewater would be generated at the Facility by the process of blow down from evaporative air inlet coolers which cool the gas turbine air intake. Blow down water would be collected in evaporation ponds lined with a synthetic liner (such as high density polyethylene) to minimise the risk of the saline blow down water escaping into the natural groundwater system.

Clean rainwater collected from the Facility catchment area would be directed to a sedimentation pond. The outlet of the stormwater system would be designed to maximize the dispersion of these high flows and thereby minimise their potential to cause soil erosion downstream.

Surface water from potentially impacted process areas and bunded areas would discharge to the sedimentation pond via a sediment and oil trap. Bunds would only be drained (manually) after confirmation that the contents are uncontaminated. In the event of contamination, the bund contents would be educted by vacuum truck and transported offsite to a licensed disposal facility.

All construction works for the Project would be undertaken in a manner to minimise the potential for soil erosion and sedimentation. Wastewater volumes have been estimated and management strategies developed to effectively maintain zero discharge from the site except for natural surface flows.

Heritage

A heritage assessment of the potential impacts of construction of the Facility, gas pipeline and access road was conducted. Subsequent assessment was also carried out across the area of the proposed Communication Tower and Hut, and the proposed route of the services trench and access road connecting these features to the Facility.

The assessments addressed the local and regional archaeology and Aboriginal and European cultural heritage, and were prepared in accordance with the draft *Guidelines for Aboriginal Cultural Heritage Assessment and Community Consultation* (DECCW 2010).

- Six sites (Dalton 2, Dalton 3, Dalton 4, Dalton 5, Dalton 7 and DGP3), and two areas of potential archaeological deposits (DPAD1 and DPAD2) would be directly impacted by the plant footprint.
- Sites Dalton 1 and Dalton 6 would not be impacted by the Project.
- DGP4 and DGP5 is within the footprint of the gas pipeline and access road and would be directly impacted by the Project.
- DGP6 is within close proximity of the pipeline and access road footprint.

Where impacts cannot be avoided then the artifacts should be collected or relocated away from the area of impact. The following management strategies would be implemented:

- Disturbance to Aboriginal archaeological sites Dalton 2, Dalton 3, Dalton 4, Dalton 5, Dalton 7 and DGP3 should be avoided if possible. If impact is unavoidable, the artefacts would be collected or relocated away from the area of impact.

- If impact to Aboriginal site Dalton 5 and potential archaeological deposits DPAD1 and DPAD2 cannot be avoided, then a program of archaeological subsurface testing would be conducted to ascertain the presence, extent and integrity of cultural material that may be present in these areas. It is noted that the majority of the identified DPAD 2 area is located external to the Facility boundary, and detailed design will aim to avoid disturbance to the portion which has been identified within the boundary.
- The artefacts exposed at DGP5 should be collected and/or relocated away from the area of impact.
- A limited program of salvage excavation should be conducted at sites DGP4 and DGP6 with the aim of recording and analysing a larger and more representative sample of artefacts

No further action is required for the DGP1, which is situated outside of the impact area.

The Dalton gas pipeline study area is located within a broad area included in an active Native Title Claim by the Gundungurra Tribal Council Aboriginal Corporation.

No European sites were located as occurring within either the power station footprint, or within the gaspipeline easement area.

Land Use and Property Impacts

Land use in the immediate surrounds of the Development Site is predominantly rural enterprises on medium size holdings and smaller rural home sites. The Development Site is located in an area that is zoned RU2 Rural Landscape, with parts of the Gas Pipeline (northern section) and Access Road, as well as the Gas Pipeline (southern section) zoned RU1 Primary Production. Zoning RU1 Primary Production and RU2 Rural Landscape, provide that “power generation” facilities are permissible with consent.

The proposal would result in changes to the land use of the development footprint itself as it is currently used primarily for agricultural purposes. An area of 183.26 ha (approximately 36 % of the Site) would form part of the Offset Area which would be conserved and managed appropriately (refer to **Chapter 13** for further details). The remainder of the Site would also be managed appropriately (refer to **Chapter 13** for further details). Therefore AGL considers that the land use change would be an overall positive one due to the higher conservation outcomes of the land use change from agricultural use and production to conservation.

Consideration was given to cumulative impacts with other major projects being undertaken or considered in the Upper Lachlan Shire Council area. The current major projects listed on the DoPI register of major projects in the Upper Lachlan Shire Council area are all windfarms. The dominance of electricity generation projects is due to the presence of wind resources and infrastructure associated with electricity generation in the region.

Executive Summary

These projects are located between 5 km and more than 20 km from the Dalton Power Project. These projects are in a range of stages from consideration of DGRs to operation having commenced. Timing of the projects for construction and operation (for those not having already commenced) is unknown and dependant on the respective proponents. Based on the distance between Dalton Power Project and other windfarm projects, potential differences in timing of construction between projects, and differences in key environmental impacts between gas fired generation and wind generation, there would not be a negative cumulative impact from the Dalton Power Project.

Mitigation measures detailed in this Environmental Assessment relate to the control of the development's impact on noise levels, air and water quality, traffic and transportation, visual amenity and other environmental matters. These mitigation measures would be implemented to ensure that the proposed Project is managed in an effective and efficient manner, with minimal impact on existing or possible future surrounding land uses.

Socio Economic

The estimated economic impacts for the Project show positive economic and social benefits at a national level in terms of contribution to GDP, income and employment resulting from the plant construction and operation. It is believed however, that a large proportion of the benefits from the Project would eventuate in the local or state regions. Some of the local impacts likely to be generated by the Project include:

- labour is likely to come from the Upper Lachlan and Goulburn-Mulwaree region, as the construction and manufacturing industries are both strong in terms of the proportion of the workforce employed in these industries, and the local region has a comparative advantage to the rest of NSW in the number of tradespersons working in the area; and
- the local population is not expected to be impacted by the Project as the employment numbers during operation are not significant.

AGL is committed to continuing its active community engagement and implementing its philosophy whereby AGL supports particular community initiatives.

The mitigation measures for social impact broadly relate to the mitigation measures relating to the control of noise levels, air and water quality, traffic and transportation, visual amenity and other environmental matters. These measures are detailed in **Chapter 7** through **Chapter 18**, and would be implemented to ensure that the proposed Project is managed in an effective and efficient manner, with minimal impact on existing or possible future surrounding land uses.

Preliminary Hazard Analysis

The preliminary hazard analysis (PHA) assessment has been undertaken in accordance with the DoP's Hazardous Industry Advisory Papers (HIPAP) No 6 (*Guidelines for Hazard Analysis*) and HIPAP No 4 (*Risk Criteria for Land Use Planning*). The main hazard associated with the proposed project is associated with the handling of natural gas (predominantly composed of methane gas), which is a flammable gas held under pressure. Other, less significant hazards are associated with the handling of flammable and combustible liquids.

Executive Summary

The risk assessment carried out in this study assumed that the safety assessment process would continue throughout the design, construction and commissioning of a potentially hazardous facility to refine and update the outcome of the development approval / environmental risk process.

Despite the conservatism built into the risk assessment, the results show that the risk associated with this development is very low. The most stringent risk criteria, as required by the Department of Planning, are adhered to. The results show that the 1×10^{-6} per year individual risk contour does not extend beyond the site boundary for the power station. This risk contour does extend by 22 m in either direction of the centreline of the pipeline, implying that future residential developments (if ever an option) would be restricted within this buffer.

Draft Statement of Commitments

The Draft Statement of Commitments has been prepared in accordance with section 75F (6) of the *EP&A Act*. The inclusion of appropriate environmental management measures into the detailed design and construction of the project would minimise adverse impacts on the environment. The proposed adoption of the relevant measures identified in the Draft Statement of Commitments into a Construction Environmental Management Plan (CEMP) and Operation Environmental Management Plan (OEMP) would be an important component of the proposal and reiterate the commitment of AGL and its contractors to mitigation of environmental impacts identified in this assessment.

The Draft Statement of Commitments describes the environmental management and monitoring to be undertaken during the construction and operation of the Dalton Power Project.

Conclusion

As Environmental Assessment Requirements were notified for the Project on 19 April 2010, the Project is a transitional Part 3A Project for the purpose of the Part 3A Repeal Act and Part 3A will continue to apply. Hence, Project Approval under Part 3A of the *EP&A Act* is being sought by AGL for the construction and operation of a gas fired power plant at Dalton, NSW. The power plant would use natural gas as its primary fuel and have a fully developed nominal generating capacity of up to 1500 MW, built over two stages. The proposed design and layout of the power plant would enable AGL to meet peak demand requirements for power generation in NSW.

The use of natural gas for the Project results in efficient use of resources for electricity generation as electricity production with gas is at a lower greenhouse intensity than the NSW average. Natural gas is a clean burning fuel and has comparatively low greenhouse gas emissions. In terms of alternate power generation technologies, open cycle gas turbines present the best balance of outcomes between the imperatives of climate change mitigation and meeting peak electricity demand while managing the price of electricity for end use consumers.

The Project is expected to have positive economic and social impacts during both construction and operation phases with potential for a positive effect on the regional economy through contribution to GDP, income and employment.

Executive Summary

The Environmental Assessment provides a comprehensive assessment of the Project and includes investigations regarding all relevant environmental issues. Potential adverse impacts have been assessed and strategies to avoid, minimise and mitigate those impacts form a key part of the Environmental Assessment. Mitigation measures to ensure impacts to both the bio-physical and socio-cultural environment remain at an acceptable level throughout the planned lifespan of the proposed power plant have been factored into the proposal.

Introduction - Summary of Key Outcomes

Over the next decade, it is predicted that rising electricity demand from the whole of NSW along with a change in the mix of generation sources as a result of the expansion of Renewable Energy Targets (RET) will substantially increase the need for rapid response "peaking" power generation within NSW. To meet this rapidly changing electricity supply landscape, AGL proposes to construct and operate a gas turbine power station with a nominal generating capacity of up to 1500 megawatts (MW) at a site near Dalton (known as the Site), south western NSW (known as the Dalton Power Project). The Dalton Power Project would be able to supply electricity during times of peak demand.

The Dalton Power Project would be constructed in two stages, and would have a total nominal generating capacity of up to 1500 MW. AGL are seeking approval for both stages of the Project as part of this current Project Application.

Stage 1 would include the installation of gas turbine units with a generating capacity of between 250 MW and 780 MW with Stage 2 increasing the total number of units and output to a nominal capacity of 1500 MW. For Stage 1, these turbines would either consist of between two to four "E" class turbines, with a nominal capacity of between 125 MW and 200 MW each run in open cycle mode, or two to three "F" class units with a nominal generation capacity of between 200 MW and 320 MW. Stage 2 would result in the construction of remaining turbines up to a total generating capacity on site of 1500 MW. Completion of both stages would result in a maximum of six turbine units within the proposed Site.

The Facility footprint would be constructed and operated on an area of approximately 26 hectares (ha) within a larger Site greater than 500 ha), thereby providing significant capacity for buffer zones.

The project cost is estimated to be between $250 million to $750 million for Stage 1, and the total project (i.e., Stage 1 and 2) consisting of up to six turbines would incur a project cost expected to be in the region of $1.5 billion.

Gas turbines burning natural gas would be installed on the Site and would typically operate for 15 % of each year, with the potential for more extended operation. AGL is a major retailer of gas and electricity in Australia with an extensive portfolio of energy assets. The objective of the Dalton Power Project is to generate electricity generally at peak times. The Dalton Power Project would assist in the management of risks and costs to delivering electricity to AGL's retail, commercial and industrial customers while ensuring acceptable environmental and social outcomes are delivered. The Minister for Planning is the consent authority for the Dalton Power Project as determined by the relevant legislation. This Environmental Assessment meets all legislative requirements and provides the Minister for Planning with the required information to determine the environmental impacts and benefits of the Dalton Power Project.

Submissions received during the public exhibition period will be provided to AGL who will prepare a response. The Department of Planning and Infrastructure will prepare an assessment report for the Minister for Planning who will determine whether to grant Project Approval.

Chapter 1 Introduction

1.1 Background

Over the next decade, New South Wales (NSW) will experience growth in peak electricity demand that will exceed existing generation capacity. NSW is the largest region of the National Electricity Market (NEM) in terms of capacity and demand for energy and is also experiencing the strongest demand growth.

To meet the rising peak electricity demand, AGL proposes the construction and operation of a two stage gas turbine power station with a total generation capacity of up to 1500 MW. This proposal near Dalton in NSW is referred to as the Dalton Power Project (or the Project). The elements of the Dalton Power Project would include the proposed power station consisting of up to six gas turbine units; a 3 km lateral gas pipeline connection from the power station to an existing natural gas supply pipeline located to the south of the Site; and a connection between the power station and the existing high voltage transmission system on Site.

1.2 Project Outline

The Dalton Power Project would be constructed over two stages, resulting in a maximum installation of six turbines with a generating capacity of up to 1500 MW. Stage 1 would initially result in the construction of a gas turbine power station with a nominal generation capacity of between 250 and 780 MW. The first stage would consist of the installation of two to four “E” class turbines, or two to three “F” class units. Each “E” class turbine would have a capacity of between 125 and 200 MW each run in open cycle mode, and each “F” class turbine would have a nominal generation capacity range between 200 and 320 MW.

At a later stage (likely to be initiated by the proposed upgrade by TransGrid of the 330 kV transmission line from the Bannaby substation to Yass), Stage 2 of the Project would involve the incorporation of additional open cycle gas turbine units into the power station to bring the maximum number of turbines to six, and the total maximum generating capacity to 1500 MW for the complete Dalton Power Project. It is envisaged that the power station would operate in open cycle mode during times of peak electricity demand, typically for less than 15 % of the year.

The site is located at Dalton, north west of Gunning in south western New South Wales (NSW) (refer to **Figures 1-1 and 1-2**). The Dalton Power Project would be constructed and operated within a 26 ha footprint within a larger area greater than 500 ha.

The power station would use natural gas supplied to the facility by a lateral gas pipeline which would extend from the existing Moomba to Sydney Gas Pipeline located to the south of the Site (refer to **Figure 1-2**). The proposed pipeline would be approximately 3 km in length to the edge of the Facility footprint, and would require a new valve station connection point to the existing gas pipeline. The proposed valve station would have aboveground facilities located in a fenced yard and would occupy an area in the order of 0.22 ha (refer to **Figure 1-2**). In addition, an underground service trench and access track easement would extend to a Communications Tower and Communications Hut to be located approximately 1.5 km to the east of the Facility (refer to **Figure 1-2)** .

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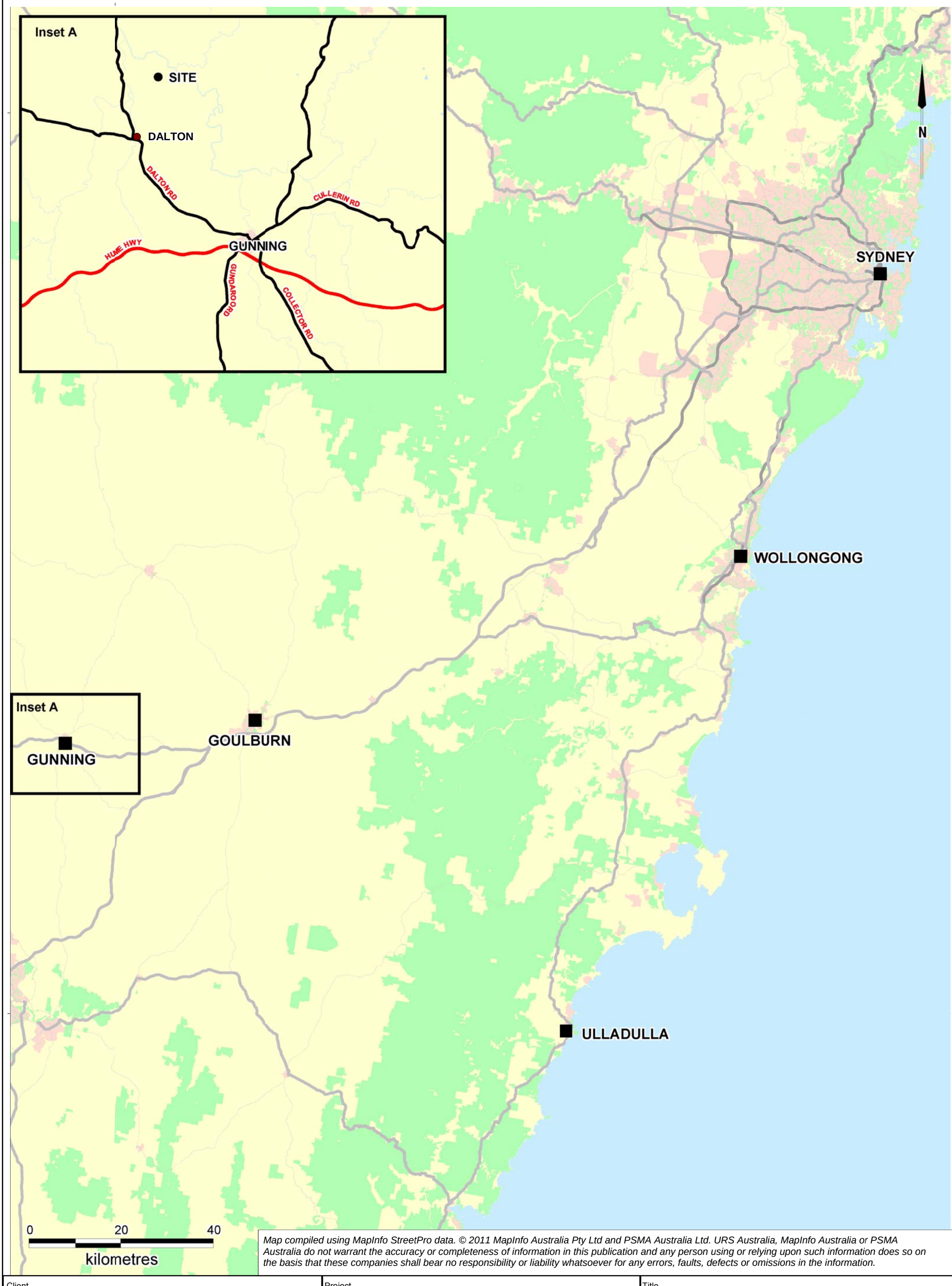
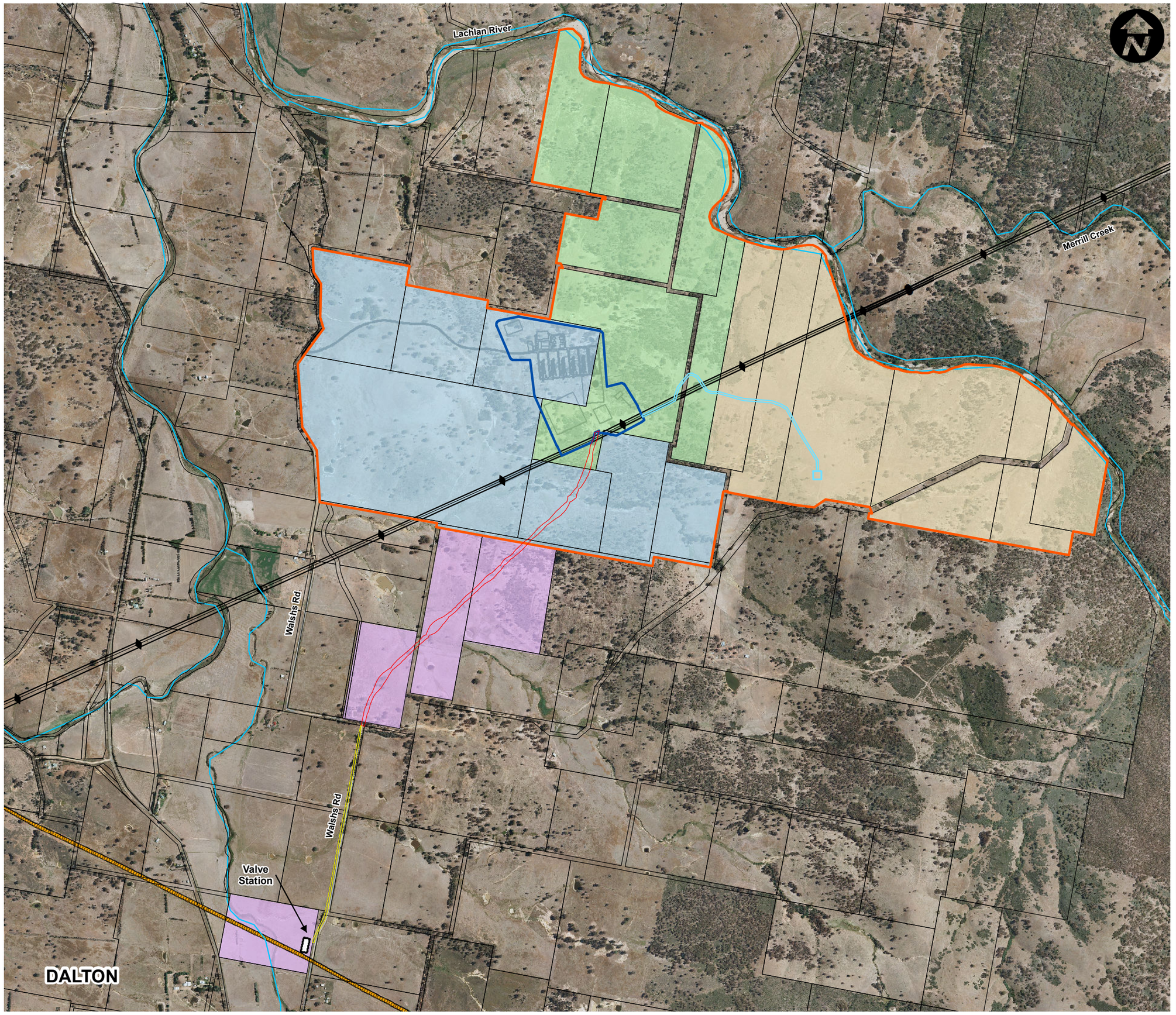


Map compiled using MapInfo StreetPro data. © 2011 MapInfo Australia Pty Ltd and PSMA Australia Ltd. URS Australia, MapInfo Australia or PSMA Australia do not warrant the accuracy or completeness of information in this publication and any person using or relying upon such information does so on the basis that these companies shall bear no responsibility or liability whatsoever for any errors, faults, defects or omissions in the information.

Client: AGL POWER GENERATION (NSW)	Project: AGL DALTON POWER PROJECT	Title: **PROPOSED SITE**
URS	Drawn: SB/AY · Approved: KT · Date: 22/02/2011 · Job No: **43177661** · File No: 43177661.048.wor	Figure: **1-1** · Rev: A · **A4**



Legend

- AGL Site Boundary

Project Approval Boundaries

- Communications Tower and Hut Footprint
- Communications Tower Services
- Gas Pipeline (northern) and Access Road
- Gas Pipeline (southern)
- Communications Tower Services and Access Track
- Valve Station
- Transmission Line
- Waterway
- Moomba-Sydney Pipeline

AGL Owned Land

- Riverview
- Holmes
- The Elms
- Other

0 1

Kilometres

Source: Aerial Image from AGL

Drawn: SB	Approved: JM	Date: 01/07/2011
Job No.: 43177661	File No.: 43177661.036.mxd	

Client

AGL

Project

DALTON POWER PROJECT

Title

PROPOSED SITE LAYOUT

Figure: 1-2

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1.3 Project Objectives

The key objectives of the Dalton Power Project are as follows:

Operational/Functional

- Provide electricity at short notice during periods of peak demand or high wholesale electricity price.
- Minimise transmission line losses and potential for overloads.
- Improve electricity network reliability.
- Complement intermittent renewable generation sources.

Economic

- Manage wholesale electricity risks and costs associated with AGL's retail customer base.
- Improve competitiveness by removing margins that would normally be paid to third party suppliers.

Environmental and Social

- Provide electricity with relatively low greenhouse gas emissions and acceptable environmental outcomes.
- Provide electricity where land zoning is compatible for the power station development and where adequate separation from sensitive neighbours, such as residential housing, exists.

1.4 The Proponent

The Proponent of the Dalton Power Project is AGL Energy Ltd (AGL). AGL has been a major participant in the Australian energy industry since 1837. It began as a privately-owned gas utility in NSW and since then has built an extensive energy business across Australia. Today AGL is a major retailer of gas and electricity to over three million customers. AGL has an extensive portfolio of wholly and partly-owned investments in energy infrastructure, infrastructure management and other energy companies.

AGL's business involves:

- buying and selling gas and electricity from gas producers and electricity generators;
- owning and investing in power generation plants, gas fields, renewable energy facilities; and
- providing customers with a wide range of energy products and services.

Chapter 1 Introduction

1.5 Environmental Assessment Process

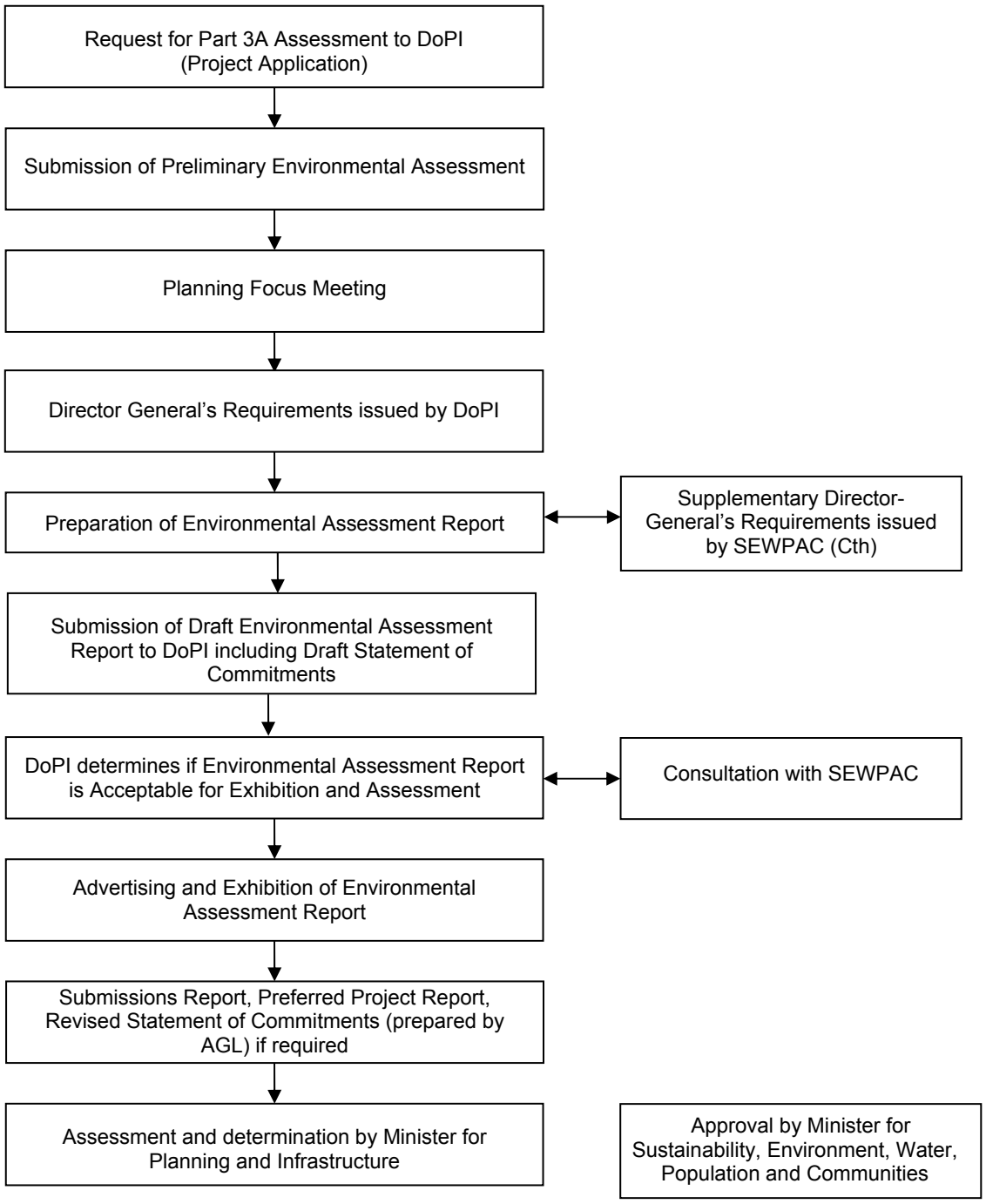
The Dalton Power Project is subject to the development and assessment processes and requirements of Part 3A of the EP&A Act. A Project Application was accepted by the Department of Planning and Infrastructure (formerly Department of Planning) on 25 March 2010 including an updated supporting Preliminary Environmental Assessment. On 19 April 2010 the Director-General issued Environmental Assessment Requirements.

The Project also triggers the Commonwealth EPBC Act. The potential impacts to Endangered Ecological Communities were the focus of an EPBC referral submitted for determination by the Commonwealth Minister for Sustainability, Environment, Water, Population and Communities. On 15 June 2010, the Project was determined to be a Controlled Action by the Minister for Sustainability, Environment, Water, Population and Communities. (EPBC 2010/5484). Supplementary Director-General Requirements for the Project were provided on 5 July 2010. Department of Planning and Infrastructure confirmed that the interim procedures in relation to an accredited assessment process will apply to the assessment of this project under the EPBC Act so that the Department of Planning and Infrastructure can undertake an environmental impact assessment of the project to satisfy the requirements of both NSW and Commonwealth legislation.

Refer to **Appendix A** for the D-G's Environmental Assessment Requirements.

A flow diagram of the assessment and approvals process under the EP&A and EPBC Acts is shown in **Figure 1-3**.

Figure 1-3 Approvals Process under Part 3A of EP&A Act 1979 / EPBC Act 1999



Chapter 1 Introduction

1.5.1 Definitions

For the purposes of the Environmental Assessment, the following definitions apply:

- **Dalton Power Project or Project:** construction and operation by AGL of a two stage gas turbine power station with a maximum generation capacity of 1500 MW. The development of ancillary infrastructure for the power station is also included. The Project would be located at a site to the north of Dalton, NSW. The Project would be constructed over two stages, with Stage 1 resulting in the construction of a power station with a generating capacity of between 250 and 780 MW, and Stage 2 incorporating additional generation capacity to a maximum of up to 1500 MW.
- **Facility:** gas turbine power station comprising up to six turbines with a total generation capacity of 1500 MW.
- **Site:** collectively refers to the property comprising "The Elms" Lot 115, 249, 252, 253, 305, 307 in DP754111; "Holmes" Lot 14, 183, 184, 187, 200, 283, 306 in DP 754111, and "Riverview" Lot 116, 321, 322, 162, 317, 318 in DP754111.
- **AGL Owned Lands:** AGL has purchased 573 ha, this includes the Site and Lots 21,186 and 251 in DP754111 through which the gas pipeline (northern portion) and access road traverse, also parts of Lot 30 and 31 DP754111, which would contain the valve station and through which the gas pipeline (southern portion) traverses. It is noted that the lots beyond the Site (other than the infrastructure footprint within these lots) have not been included in this assessment.
  Development Footprint: area within the wider 508 ha Site to be developed for the power station and associated infrastructure.
- **Access Road:** new road to be constructed to provide access to the Facility. The access road would extend approximately 1.9 km north east from Walshs Road at the point where Walshs Road takes a 90-degree turn west.
- **Gas Pipeline:** proposed lateral gas pipeline extension connecting the Facility to the existing Moomba to Sydney Gas Pipeline. The underground gas pipeline would be incorporated into the proposed access road easement within the northern portion, and would be located within the existing reserve of Walshs Road within the southern portion.

1.6 Environmental Assessment Preparation and Exhibition

The Environmental Assessment has been prepared in accordance with Part 3A of the EP&A Act and the Director-General's Environmental Assessment Requirements.

The objectives of the Environmental Assessment are:

- to comply with the requirements of the EP&A Act, as formalised in the Director-General's Environmental Assessment Requirements;
- to concurrently comply with the requirements of the EPBC Act, as formalised in the Supplementary Director-General's Environmental Assessment Requirements;
- to provide the NSW Minister for Planning and Infrastructure with sufficient information to determine the environmental impacts and benefits of the Dalton Power Project;
- to provide the Commonwealth Minister for Sustainability, Environment, Water, Population and Communities with sufficient information to determine the environmental impacts and benefits of the Dalton Power Project; and
- to inform the community about the Dalton Power Project.

The EP&A Act requires that the Environmental Assessment be placed on exhibition for public review for a minimum period of 30 days.

1.6.1 Decisions and Assessments

Subsequent to exhibition of the Environmental Assessment, copies of all submissions or a report of all issues raised would be provided to AGL and relevant Government authorities. AGL would review the submissions and consider and respond to issues raised.

The Director-General would prepare an assessment report on the Project which would take into account comments from relevant Government authorities as well as other stakeholders and the community. The assessment report will be provided to the Minister for Planning who would determine whether to grant Project Approval and specify the conditions under which the Project would operate in accordance with the EP&A Act.

1.6.2 Key Assessment Requirements

The Director-General's Environmental Assessment Requirements identified specific issues to be addressed in the Environmental Assessment. These comprised the review and assessment of:

- gree nhouse gases;
- air quality impacts;
- water quantity and quality;
- noise impacts;
- flora and fauna impacts;
- indige nous heritage;
- hazard and risks;
- visual impacts; and
- traffic and transport.

Chapter 1 Introduction

These key issues have been addressed by specialist investigations commissioned for the Project. The resulting technical assessments have been used as source materials for this Environmental Assessment and are submitted as components of this Project Application. Detailed technical studies are presented in **Volume 2 Appendices (Part 1 and 2)** and summarised within the relevant sections of this main report. In other instances, the whole assessment forms the relevant section of this main document (**Volume 1**).

1.6.3 General Environmental Risk

The Environmental Assessment Requirements state that the Environmental Assessment must consider environmental risks that may lead to potential environmental impacts associated with the Project. Further to the issues listed in **Section 1.6.2** above, additional issues that were considered relevant to this Project included soils, geology and groundwater.

Environmental risk is further discussed in **Chapter 7**.

1.7 Environmental Assessment Document Structure

The Environmental Assessment document is divided into a number of parts. The content of each part is outlined below:

Volume 1 Main Document

- ***Executive Summary*** **–** This provides a brief description of the key issues and findings detailed in the other parts of the Environmental Assessment.
- ***Part A: Project Description*** **– Chapter 1** briefly outlines the environmental impact assessment process, describes the background and context to the Project and provides an outline of the proposal. **Chapters 2** to **4** detail the needs, objectives and alternatives for the development and provides a detailed description of the proposed Project. **Chapter 5** includes the relevant controlling Commonwealth and State legislation, and nominates the various licences and approvals required to enable the Project to proceed. **Chapter 6** summarises the issues raised during consultation with statutory and other relevant authorities as well as the local community. The issues raised during the consultation process are cross referenced throughout the proceeding sections of the Environmental Assessment. **Chapter 7** provides a discussion on the environmental risks of the Project.
- ***Part B: Environmental Assessment*** **– Chapters 8-18** provide an overview of the existing environment, an assessment of the likely impacts of the proposal and the identification of appropriate mitigation measures to safeguard the environment.
- ***Part C – Commitments and Conclusion***
  - *Draft Statement of Commitments* – **Chapter 19** outlines AGL's commitment to proposed environmental management measures to safeguard against any potential impacts, as well as commitments around ongoing project monitoring.

- *Conclusion* – **Chapter 20** addresses the principles of Ecologically Sustainable Development (ESD) and provides justification for the proposed Project.
- *References* – **Chapter 21** provides a list of materials referenced during preparation of the Environmental Assessment.

- **Volume 2 Appendices (Part 1 and 2) –** This part contains stakeholder correspondence as well as the detailed technical assessments conducted for the Environmental Assessment.

Table 1-1 provides an evaluation of the Director-General's Environmental Assessment Requirements (referred to as DGRs) as addressed within this Environmental Assessment and the location within the document. Supplementary DGRs for the Project were provided by the Federal Environment Minister on 5 July 2010 in relation to the concurrent EPBC Act project approval (EPBC 2010/5484). An evaluation of the Environmental Assessment against these supplementary requirements is presented in **Table 1-2**.

Table 1-1 NSW Department of Planning (now Department of Planning and Infrastructure) Director General's Requirements

Requirement	Description	Chapter / Section of Environmental Assessment
General Requirements		
The Environmental Assessment (EA) must include:		
	• An executive summary	Separate Executive Summary provided at beginning of document.
	• A description of the Project including construction, operation and staging. The description should include any required infrastructure such as pipelines and connection to the grid for the operation of the Project	Chapter 4 - Project Description.
	• Consideration of any relevant statutory provisions including the consistency of the Project with the objects of the *Environmental Planning and Assessment Act 1979*	Chapter 5 - Statutory Planning and in Chapter 20 – Conclusion.
	• Consideration of alternatives to the project, including site selection	Chapter 3 - Alternatives to the Proposal.
	• An assessment of the environmental impacts of the project with particular focus on the key assessment requirements specified below and proposed mitigation / management measures for residual environmental impacts	Throughout the Environmental Assessment, specifically through chapters 7 to 18.
	• Justification for undertaking the project with consideration of the benefits / impacts of the proposal (including community benefits) and proposed management / mitigation / monitoring	Chapter 2 - Project Need and Justification, and throughout chapters 7 through to 18.
	• A Draft Statement of Commitments outlining environmental management, mitigation and monitoring measures	Chapter 19 - Statement of Commitments.
	• Certification by the author of the Environmental Assessment that the information contained in the assessment is neither false nor misleading	Statement of Validity included as front page within this document.

Chapter 1 Introduction

Requirement	Description	Chapter / Section of Environmental Assessment
Key Assessment Requirements		
Strategic Justification	Strategic assessment of the need, scale, scope, operational mode (eg. baseload, intermediate, peaking) and location for the project in relation to predicted electricity demand, transmission constraints and the strategic direction of the region and the State in relation to electricity supply, demand and electricity generation technologies	Chapter 2 - Project Need and Justification, Chapter 3 - Alternatives to the Proposal.
	Analysis of site suitability with respect to potential land use conflicts with existing and future land uses taking into account local and strategic land use objectives	Chapter 3 – Alternatives to the Proposal. Chapter 5 – Statutory Planning, and Chapter 16 – Land Use and Property Impacts.
	Describe alternatives considered for the project in particular technology and configuration including fuel source, air emission, water use and options for waste disposal / beneficial reuse and provide justification for the project demonstrating its benefits at a local and strategic scale in comparison to alternatives considered, including the do nothing option.	Chapter 3 – Alternatives to the Proposal.
Greenhouse Gases	The EA must include a comprehensive greenhouse gas assessment undertaken in accordance with the methodology specified in the *National Greenhouse Accounts (NGA) Factors* (latest release) including: • Quantificati on of emissions (in tonnes of carbon dioxide equivalent) in accordance with the Greenhouse Gas Protocol: Corporate Standard (World Council for Sustainable Business Development & World Resources Institute) including: direct emissions (Scope 1), indirect emissions from electricity (Scope 2) and any significant up or down stream emissions (Scope 3) considering all stages of the project (annual emission for each year of the project during construction, operation and decommissioning is required to be provided)	Chapter 9 -Air Quality, section 9.4, and Appendix E – Greenhouse Gas Assessment.
	• Comparison of predicted emissions intensity and thermal efficiency against best achievable practice and current NSW averages for the activity, and of predicted emissions against total annual national emissions (expressed as a percentage of total national greenhouse gases production per year over the life of the project)	Chapter 9 – Air Quality, section 9.4 and Appendix E – Greenhouse Gas Assessment.
	• Evaluation of the availability and feasibility of measures to reduce and/or offset the greenhouse emissions of the project including options for carbon capture and storage. Where current available mitigation technology is not technically or ergonomically feasible, the Environmental Assessment must demonstrate that the proposal will use best available technology, including carbon capture and readiness, and identify options for triggers that would require stages implementation of emerging mitigation technologies	Chapter 3 - Alternatives to the Proposal, Chapter 9 -Air Quality, section 9.4, and Appendix E – Greenhouse Gas Assessment.
	• Evaluation of the project in the light of various carbon emission prices per tonne both with and without proposed mitigation measures	Chapter 9 – Air Quality, section 9.4 and Appendix E – Greenhouse Gas Assessment.

Requirement	Description	Chapter / Section of Environmental Assessment
Air Quality Impacts	The Environmental Assessment must include a comprehensive air quality impact assessment based on dispersion modelling prepared in accordance with the Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales (DECC, 2005) (Approved Methods) considering worst case operating scenarios and meteorological conditions, representative monitoring and receiver locations and cumulative impacts, as applicable. The Environmental Assessment must address air quality impacts at a local, regional and interregional level and include a plume rise assessment. The assessment must demonstrate that the project would meet the impact assessment criteria in Section 7 of the Approved Methods and the requirements of the Protection of the Environment Operations (Clean Air) Regulation 2002 for all relevant pollutants based on ground level concentrations at the plant boundary and beyond at all sensitive receptors. The Environmental Assessment must clearly demonstrate that the project has been designed to include the application of Best Available Control Technology (BACT) in relation to air emissions. The assessment must include a framework for the mitigation, management and monitoring of air quality impacts, particularly with respect to sensitive receptors likely to be impacted by cumulative air quality impacts in the local area.	Chapter 3 – Alternatives to the Proposal, Chapter 9, - Air Quality, sections 9.2, 9.3, 9.6 and 9.7, and Appendix C - Air Quality Impact Assessment
Water Quantity and Quality Impacts	The Environmental Assessment must include an assessment of the water quantity and quality impacts of the proposal (i.e. surface and groundwater), with particular reference to the water needs for the life of the project, the proposed source of water, and the implementation of water saving measures (including use of rainwater and runoff from sealed, hardstand and disturbed areas as much as practically possible). In this regard, a water balance must be provided. The Proponent must be able to demonstrate that an adequate and secure water supply is available for the life of the project. The Environmental Assessment must demonstrate that any water crossings are designed in accordance with DWE Guidelines Controlled Activity Approvals. The Environmental Assessment must consider the adherence to existing embargo provisions for proposed water use or impact (e.g. Murray Darling Basin Groundwater Embargo – Order 2). The Environmental Assessment must also identify the quantity and quality of wastewater, how this wastewater would be disposed of, and how stormwater would be managed at the site. The Environmental Assessment must reflect a design philosophy of zero water discharge from the site, except for natural surface water flows.	Chapter 8 – Soils, Geology and Groundwater, and Chapter 14 – Water Management

Chapter 1 Introduction

Requirement	Description	Chapter / Section of Environmental Assessment
Noise Impacts	The Environmental Assessment must include a comprehensive operational noise impact assessment for the project, prepared in accordance with *NSW Industrial Noise Policy* (EPA, 2000) considering worst case operating scenarios and meteorological conditions, representative monitoring and receiver locations, and cumulative impacts from any adjacent relevant land uses (existing and approved). The assessment must consider the potential for low frequency noise generation, peak noise events with the potential to cause sleep disturbance and the effects of stable atmospheric conditions. The Environmental Assessment must also consider the potential for:	Chapter 12 – Noise and Vibration, sections 12.4, 12.5, and 12.6, and Appendix G – Noise
	• Construction noise impacts consistent with the Interim Construction Noise Guidelines (DECCW, 2009)	Chapter 12 – Noise and Vibration, and Appendix G – Noise
	• Vibration impacts during construction and operation consistent with Environmental Criteria for Road Traffic Noise (EPA, 1999). The method, data and assumptions used to assess the impact of road haulage on residential properties must be fully documented and justified.	Chapter 12 – Noise and Vibration, and Appendix G – Noise
	• The Environmental Assessment must clearly outline the noise mitigation, monitoring and management measures the Proponent intends to apply to the project.	Chapter 12 – Noise and Vibration, section 12.6, and Appendix G – Noise
Flora and Fauna Impacts	The Environmental Assessment (EA) must include an assessment of impacts of the project on flora and fauna, prepared in accordance with *Guidelines for Threatened Species Assessment* (DEC/DPI, July 2005) and specifically report on the considerations listed in Step 3 and whether it meets each of the key thresholds set out in Step 5. The development will need to avoid any endangered ecological communities and provide an appropriate buffer and asset protection zone. The EA must specifically consider threatened species and communities listed under both State and Commonwealth legislation that have been recorded on the site and surrounding land. The EA must also detail measures to avoid or mitigate impacts on threatened species associated with the siting and construction of any access roads and other infrastructure. This must include the identification of any potentially impacted paddock and fence trees with an assessment of the functioning of this vegetation in terms of habitat and movement of arboreal threatened fauna in the local area.	Chapter 13, - Flora and Fauna, and Appendix H – Flora and Fauna Assessment
Indigenous Heritage	The EA must include an assessment of impacts on Aboriginal heritage, in accordance with draft *Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation* (DEC, 2005). The EA must also include an assessment of the potential for the project to impact on known items of non-Aboriginal heritage significance, and include a management framework for management of any additional heritage items that may be uncovered during construction of the project. The EA needs to clearly demonstrate that effective community consultation with Aboriginal communities has been undertaken in determining and assessing impacts, developing options and making final recommendations for the mitigation of impacts.	Chapter 15 – Heritage, and Appendix I – Cultural Heritage Assessment, and Chapter 6 - Consultation

Requirement	Description	Chapter / Section of Environmental Assessment
Hazards and Risk Impacts	The EA must include a screening of potential hazards on site (including new gas supply infrastructure) to determine the potential for off-site impacts and any requirement for a Preliminary Hazard Analysis (PHA). The PHA, should potential off-site impacts be identified, must be prepared in accordance with the Department's *Hazardous Industry Planning Advisory paper No. 3, Hazardous Industry Planning Advisory Paper No. 6* and *Multi-level Risk Assessment,* and with reference to applicable Australian Standards (including AS2885 Pipelines – Gas and Liquid Petroleum – Operation and Maintenance). Risk impacts associated with the transport of dangerous goods and hazardous materials must be documented with reference to the Department's draft Route Selection guideline.	Chapter 18 – Preliminary Hazard Analysis, and Appendix J - Preliminary Hazard Analysis.
Visual Impacts	The EA must include an assessment of the visual impact of the project from representative viewing points including residential receivers, settlements and significant public view points and include the mitigation and management of visual amenity impacts on affected receivers. An overview of the effectiveness and reliability of the measures and any residual impacts after the implementation of such measures must also be included.	Chapter 10 – Landscape and Visual, and Appendix K – Landscape and Visual Assessment
General Environmental Risk Analysis	Notwithstanding the above key assessment requirements, the EA must include an environmental risk analysis to identify potential environmental impacts associated with the project (construction and operation), proposed mitigation measures and potentially significant residual environmental impacts after the application of proposed mitigation measures. Where additional key environmental impacts are identified through this environmental risk analysis, an appropriately detailed impact assessment of this additional key environmental impact must be included in the Environmental Assessment.	Chapter 7 – Environmental Risk
Consultation Requirements		
Consultation	You must undertake an appropriate and justified level of consultation with the following parties during the preparation of the Environmental Assessment: • NSW Department of Environment, Climate Change and Water including separate consultation with the Office of Water; • Upper Lachlan Shire Council; • NSW Department of Industry and Investment; • T ransgrid; • Air Services Australia; • Civil Aviation Authority; • Department of Defence; • Rural Fire Service; • Lachlan Catchment Management Authority; and • The local community including surrounding land owners. The Environmental Assessment must clearly indicate issues raised by stakeholders during consultation, and how those matters have been addressed in the document.	Chapter 6 – Consultation and Appendix B.

Chapter 1 Introduction

Table 1-2 Evaluation of Commonwealth Supplementary Director General's Requirements

Requirement	Description	Chapter / Section of Environmental Assessment
General Requirements		
1. The background of the action, including:		
a	the title of the action	Chapter 1 -Introduction
b	the full name and postal address of the designated proponent	Chapter 1 -Introduction
c	a clear outline of the objective of the action	Chapter 1 –Introduction, Chapter 2 – Project Need and Justification, Chapter 4 - Project Description
d	the location of the action	Chapter 1 –Introduction
e	the background to the development of the action	Chapter 2 – Project Need and Justification
f	how the action relates to any other actions (of which the proponent should reasonably be aware) that have been, or are being, taken or that have been approved in the region affected by the action	Chapter 2 – Project Need and Justification, section 2.6
g	the current status of the action	Proponent is seeking approval for action.
h	the consequences of not proceeding with the action	Chapter 2 – Project Need and Justification Chapter 3 – Alternatives to the Proposal
Description of the controlled action		
2. A description of the action, including:		
a	all the components of the action	Chapter 4 - Project Description
b	the precise location of any works to be undertaken, structures to be built or elements of the action that may have relevant impacts	Chapter 4 - Project Description
c	how the works are to be undertaken and design parameters for those aspects of the structures or elements of the action that may have relevant impacts	Chapter 4 - Project Description
d	to the extent reasonably practicable, a description of any feasible alternatives to the controlled action that have been identified through the assessment, and their likely impact, including:	Chapter 4 - Project Description
i	if relevant, the alternative of taking no action	Chapter 3 – Alternatives to the Proposal
ii	a comparative description of the impacts of each alternative on the matters protected by the controlling provisions for the action	Chapter 3 – Alternatives to the Proposal
iii	sufficient detail to clarify why any alternative is preferred to another	Chapter 3 – Alternatives to the Proposal
A description of the relevant impacts of the controlled action		
3. An assessment of all relevant impacts[1] with reference to the *EPBC Act Policy Statement 1.1 Significant Impact Guidelines Matters of National Environmental Significance (2009)* that the controlled action has, will have or is likely to have on: [1]The term "relevant impact" is defined in section 82 of the EPBC Act.		
a	relevant threatened species and/or threatened ecological communities listed under sections 18 and 18A of the EPBC Act, including the Box-Gum Woodland and NTG.	Chapter 13 – Flora and Fauna, Appendix H – Flora and Fauna Assessment

Requirement	Description	Chapter / Section of Environmental Assessment
4. Information must include:		
a	a description of the relevant impacts of the action on matters of national environmental significance	Appendix H – Flora and Fauna Assessment
b	a detailed assessment of the nature and extent of the likely short term and long term relevant impacts	Appendix H – Flora and Fauna Assessment
c	a statement whether any relevant impacts are likely to be unknown, unpredictable or irreversible	Appendix H – Flora and Fauna Assessment
d	analysis of the significance of the relevant impacts	Appendix H – Flora and Fauna Assessment
e	any technical data and other information used or needed to make a detailed assessment of the relevant impacts	Appendix H – Flora and Fauna Assessment
5. A description of the relevant impacts on the Box-Gum Woodland and NTG should include an analysis of the vegetation condition on the site, as well as the methods by which this was determined. It should also include direct, indirect, cumulative and facilitative impacts on the:		
a	extent of the Box-Gum Woodland and NTG, including connectivity with other areas of the ecological communities (These impacts should be described for the construction and operation phases of the controlled action).	Appendix H – Flora and Fauna Assessment
b	quality or integrity of the Box-gum Woodland and NTG (including, but not limited to, assisting invasive species, that are harmful to the ecological communities, to become established; or causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the communities which kill or inhibit the growth of species in the ecological community) (These impacts should be described for the construction and operation phases of the controlled action).	Appendix H – Flora and Fauna Assessment
c	EPBC Act listed species in, or in any way dependent upon, the Box-Gum Woodland or NTG (These impacts should be described for the construction and operation phases of the controlled action).	Appendix H – Flora and Fauna Assessment
d	composition of the Box-Gum Woodland and NTG (These impacts should be described for the construction and operation phases of the controlled action).	Appendix H – Flora and Fauna Assessment
e	habitat present on site critical to the survival of the Box-Gum Woodland and NTG (These impacts should be described for the construction and operation phases of the controlled action).	Appendix H – Flora and Fauna Assessment
f	abiotic (non-living) factors (such as water, nutrients or soil) necessary for the Box-Gum Woodland and NTG's survival, for example increasing groundwater levels or making the site wetter, soil disturbance or substantial alteration of surface water drainage patterns (These impacts should be described for the construction and operation phases of the controlled action).	Appendix H – Flora and Fauna Assessment
6. Where there is a potential habitat for EPBC Act listed species, such as the Golden Sun Moth (*Synemon plana*), Grassland Earless Dragon (*Tympanocryptus pinguicolla*), Pink-tailed Worm-lizard (*Aprasia parapulchella*) or Striped Legless Lizard (*Delma impar*), surveys must be undertaken. These surveys must be timed appropriately and undertaken for a suitable period of time by a qualified person" , A subsequent description of the relevant impacts on such EPBC Act listed species should include, inter alia, direct, indirect, cumulative and facilitative impacts on the:		Appendix H – Flora and Fauna Assessment
a	population of the species at the site	Appendix H – Flora and Fauna Assessment (Section 6)

Chapter 1 Introduction

Requirement	Description	Chapter / Section of Environmental Assessment
b	area of occupancy of the species	Appendix H – Flora and Fauna Assessment (Section 6)
c	habitat critical to the survival of the species	Appendix H – Flora and Fauna Assessment (Section 6)
d	breeding cycle of the population	Appendix H – Flora and Fauna Assessment (Section 6)
e	availability or quality of habitat for the species	Appendix H – Flora and Fauna Assessment (Section 6)
Proposed safeguards and mitigation measures		
7. A description of feasible mitigation measures, changes to the controlled action or procedures, which have been proposed by the proponent or suggested in public submissions, and which are intended to prevent or minimise relevant impacts. Information must include:		
a	a description, and an assessment of the expected or predicted effectiveness of, the mitigation measures	Appendix H – Flora and Fauna Assessment (Section 7.2) Chapter 19 - Statement of Commitments
b	any statutory or policy basis for the mitigation measures	Appendix H – Flora and Fauna Assessment (Section 7.2)
c	the cost of the mitigation measures	Mitigation Measures have not been costed at this stage of the Project.
d	an outline of an environmental management plan that sets out the framework for continuing management, mitigation and monitoring programs for the relevant impacts of the action, including any provisions for independent environmental auditing	Appendix H – Flora and Fauna Assessment (Section 7.2.1) Chapter 19 - Statement of Commitments
e	the name of the agency responsible for endorsing or approving each mitigation measure or monitoring program	Chapter 19 - Statement of Commitments The Agency responsible would be addressed in the Conditions of Approval for the Project.
f	a consolidated list of mitigation measures proposed to be undertaken to prevent, minimise or compensate for the relevant impacts of the action	Appendix H – Flora and Fauna Assessment, Section 7 Chapter 19 - Statement of Commitments
Offsets		
8. Should any residual impact exist that cannot be mitigated it may be necessary for offset measures to be considered in order to ensure the protection of matters of national environmental significance in perpetuity. If required, the department may negotiate offsets with you during the assessment phase.		Appendix H – Flora and Fauna Assessment, Section 7.2.16

Requirement	Description	Chapter / Section of Environmental Assessment
Other approvals and conditions		
9. Any other requirements for approval or conditions that apply, or that the proponent reasonably believes are likely to apply, to the proposed action. Information must include:		
a	details of any local or State government planning scheme, or plan or policy under any local or State government planning system that deals with the proposed action, including:	Appendix H – Flora and Fauna Assessment
i	what environmental assessment of the proposed action has been, or is being, carried out under the scheme, plan or policy	Appendix H – Flora and Fauna Assessment
ii	how the scheme provides for the prevention, minimisation and management of any relevant impacts	Appendix H – Flora and Fauna Assessment
b	a description of any approval that has been obtained from a State, Territory or Commonwealth agency or authority (other than an approval under the Act), including any conditions that apply to the action	Part 3A Project Approval currently being sought from NSW DoPI. No approvals have been obtained to date.
c	a statement identifying any additional approval that is required	Part 3A Project Approval is currently being sought.
d	a description of the monitoring, enforcement and review procedures that apply, or are proposed to apply, to the action	Appendix H – Flora and Fauna Assessment (Section 7)
Economic and social matters		
10. A description of the short-term and long-term social and economic implications and/or impacts of the project.		Chapter 17 - Socio Economic Assessment
Environmental record of person proposing to take the action		Chapter 2 - Project Need and Justification (Section 2.5)
11. Details of any proceedings under a Commonwealth, State or Territory law for the protection of the environment or the conservation and sustainable use of natural resources against:		
a	the proponent	Chapter 2 – Project Need and Justification (Section 2.5)
b	for an action for which a person has applied for a permit, the person making the application	Chapter 2 – Project Need and Justification (Section 2.5)
12. Details of the proponent's environmental policy and planning framework		Chapter 2 – Project Need and Justification (Section 2.5)
Information sources		
13. For information given in an environment assessment, the draft must state:		
a	the source of the information	Chapter 21 – References, Appendix H – Flora and Fauna (Section 9)
b	how recent the information is	Appendix H – Flora and Fauna (Section 4)
c	how the reliability of the information was tested	Appendix H – Flora and Fauna (Section 4)
d	what uncertainties (if any) are in the information	Appendix H – Flora and Fauna (Section 4)

Chapter 1 Introduction

Requirement	Description	Chapter / Section of Environmental Assessment
Consultation		
14. Any consultation about the action, including		
a	any consultation that has already taken place	Chapter 6 - Consultation
b	proposed consultation about relevant impacts of the action	Chapter 6 - Consultation
c	if there has been consultation about the proposed action – any documented response to, or result of, the consultation	Chapter 6 - Consultation
15. Identification of affected parties, including a statement mentioning any communities that may be affected and describing their views.		Chapter 6 - Consultation, Chapter 15 – Heritage and Chapter 17 - Socio-economic

Project Need and Justification | Chapter 2

Project Need and Justification – Summary of Key Outcomes

The Dalton Power Project would contribute to ensuring the adequate, reliable and consistent supply of electricity during times of peak demand / high price in NSW.

The Dalton Power Project is consistent with NSW Government policy indicating a preference for private investment in electricity generation. Peaking power generation enables AGL to manage its cost of electricity sold to consumers and minimises market exposure along with providing rapid start up generation capacity at times of reduced supply or generation capability from other plants or sources.

The NSW Government's *Energy Directions Green Paper* (2004) and Australian Energy Market Operator (AEMO) *Statement of Opportunities* (2010) predict that over the next decade rising electricity demand from the whole of NSW will exceed existing generation capacity. To meet the immediate growth in demand for electricity, a number of additional power plants will be required.

The Dalton Power Project would contribute positively to the NSW electricity market by providing a peaking plant to service demand in addition to minimising AGL's market exposure and complementing the introduction of intermittent renewable generation sources into the NSW electricity market.

Chapter 2 Project Need and Justification

2.1 Introduction

There are four distinct components of the supply of electricity: generation, transmission, distribution and retailing. The Dalton Power Project relates to the 'generation' component of electricity supply.

The National Electricity Market (NEM) controls the supply of electricity in Australia and is managed by the AEMO. AEMO predicts that growth in electricity demand in NSW will exceed existing capacity, requiring the construction and operation of new power stations. Due to the type of load growth, the immediate need highlighted is for power stations which meet peak electricity demand only.

The NSW Government's *Energy Directions Green Paper* (December 2004) has provided an indication of the Government's receptivity for private investment in electricity generation in this state. The Owen Inquiry (September 2007) has also supported private investment arrangements towards electricity generation. The electricity market and the drivers behind the supply and demand of electricity are discussed in further detail in **Section 2.3**. The proposed Dalton Power Project would contribute to the improvement of the state's future electricity security, and the Project complies with current NSW Government policy direction.

This chapter addresses the project justification in terms of the NEM, the transmission network and AGL's market participation. **Chapter 3** *Alternatives to the Proposal* addresses the alternative Development Site locations and technologies considered for the Dalton Power Project.

2.2 Background

2.2.1 The National Electricity Market

In December 1998, a single competitive national electricity market for the supply of electricity was introduced. The NEM introduced competition in the wholesale supply and purchase of electricity combined with an open access regime for the use of electricity networks across the Australian Capital Territory, New South Wales, Queensland, South Australia and Victoria.

The NEM is a wholesale market for the supply and purchase of electricity; the arrangements for which are defined in the National Electricity Code. AEMO manages the operation of the wholesale electricity market and security of the power system.

Generators bid their electricity into the NEM, which is split into regions based largely upon state boundaries. The last bid accepted sets the spot price for electricity with prices set on a half-hour basis. Retailers purchase the electricity direct from the NEM. AEMO facilitates these purchases. The electricity is then on-sold to the consumer and transported by transmission lines (high voltage) and distribution networks (lower voltage).

As the NEM can be volatile, with the average price below $50 per megawatt hour (MWh) and a maximum price of $12,500/MWh, retailers (and generators) often enter into derivative contracts to mitigate market risk. These contracts can involve setting the price paid (or received) for a defined volume of electricity over a period of time or paying an ongoing premium to limit the maximum price paid for electricity. Derivative contracts are necessary as the price for electricity received by AGL from retail consumers is regulated and fixed.

The cost of power in the market varies each half hour based on the prices bid in by generators that wish to sell power. As demand varies, different power plants run and the price of power varies. NSW, Snowy Mountains, Victoria, South Australia and the Queensland regions of the NEM are interconnected and electricity flows between the regions based on the half hour price that prevails between adjacent regions.

Historically, prior to the NEM, prices did not play a pivotal role in shaping energy infrastructure development. However since the creation of the NEM, price determines how infrastructure is developed through the supply and demand mechanism. Increasing prices provide an incentive for investors to secure new generation capacity or transmission connections to facilitate the importation and distribution of excess supply from other States.

2.2.2 Transmission Network

The majority of the State's electricity usage occurs in the Newcastle – Sydney – Wollongong area which accounts for over 75 % of peak demand. Transmission access to this peak demand area is important in selecting a power station site. A stylised diagram of TransGrid's network is presented in **Figure 2-1.**

In formulating the current proposal, potential sites reviewed for the Dalton Power Project included the Dalton site; the Central Coast and Newcastle area; an area between Young and Culcairn; an area between Culcairn and Albury; south-west of Nowra; and an area between Nowra and Wollongong. These sites are discussed further in **Chapter 3** *Alternatives to the Proposal*.

Each site was assessed in terms of network reliability, losses and potential overloads. The clear benefits of the Dalton site in comparison to alternatives included a crucial transmission advantage in that Line 39, a 330 kV transmission line, traverses the project site. This would enable easy connection between the proposed power station and the existing transmission network.

TransGrid is nearing completion of the Western 500 Project, which is the largest upgrade of TransGrid's transmission line infrastructure ever undertaken. The project focuses on operating the western backbone of the core NSW transmission network at 500 kV rather than 330 kV to maximise the useful capacity of all the transmission lines that supply the Newcastle, Sydney and Wollongong load centres.

The Western 500 Project links major electricity generating locations in the Hunter region, western NSW and the Snowy Mountains Scheme. A key component of the Western 500 Project also involved the construction of a new 500kV / 330kV Substation at Bannaby which is now complete. It is envisaged by the proponent that in the future TransGrid may increase the capacity of the Bannaby to Yass 330 kV transmission line, Line 39, which traverses the Dalton Power Project site, allowing up to 1500 MW of generation to be installed.

Chapter 2 Project Need and Justification

Figure 2-1 Stylised NSW Network

Source: Provided by AGL as sourced from TransGrid 2010.

2.3 Electricity Demand

2.3.1 Energy Directions Green Paper

As the security of energy supply is a critical issue for the future of NSW, the NSW Government released their *Energy Directions Green Paper* (the Green Paper) in December 2004. The Green Paper states that while there is currently sufficient electricity generation capacity in New South Wales to meet demand, capacity will be exceeded by demand in the future. The potential for demand management is significant and can be achieved through the interruption of supply, energy efficiency and the substitution of gas for electricity as an energy source. Such initiatives are normally left with Government to implement, although AGL does participate in energy efficiency programs. This was demonstrated in 2006 when AGL won a Green Globe Award from the NSW Minister for Energy for *"superior performance in the development and delivery of energy efficiency initiatives"*. However the Green Paper notes that even where demand management potential is realised, the *"effect will be to defer the need for new supply by a year or two, rather than eliminate it."* As such, demand

management is not considered to materially affect the requirement for new generation capacity in NSW.

Over the next decade, it is predicted that rising electricity demand from the whole of NSW will exceed existing generation capacity.

2.3.2 AEMO Statements of Opportunities

Each year, AEMO releases its Electricity Statement of Opportunities (ESOO) which, in part, analyses the supply and demand scenarios for each region of the NEM. The ESOO includes a supply-demand balance for each of the five interconnected states that form the National NEM – indicating the point, known as the Low Reserve Condition (LRC), when additional capacity may be needed to maintain the established level of electricity supply reliability.

If no capacity in addition to that already committed is made available to the market, this point in time is reached for NSW somewhere around 2014 and 2015. After a prolonged period without substantial investment in power generation capacity in NSW, there is a requirement for new generation capacity investment that will be sustained over a number of years. Regardless of which forecast is used to predict the requirement for new generation capacity in NSW, the underlying message does not change.

The ESOO is only one of several factors that determine project need and timing. Other factors that determine the project need and timing include the retail position of AGL. This is influenced by AGL's ability to hedge market exposure through contracting. As the time approaches where demand becomes equal to supply, the wholesale price of electricity to AGL rises, sometimes dramatically, while sales to consumers remain at a fixed, regulated price. This affects the contract market and increases the cost of electricity for AGL that it supplies to consumers at a fixed price. The Dalton Power Project is fundamental to allowing AGL to continue to supply electricity to consumers at a competitive and regulated price.

In order to reduce its exposure to electricity price volatility, AGL seeks to construct and operate a gas fired peaking power station to mitigate against potential substantial losses during times of high price. This is in addition to a number of gas fired power stations which have been considered and progressed through the NSW approvals process to fulfil this peaking generation demand. It is clear that the short run operating cost of gas peaking generation plant has proven to be significantly higher than the other technologies such as coal fuelled power stations meaning that it will be less economic to run at times when prices are not high. For this reason, more cost efficient power plants will be constructed to meet intermediate and base load electricity demand.

2.3.3 Response to Electricity Demand

The Federal Government's Renewable Energy Target (RET) is resulting in increased penetration of renewable energy sources such as wind and solar generation. Most of these renewable sources rely on a variable and uncontrollable natural resource (i.e. wind and solar energy) and are not assured to be available at times of high electricity demand or price. Complementary and controllable generation sources are needed to support the renewable energy generation sources. Gas fuelled turbines operating in open cycle arrangement are the most efficient and environmentally friendly method of complementing uncontrollable renewable generation sources.

Chapter 2 Project Need and Justification

Open cycle gas turbines are able to be quickly started and stopped (typically less than 30 minutes from off to full output) meaning they are not required to operate constantly like thermal power stations, which typically take up to eight hours to start from cold and as a result are rarely turned completely off.

This form of generation allows AGL to meet times of high demand and manage commercial risks associated with high price. If AGL's generation portfolio had only renewable energy sources of electricity and there was a high electricity price, then AGL could be exposed to paying the high prices. The development of the Dalton Power Station is part of AGL's strategy to mitigate commercial risk, so that AGL can supply it's customers at time of high prices.

AGL has demonstrated that it is prepared to invest in low emissions and renewable energy technology through its previous generation activities involving:

- the acquisition of hydro assets from Southern Hydro in Victoria;
- acquisition of the 1280 MW natural gas fired Torrens Island Power Station;
- construction of the 95 MW Hallett wind farm in South Australia;
- construction of the 71.4 MW Hallett II wind farm in South Australia;
- construction of the 63 MW Oaklands Hill windfarm in Victoria; and
- construction of the 130 MW Bogong Hydro Project in Victoria;
- construction of the 420 MW Macarthur wind farm in Victoria; and
- development of the approximately 150 MW Ben Lomond wind farm in NSW (Site under option; permitting ongoing).

2.3.4 Owen Inquiry

The NSW Government established an inquiry into Electricity Supply in NSW in May 2007 to advise the Government on the actions it needs to take for the timely investment into new base load generation. The inquiry was undertaken by Anthony Owen, Professor of Energy Economics at Curtin University of Technology (generally referred to as the Owen Inquiry), with the terms of reference to:

- review the need and timing for new base load generation that maintains both security of supply and competitively priced electricity;
- examine the base load options available to efficiently meet any emerging generation needs;
- review the timing and feasibility of technologies and / or measures available both nationally and internationally that reduce greenhouse gas emissions; and
- determine the conditions needed to ensure investment in any emerging generation, consistent with maintaining the NSW AAA Credit Rating.

The Owen Inquiry noted that *"Generation reliability means that New South Wales needs to generate or import enough electricity to meet customer needs at all times, including times of peak demand. The State's everyday energy needs should be met in a way that gives its customers value for money[1]"*.

Further it stated that:

> *"Peaking generators can start up at short notice, operate over a wide range of output and respond rapidly to short-term peaks in demand. In New South Wales, hydro generators have mainly filled the peaking role. However, further potential for hydro peaking plants is very limited. Open cycle gas turbines are now used for peaking duty[2]"*

The Owen Inquiry concluded that

> *"The private sector has demonstrated it will invest in new generation in the NEM under the right conditions (including access to a stable revenue stream, to generation development sites and to fuel sources). The private sector can manage the commercial risks in developing a power station but has less capacity to handle policy and regulatory risks.[3]"*

Further it stated that

> *"Vertically integrated firms, such as AGL, Origin Energy and TRUenergy, are able to insulate their business's earnings from potentially volatile movements in wholesale electricity prices through having both retail customers and power stations. Such models, commonly referred to as 'gentailers', have evolved largely from the requirement for large electricity retailers to add generation capacity to offset the risk from variable input costs (wholesale electricity prices) being sold at a fixed cost to customers (regulated price caps or contestable contracts).[4]"*

Whilst AGL gained approval for the Leafs Gully Gas Fired Peaking Power Plant, it is insufficient to meet AGL's peak generation needs and AGL does not currently have access to any peaking generation plant in NSW over which it has control. This significantly limits AGL's ability to mitigate its exposure to the volatile movements in wholesale electricity prices referred to in the Owen report and to also contribute to competition for customers in NSW.

2.4 Peak Energy Demand

There are two common measures of electricity demand:

- *Average (base load) demand*: demand that occurs most of the time; and
- *Peak demand:* demand that typically occurs when customers use air conditioning or heating at times of very high or very low temperatures respectively.

The Green Paper states that peak demand is growing much faster than average demand. In NSW, summer peak demand has grown by around 3.8 % (500 MW) per year for the past five years. Average demand growth has been significantly slower at around 2.8 %. The Green Paper further notes that effectively 10 % of NSW generation and network capacity is used for only 1 % of the time. If current

[1] Owen, A.D. *Report of the Owen Inquiry into Electricity Supply in NSW*, September 2007, page 1-2
[2] Owen, A.D. Report of the Owen Inquiry into Electricity Supply in NSW, September 2007, page 1-5
[3] Owen, A.D. *Report of the Owen Inquiry into Electricity Supply in NSW - Summary*, September 2007, page 9
[4] Owen, A.D. *Report of the Owen Inquiry into Electricity Supply in NSW*, September 2007, page 7-6

growth trends continue, in 10 years time around 18 % of generation capacity will be required for only 1 % of the year. The Green Paper states that trend toward 'peakier' electricity demand has significant cost implications for NSW consumers. The Green Paper further notes that this trend has further implications for the types of new generating plants that are likely to be cost effective in the future.

Historically, NSW peak electricity requirements have been met by the Snowy Mountains hydro-electric scheme and through older coal plant. However as demand has risen, the older coal plants are required to meet base load demand. As a result, the NSW Government has acknowledged that new peaking capacity will be needed in the next few years while the need for new power plant to meet base load demand will not be required for some time.

AGL expects that without a carbon price, additional base load would not be required for some time. However, if a carbon price is introduced this will put price pressures on the least carbon efficient power stations and likely result in them closing down and a subsequent increased need for combined cycle power stations.

The Dalton Power Project would form part of AGL's diverse energy portfolio which also includes investments in hydro and wind farms, base load power plants, gas production facilities as well as gas and electricity retailing. Different energy sources have unique limitations and uses. Gas is used in open cycle peaking plants because gas turbines can be turned on and off quickly to meet surges in demand for power, but is expensive to run continuously. While hydro is also used for peaking capacity, there are increasing limitations on the amount of water available for this purpose.

AGL is a retailer of electricity and as noted previously, during periods of peak demand the wholesale price that AGL pays to other generators can increase by 200 times the cost of base load power. To avoid such high prices AGL must have the capacity to generate electricity at times of peak demand.

The need for AGL to have more Peaking Power Generation in NSW was exemplified in January/ February 2011. During this period, there was a high demand in NSW, Victoria, and South Australia due to the high temperatures. AGL's contracted electricity supply in Queensland, however, was limited and/or not available due to the effects of the floods and Cyclone Yasi in Queensland. This resulted in the demand and supply in NSW being out of balance, resulting in very high electricity prices.

AGL is prepared to invest large sums of money in a power plant that operates infrequently in order to avoid heavy financial losses and costs associated with buying electricity from wholesalers at periods of peak demand.

The capital cost per megawatt of capacity for an open cycle gas turbine is lower than that for combined cycle gas turbines or coal fired generators making it more cost effective for short periods of operation during peak times. However the operating cost is higher than the other technologies such that it will generally not be economic to run when the price of electricity is lower, for example at average prices of less than $70 per megawatt hour.

Based on the high operating costs for continuous running of open cycle gas turbines, it is unlikely the operating hours of the gas turbine will increase over time as other power plants will be constructed to meet intermediate and base load demand. In the event that gas-fired generation is more competitive than coal due to emissions trading or a similar scheme, then gas-fired power stations would be developed for base load operation. However, due to fluctuations in electricity demand at different

times of the year, a peaking plant is still required in the market and the full capacity of the Dalton Power Project would be utilised for that purpose.

Should AGL decide to develop a base load gas-fired power station in addition to a peaking plant, it would be required to go through a separate approvals process to determine the feasibility at various locations and assess environmental impacts. Base load gas-fired power stations, whilst having similar NO_X emissions, are significantly more efficient at producing electricity. There is no requirement for combined cycle gas turbines in the AGL portfolio in NSW at this time and as such, they are not being considered.

AGL has demonstrated that it is prepared to invest in peaking power plants through its generation activities involving:

- securing approvals for the Leafs Gully Power Project;
- operation of the Somerton gas peaking power station in Victoria;
- construction of the 140 MW Bogong hydro power station in Victoria; and
- acquisition of hydro assets from Southern Hydro in Victoria.

2.5 Operation of the power station

It is envisaged that the Facility would operate in open cycle mode during times of peak electricity demand, typically for less than 15 % of the year.

The normal operation of the plant is expected to be approximately 3 % of the year (260 hours). This is the historical average for the operation hours for AGL's peaking plants. However, this has quite a wide variance. Some years it can be as low as 1% (90 hours) or as high as 5 % (450 hrs).

The one instance in the past decade when operation of the AGL's Peakers was higher than 5 % was around 2007 / 08. The demand was high due to a concurrent heat wave in Queensland, NSW, Victoria and South Australia, and the supply was significantly reduced, due to the output of several power stations in Queensland being reduced. Under normal scenarios, this sort of issue lasts for a limited time (maybe a couple of 5 day periods in a summer). In 2007 / 08, the issue went on for a long time and the peaking requirement was much longer than normal (approximately 10 % of the year).

Operation of the Dalton Power Station for up to 15 % of the year allows for these rare and extreme events.

2.6 AGL's Environmental Record

2.6.1 Environmental Principles

AGL has established a set of overarching principles that define how they manage and measure their impact on the environment. AGL has committed to the following:

- Compliance - AGL will meet or exceed statutory obligations and relevant codes of conduct and Company standards;
- Monitoring, Reporting and Communication - AGL's environmental performance measurement and reporting will be consistent with recognised national and global reporting standards. AGL will

apply the assurance and verification principles of materiality and completeness and responsiveness when measuring, monitoring and reporting environmental performance;

- Impact Minimisation - AGL will reduce risk to the environment and minimise our environmental impact, by integrating considerations of environmental sustainability in all activities. Key considerations for AGL and our stakeholders in minimising environmental impact include pollution prevention, promotion of waste minimisation, reuse and recycling, the efficient use of resources such as water and energy and protecting cultural heritage;
  - AGL will provide products, services and information to help customers make informed energy choices to benefit their home, business and the environment; and
  - Contractors and suppliers are expected to demonstrate consistency with AGL's approach by fulfilling their environmental responsibilities.
- Climate Change and Renewables - Consistent with business objectives and AGL's Greenhouse Gas Policy, AGL will work in consultation with its external stakeholders to improve greenhouse gas emission outcomes;
- Stakeholder Engagement - AGL will provide leadership and actively participate in the policy debate on energy and environmental matters; engage with government, industry and community, our people and other stakeholders about how to achieve sustainability in the energy sector;
  - AGL's employees are encouraged to contribute to improving the Company's environmental performance; and
  - AGL aims to build knowledge, capability and understanding of environmental management issues for their employees.

These principles would govern the construction and operation of the Dalton Power Project.

2.6.2 Proceedings

AGL has not been subject to any proceedings under a Commonwealth, State or Territory law for the protection of the environment or the conservation and sustainable use of natural resources.

2.7 Relationship to other projects in the region regarding EPBC matters

A search of the EPBC referral website was undertaken for the last two years for the areas of Dalton, Crookwell, Gunning and Goulburn. It was identified that the project 132 kV Transmission Line from Gunning wind farm to existing Yass-Goulburn transmission line was in the region of the Dalton Power Project.

Table 2-1 summarises relationship of the above projects to the Dalton Power Project.

Table 2-1 Relationship to other projects

Project	Proponent	Status and Relationship to Dalton Power Project
132 kV Transmission Line from Gunning wind farm to existing Yass-Goulburn transmission line.	ACCIONA Energy Oceania Pty Ltd	EPBC Referral. Determined to be not a controlled action 18 December 2008. No operational issues anticipated related to Dalton Power Project.

The proposed action is not related to any known proposals in the region.

Further detail about other projects in the region is provided in **Chapter 16** (**Section 16.8**).

2.8 Project Benefits

The Dalton Power Project would be an important addition to the electricity infrastructure for NSW. In relative terms of electricity provision, generation would be close to the areas of consumer demand, therefore the Project would contribute to ensuring a reliable and efficient electricity supply during peak consumption times. As the proposed Facility would be able to operate without water in times of emergency, it would not be impacted by drought conditions which affect other forms of generation. Further, natural gas is clean burning and has comparatively low greenhouse gas emissions. New power generation will continue to be required in future years and the Dalton Power Project would enhance the local electricity network in the interterm and into the future.

The Project would create economic benefits both for the state of NSW and AGL. For NSW, private investment in generation would offset Government expenditure requirements. The Project would generate a modest level of additional employment to operate the plant and would contribute to higher levels of employment generation during the construction period. Peak power generation also enables AGL to better manage its cost of electricity sold to consumers providing better competition in the retail, wholesale and industrial electricity market with consumer benefits as well.

The Dalton Power Project delivers electricity with acceptable environmental outcomes. It has lower greenhouse gas emissions than coal fired plant and is located in an appropriately zoned area with adequate separation from sensitive receptors.

Project Alternatives – Summary of Key Outcomes

A range of alternatives for plant, proposed location and water sources were considered. Operation of gas turbines in open cycle mode was found to be preferable to combined cycle gas turbines and coal fired generation for meeting peak electricity demand while renewable technologies are not conducive to meeting peak demand requirements. Natural gas is a clean burning fuel and has comparatively low greenhouse gas emissions. In terms of alternate power generation technologies, open cycle gas turbines present the best balance of outcomes between the imperatives of climate change mitigation and meeting peak electricity demand while managing the price of electricity for end use consumers.

NO_x emissions would be controlled through implementation of Dry Low NO_x technology, reducing NO_x emissions by about 88 %. Alternative NO_x emission control technologies such as catalytic combustion and selective catalytic reactor are not suitable for this application due to technology constraints. Other viable mechanisms for NO_x offset and reductions would be regulatory policy, namely a NO_x cap and trade scheme. Given the anticipated introduction of the Emission Trading Scheme to reduce greenhouse gas emissions, a similar framework for NO_x emissions would allow a consistent approach in addressing emissions reduction and also provide a 'level playing field' for all emission sources.

AGL has undertaken a comprehensive review of existing gas turbine developments in Australia and has also reviewed more than 12 alternative sites for the proposed development in NSW. Network connections, existing land uses and environmental constraints were reviewed as part of the Project's siting investigation, and the Dalton area remains the preferred region due to the proximity of the Site to demand, the existing concentration of infrastructure, and the appropriate site setback from neighbouring properties and communities.

The location of the proposed footprint (about 26 ha in size within a total Site area of approximately 508 ha) was determined as a balanced outcome between competing interests of various landowners, environmental considerations and cost considerations. Alternatives were also considered for the location of the access road and gas pipeline. The proposed location of this infrastructure balances the ecological and engineering constraints.

A number of water source and treatment have been considered. AGL is considering potential supply by one or a combination of options. This Environmental Assessment has considered the supply of some of the water requirements to the Site for the options by tanker. Further consideration would be given in the detailed design stage regarding piping from these sources, however, this Environmental Assessment does not address the broader environmental impacts associated with construction and operation of a water supply pipeline from these sources. Each of the potential pretreatment processes has an associated wastewater stream. The water supply would therefore need to accommodate these losses to meet the Facility demands. This Environmental Assessment has considered the water requirements for the identified pretreatment options.

Chapter 3 Project Alternatives

3.1 Introduction

A number of alternatives to the Dalton Power Project were considered to determine how best to meet the project need described in **Chapter 2** *Project Need and Justification*. In addition to contextualising AGL's current operations and vision for Australia's energy future, this chapter addresses alternatives to the type, scale, location of the Dalton Power Project. Alternatives considered by AGL and presented in this chapter are discussed as follows:

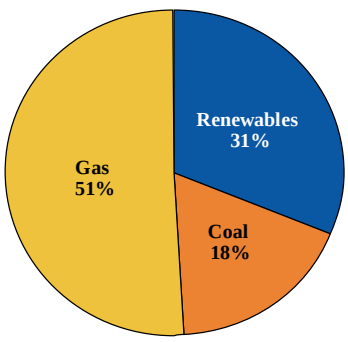
- power generation technology options;
- gas turbine technology options;
- site selection considerations;
- plant footprint options;
- access roads, services and pipeline infrastructure routes;
- communications tower and infrastructure placement options;
- plant technology options (including emissions reduction and control options; inlet air cooling and densifications; and water source and treatment alternatives); and
- the 'do nothing' scenario.

3.1.1 Context of AGL's Operations

AGL believes that Australia should renew efforts to address the challenge of climate change. Notwithstanding current policy uncertainties relating to carbon emissions trading, AGL incorporates a cost of carbon in its current business decision making. AGL is committed to working with the Commonwealth Government on implementing a Carbon Price that would evolve into an emissions trading scheme. This would require the national development and deployment of low emission technologies and an economy wide approach with greenhouse gas abatement implemented on a least cost basis. AGL has been committed to investing in low emission (including natural gas) technology and renewable energy projects for a number of years, and will remain committed to this into the future.

The installed capacity of AGL power generation assets is shown in **Figure 3-1**.

Figure 3-1 AGL Energy – Installed Capacity Generation (Source: AGL 2008)



AGL supports the establishment of a long-term greenhouse gas (GHG) emissions reduction target and the creation of market-based mechanisms to achieve this goal.

As part of AGL's commitment to sustainability, AGL is committed to, and has been for many years:

- at a minimum, meet all statutory requirements relating to reducing GHG emissions;
- quantify and publish the greenhouse gas impacts of their investments, operations and supply chain;
- seek to reduce the greenhouse gas intensity of energy across the supply chain by:
  - expanding investments in low emission and renewable generation, and through the development and commercialisation of technologies that assist in reducing greenhouse gas emissions; and
  - helping customers to reduce GHG emissions by providing practical and accurate information on energy use and offering and promoting green energy;
- improve the greenhouse gas efficiency of their operations, and those in which they have an influence; and
- work with customers, shareholders, governments and the community to progress policy options and initiatives to reduce GHG emissions.

AGL is committed and has been for years, to the following actions:

- Incorporating a forecast of future carbon pricing into all major business decisions.
- Publishing information about AGL's greenhouse gas impacts.
- Benchmarking AGL's performance (both using our supply chain intensity and AGL's generation intensity) against the overall industry.
- Working with all AGL's stakeholders to better understand their options for reducing greenhouse gas emissions.
- Continue to consider a suite of opportunities to expand AGL's low emission and renewable generation interests including the Macarthur wind farm, Oaklands Hill windfarm in Victoria, Ben Lomond windfarm in NSW and two further wind farm projects surrounding Hallett in South Australia;
- Continue to work with the Commonwealth and State Governments as they implement a carbon price that would evolve into an emissions trading scheme and effective Renewable Energy Target;
- Continue to offer to forward trade in Australian Emission Units (AEUs), promoting the scheme and providing liquidity in an emerging market;
- Continue to work with AGL's stakeholders to foster greater levels of shared understanding about the targets, pathways and costs associated with reducing greenhouse gas emissions;

- Provide expert advice on energy efficiency and carbon management services through AGL's new business offering for our major commercial and industrial customers called Carbon Management Services;
- Aim for AGL's state electricity supply intensity to be beneath state averages; and
- Continue to work with governments and agencies at all levels to foster understanding around energy markets and energy efficiency programs.

3.2 Power Generation Technology Options

3.2.1 Conventional Fossil Fuel Options

Coal-Fired Power Stations

Coal-fired power stations are a cost effective means of catering for base load demand. Coal-fired power stations can meet peak load demand by operating at over the rated capacity. However this practice is generally limited to very short periods of time due to additional stresses placed on the plant and a subsequent increase in maintenance requirements. This limits the capacity of these base load generators to service peak demand periods.

The relatively long start up and shut-down times for coal fired power stations also limits the ability of plant that is out of service to meet peak load demand and increases greenhouse gas emissions. A coal fired power station results in significantly greater greenhouse gas emissions and environmental impacts than a gas-fired power station, and so is not a preferred option for the Dalton Power project.

3.2.2 Renewable technology options

Hydro-electric power stations

Hydro-electric power stations can provide peak load supply to the NEM. The Snowy Mountains Hydro-Electric Scheme has traditionally provided peak power generation requirements to NSW and Victoria through its hydro assets. As electricity demand has grown, additional peak generation capacity is required. In NSW, the opportunities have been substantially exhausted to develop hydro-electric power stations for large scale electricity generation to meet the projected peak demand requirements identified by AEMO.

In Victoria, AGL has constructed the 140 MW Bogong hydro power station without building new dams or harvesting additional water by adding to the existing hydro assets AGL currently owns and operates. This asset will add to the over 1000 MW of renewable generation capacity already in the AGL portfolio. This demonstrates AGL's commitment to investment in renewable energy.

While the option of hydro generation is appealing as it utilises renewable energy, it is not a feasible alternative as a means of generating up to 1500 MW of electricity in NSW to meet peak demand supply.

Wind and Solar

Generation from solar and wind power is not suitable for peak load power stations due to the intermittent nature of the resource. Often weather conditions that provide a good wind resource correspond to times when electricity demand is low. For solar generation, the low capacity and high technology cost for electricity generation is such that it is not feasible even though weather conditions conducive to solar generation are often coincident with high electricity demand. In addition, AGL considers the storage technology is not sufficiently advanced to store large amounts of energy for later use. Therefore, AGL considers these technologies do not currently provide suitable alternatives that can service peak load demand.

AGL currently operates and maintains the 91 MW Wattle Point wind farm near Edithburgh, a 94.5 MW Hallett Stage 1 wind farm in South Australia, the 71.4 MW Hallett Stage 2 wind farm, also in South Australia and is constructing Hallet IV, V and Oaklands Hill windfarm in Victoria. Additionally, AGL also has plans to develop 80 MW at Hallett Stage 3. The Macarthur wind farm in Victoria is currently under construction and will have a capacity of about 330 MW.

These projects demonstrate that AGL will invest in renewable projects where the opportunity exists.

3.3 Gas Turbine Technology Options

In the absence of renewable technology options to meet the rising peak demand requirements of NSW, the best alternative is to implement low emission technology for power generation. Natural gas is clean burning and has between 30 % and 50 % lower carbon emissions than coal depending on the technology used.

3.3.1 Open Cycle Gas Turbines

Gas turbine power stations are referred to as operating in open cycle mode when no heat is recovered from the exhaust gas to drive a steam turbine. Open cycle gas turbines have a similar thermal efficiency to coal fired power stations but with 30 % lower greenhouse gas emissions. The typical establishment time for design and commissioning of open cycle gas turbine units is around two years which is significantly less than for a coal fired power station.

Open cycle gas turbine units can be operating at full capacity within thirty minutes following a cold start, compared to a minimum of eight hours for a coal fired power station. Rapid start up and shut down provides a further benefit in the saving on greenhouse gas emissions by responding to demand as it arises.

Given the relatively short start-up and shut down times for these systems, open cycle gas turbine units are ideal for operations to meet peak load demand and generally represent best practice technology

for this type of use. Open-cycle gas turbine units are also ideally placed to respond to the short term variability in the generation capacity of wind farms as a result of variable wind conditions. This will become increasingly important as more wind-generated power is introduced into the system.

The capital cost per megawatt generated for open cycle turbine is lower than that for combined cycle gas turbines (see below) or coal fired generators making it more cost effective for short periods of operation during peak times. However the operating cost is higher than the other technologies such that gas turbines are less economic to run when the price of electricity is at average prices of less than $70 per megawatt hour. For this reason it is unlikely the operating hours of the gas turbine would increase over time as other power plants would be constructed to meet intermediate and base load demand.

Peaking gas turbines can operate with a liquid fuel source in the event of gas supply irregularities or interruption. Alternative liquid fuels for the turbines include methanol, kerosene, diesel and heating fuels. Where there is access to gas, the likelihood of gas supply irregularities or interruption is reduced. This would eliminate the requirement for storage and combustion of liquid fuel to fuel the turbines where natural gas constraints do not exist, further reducing potential emissions from the power station.

Increasing penetration of intermittent renewable energy sources such as wind into the grid increases the need for rapid response dispatchable generation facilities to ensure security of supply (for example, at times of low wind generation). In this way, the construction of peaking plants is seen as integral to support the introduction of renewable energy use in NSW.

3.3.2 Combined Cycle Gas Turbines

Combined cycle gas turbine power stations consist of one or more open cycle gas turbine units coupled to a steam turbine. Steam is generated using the residual heat from the open cycle gas turbine units that is then used to drive a steam turbine.

Combined cycle gas turbine units have the advantage of offering greater thermal efficiencies than open cycle gas turbine power stations and coal fired power stations. Combined cycle gas turbines are more suited to intermediate or base load operations as they require greater start-up and shut down periods than open cycle gas turbine units and have a lower operating cost.

As AGL is seeking to install peaking capacity this technology does not meet business requirements due to the long start times.

3.3.3 Selected Generation Technology

Open cycle gas turbines using natural gas as the only fuel source were selected as the best option for this project as they represent the best practice technology for peak load operations. Rigid frame (E class and F class) units were considered in this Environmental Assessment based on the objective of the Dalton Power Project to meet peak electricity demand.

This objective determined the type of gas turbine that can be used. The requirements are for turbine units that can be placed in service rapidly and can handle intermittent operation, tolerate a high number of starts and stops, and demonstrates reliable operation. As the plant would normally run during high peak times, it is essential that multiple gas turbines be installed to increase reliability. Rigid frame E and F class industrial turbines are suitable for this type of duty.

Aero-derivative gas turbines are turbines generally derived from aircraft applications and are similarly suited to peaking plant as the E and F class turbines. However, the generation capacity of these units is typically 10 to 50 MW although larger units in the order of up to 320MW have been developed more recently. The installation of many smaller turbines to meet the required output is not considered practical because of the larger footprint required and significant additional capital and maintenance costs.

The E class and F class type turbines are the best type of turbine as they reliably handle intermittent operation with a high number of starts and stops and the impacts of this technology type has been assessed within this current Environmental Assessment.

3.4 Site Selection Considerations

The NSW gas and electricity transmission networks were developed independently. The potential construction of gas-fired power generation was not considered in developing the separate networks. As construction of a commercially competitive gas-fired power station involves connection to high capacity electricity and gas networks, this leads to the identification of a limited number of corridors where gas and electricity networks are coincident.

AGL has identified these as:

- various locations between Young and Wilton;
- a corridor from Wilton through western Sydney;
- the Central Coast and Newcastle area;
- between Young and Culcairn;
- between Culcairn and Albury;
- south-west of Nowra;
- Nowra to Wollongong; and
- the Dalton / Gunning region.

The target sites identified in the areas nominated above were considered by AGL and a summary of their assessment is discussed in the following sections.

3.4.1 Site Selection Parameters

In identifying target sites in the identified corridors, AGL considered several parameters including network connection and land use. The basis for these selection parameters is set out in the following subsections.

Gas Network Connection

Gas-fired power generation is a substantial gas consumer as shown in **Table 3-1.**

Table 3-1 Consumption of Gas

Parameter*	1500 MW Peak Generation	Moomba Sydney Pipeline	Eastern Gas Pipeline
Daily Throughput	70-105 TJ	1000 – 2250 TJ	1000 TJ
Hourly Throughput	8.5 TJ	40 - 95 TJ	40 TJ

While a peaking power plant would take around 3-5 % of the maximum daily flow through the Moomba Sydney Pipeline, its instantaneous consumption could range between 20-40 % of flow. For the Eastern Gas Pipeline, the situation is more extreme. As a result, peaking plants are only suitable for installation on, or close to, main gas transmission lines where their impact on system pressure is mitigated by line pack. Line pack is the amount of gas in the pipeline system between the supply and delivery points. In contrast, locations at the end of a gas distribution network are not suitable because pipe sizes are smaller and line pack is negligible. Significant capital investment for a compressor is required to upgrade pipeline capacity to a level suitable for a peaking power plant.

In assessing sites, the costs of gas system connection and the ability to service demand have both been analysed. In general, sites in the immediate vicinity (approx 1 km) of a high-pressure pipeline were selected to minimise connection costs and access / easement issues.

There are also cost advantages if use is made of AGL's ongoing haulage commitments on each pipeline. Instead of purchasing gas and pipeline capacity at short notice for limited periods (which can be expensive), gas and pipeline capacity already purchased under long term contracts is used, thus reducing cost.

Electrical Network Connection

The NSW electricity transmission system was originally planned to deliver power from Snowy, Hunter Valley and Central Coast power stations to the greater Sydney area. Subsequently interconnectors were established to Queensland and South Australia (via Victoria). AGL has identified upgrade plans by TransGrid in the immediate vicinity of the Dalton Power Project, including upgrade of the Bannaby to Sydney West lines and Bannaby to Yass line to 500 kV. Upgrade of these lines would benefit the Dalton Power Project and allow expansion of the proposal beyond that proposed for Stage 1 to an ultimate capacity of up to 1500 MW. This would allow efficient introduction of additional capacity into the NSW network following these upgrades. In assessing sites, the costs of electrical system

connection and the ability to service demand have both been assessed. In general, sites in the immediate vicinity (approximately 1 km) from a 330 kV high-voltage transmission line and preferably close to existing substations were selected to minimise connection costs and access / easement issues.

Availability of land

Based on known impacts of gas turbines and previous installations in Australia, when identifying target sites AGL assessed a number of land-related issues. These included:

- existence of adequate undeveloped land available for a power station site;
- land zoning compatible with proposed development; and
- adequate separation from sensitive neighbours such as existing residential housing.

These issues are generally satisfied by sites that:

- contain areas greater than 10 ha that are reasonably flat and level;
- zoned general industry or rural (most NSW zoning plans allow power generation in rural areas with consent); and
- are ideally more than 1 km from existing housing.

Availability of water

Relatively small quantities of water are required for cooling of air before it enters the gas turbines. Ideally the infrastructure for water supply would be located near a suitable site. While this is a consideration, it is noted that the plant can run without water. Potential water sources considered include potable water, raw water and treated effluent.

Altitude and climate

The capacity of a given gas turbine unit reduces as air density decreases. The density of air in turn decreases with increased temperature and altitude (reduced pressure). As a result, the sites most favourable to gas turbine development are relatively cool and at low altitude. As an example, increases of 100 m in altitude decrease the output and hence value of a typical industrial gas turbine by 1.25 %. Similarly, an increase in temperature of 1°C will reduce output by 0.8 %.

These effects were taken into account in calculating the performance of plant at given sites based on altitude and summer temperature data from the Bureau of Meteorology.

Potential Environmental Impacts

The main environmental concerns in relation to gas turbine power plants relate to potential impacts on air quality, noise, visual, water quality, traffic, flora and fauna and geotechnical conditions.

Chapter 3 Project Alternatives

In conducting a site selection process, as potential impacts are similar, AGL focussed on local issues that may differentiate one region from another. For air quality, existing air quality and previous modelling is considered. Noise impacts are chiefly associated with distance to sensitive receptors and site selection criteria for setback generally addresses this issue.

Surrounding topography and location of sensitive receptors influences visual impact while the condition and status of local roads is reviewed for traffic issues during construction. The potential for flora and fauna issues based on adjoining vegetation (if any), is also reviewed while a relatively level and undisturbed site is optimal to suit geotechnical issues.

3.4.2 Alternative Site Assessment

AGL undertook a comprehensive site selection study in mid 2008 that examined a number of potential locations for a new gas fired peaking power station in NSW. The results of that study found that the Leafs Gully site in Appin was the preferable site for the development of a gas fired peaking power station. The site selection study directly informed AGL's decision to proceed with developing the Leafs Gully Power Project, and aspects of that study were incorporated into the detailed Environmental Assessment that supported AGL's application to the Department of Planning. The Leafs Gully Power Project was approved by the Minister for Planning in August 2009.

Whilst AGL gained approval for the Leafs Gully Gas Fired Peaking Power Plant, it is insufficient to meet AGL's peak generation needs and AGL does not currently have access to any peaking generation plant in NSW over which it has control. This significantly limits AGL's ability to mitigate its exposure to the volatile movements in wholesale electricity prices referred to in the Owen report and to also contribute to competition for customers in NSW.

The 2008 alternative site assessment was reviewed after the approval of the Leafs Gully Power Project to assess its validity and currency of its information. This review by AGL deemed that the sites that were originally assessed as being potential new locations for the development of another peaking power station were still worthy of consideration, and that the criteria used in that report were still valid in terms of site assessment evaluation.

In order to locate optimal sites for the development of a new peaking power station, target areas in the corridors containing electricity, gas and water infrastructure were identified. AGL evaluated the target areas identified on the basis of their proximity to gas and electrical infrastructure.

A number of sites within target areas were identified, visited and assessed by AGL. These included sites in the following locales:

- Dalton - Walshs Road;
- Nowra - Turpentine and Braidwood Roads, Tomerong;
- Wollongong – Dapto substation;
- Marulan – Marulan substation;
- Moss Vale – Wingecarribee Reservoir;
- Wagga Wagga – Bomen Industrial area and 330kV substation;
- Canberra – Hume Power Station proposal;

- Central Coast – Munmorah and Tomago proposals; and
- North Albury and Culcairn – generic area.

The sites were assessed against the key selection parameters identified above.

3.4.3 Dalton

The Dalton site was found to possess a number of locational advantages for the development of the proposed gas fired power station. The 330 kV Bannaby transmission line traverses the site, and the Moomba to Sydney Gas Pipeline is also located within close proximity . At this location, the gas and electricity infrastructure is capable of accommodating a power station development. AGL found available land within this area which is not constrained by surrounding development or zoning controls.

Furthermore, the site has been used for grazing and agricultural purposes for some time, reducing the area of native vegetation which would require removal from the site. The location is isolated enough to minimise negative environmental impacts, especially in terms of visual and noise effects.

Figure 3-2 presents the Dalton area considered by AGL during the 2008 alternative site assessment for the Leafs Gully Project.

Location

The Dalton site is located 3 km north of the small town of Dalton in the Southern Tablelands of NSW. The site is generally located between Goulburn and Yass and is approximately 12 km north-west of the town of Gunning.

Gas infrastructure

The Moomba to Sydney gas pipeline is within 2 km of the Dalton site. AGL considered connection to the pipeline at the existing offtake or via a new valve station.

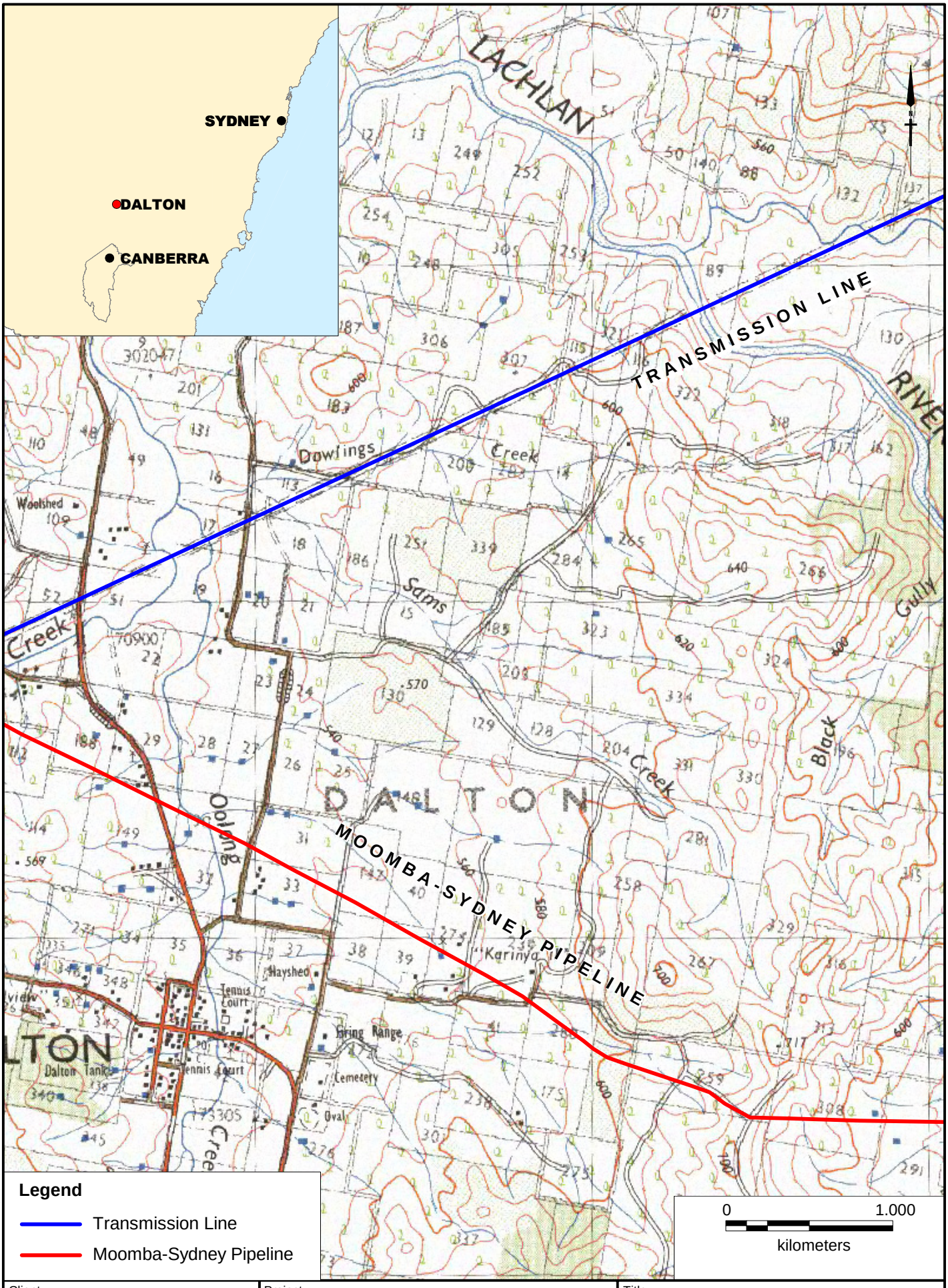
Performance

The effects of the local climate and altitude of Dalton on the potential performance of the proposed turbine units are listed in **Table 3-2**.

Table 3-2 Turbine Performance for Dalton locality

Feature	Value	Relative De-rating (%)
Altitude 530m		-5.0
Mean daily maximum	27 ^{o}C	+1.5
Total de-rating (%)[1]		**-3.5**

[1] Note: compared to notional reference site



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Client	Project	Title
AGL	AGL DALTON POWER PROJECT	ASSESSMENT OF TARGET SITES - DALTON

URS

Drawn: AO/SB	Approved: LO	Date: 10/02/2011	Figure: **3-2**
Job No: **43177661**	File No: 43177661.021.wor		

Electricity infrastructure

The Dalton site is crossed by TransGrid's Yass to Bannaby's 330 kV feeder. TransGrid's response to AGL's connection inquiry indicates that the 330 kV line has a nominal capacity of at least 780 MW. However, this section of the feeder is likely to be upgraded as part of TransGrid's ongoing 500 kV Project, enabling the Project at this respective location to be upgraded to a total generating capacity of 1500 MW as proposed.

Water infrastructure

Preliminary investigations of the Dalton site highlighted some limitations in access to water from the adjacent Lachlan River as well as a groundwater extraction embargo covering the area. The low ongoing water requirements of the proposal as well as potential water sourcing opportunities elsewhere indicated that water access was not an unsurmountable challenge at this location. Water Management for the proposed Dalton Site is discussed in **Chapter 14** *Water Management*.

NEM regions and constraints

The Dalton site is located within the NSW region and is electrically close to the Sydney load centre.

Land and availability

There is significant land available at the Dalton site, with approximately 500 ha currently in AGL's ownership. Significant parts of the site have already been cleared for previous grazing and agricultural uses, and the site has favourable topography.

Permitting and regulatory

The Dalton site falls within the Upper Lachlan Shire, and is zoned 1A Rural under the provisions of the Gunning Local Environmental Plan 1997. Power generation is permissible with development consent.

Competing developments

Other proposed developments in NSW are unlikely to impact a gas turbine power station development at Dalton. A number of windfarms are under development but not committed to construction in the area. As described elsewhere in this assessment, the Dalton Power Project would complement rather than compete with windfarm developments.

Preliminary Environmental Assessment

Initial investigations of the Site highlighted a number of environmental considerations for further assessment. Potential impacts on flora and fauna, noise, air quality and greenhouse gas emissions, landscape and visual impacts, and impacts on cultural heritage were highlighted. Preliminary investigation into these issues indicated significant opportunities for AGL to manage and mitigate the potential negative impacts of the proposal at this location.

Chapter 3 Project Alternatives

The site selection of the proposed Project Footprint within the wider Dalton Site is discussed in **Section 3.8**

3.4.4 Marulan

This area is traversed by the Moomba Sydney Pipeline and two 330 kV electricity transmission lines. Sites north of the Marulan substation are located in an area of the network that is less affected by constraints between NEM regions.

General

Marulan is located approximately 190 km south-west of Sydney, and around 30 km north east of Goulburn. The area is rural. Refer to **Figure 3-3** for the areas under consideration.

The area was considered due to its proximity to gas and electricity infrastructure. Two locations were considered.

Location A is just south of Brayton where the Brayton Road is crossed by 330 kV lines. This location is distant and south from the Marulan 330 kV substation.

Location B is adjacent to the Marulan 330 kV substation. This site offers potential electrical interconnection savings though gas connection costs are greater. This site is under development by other entities and as such is not available to AGL.

Further development beyond that of Delta and EnergyAustralia may be limited by transmission constraints.

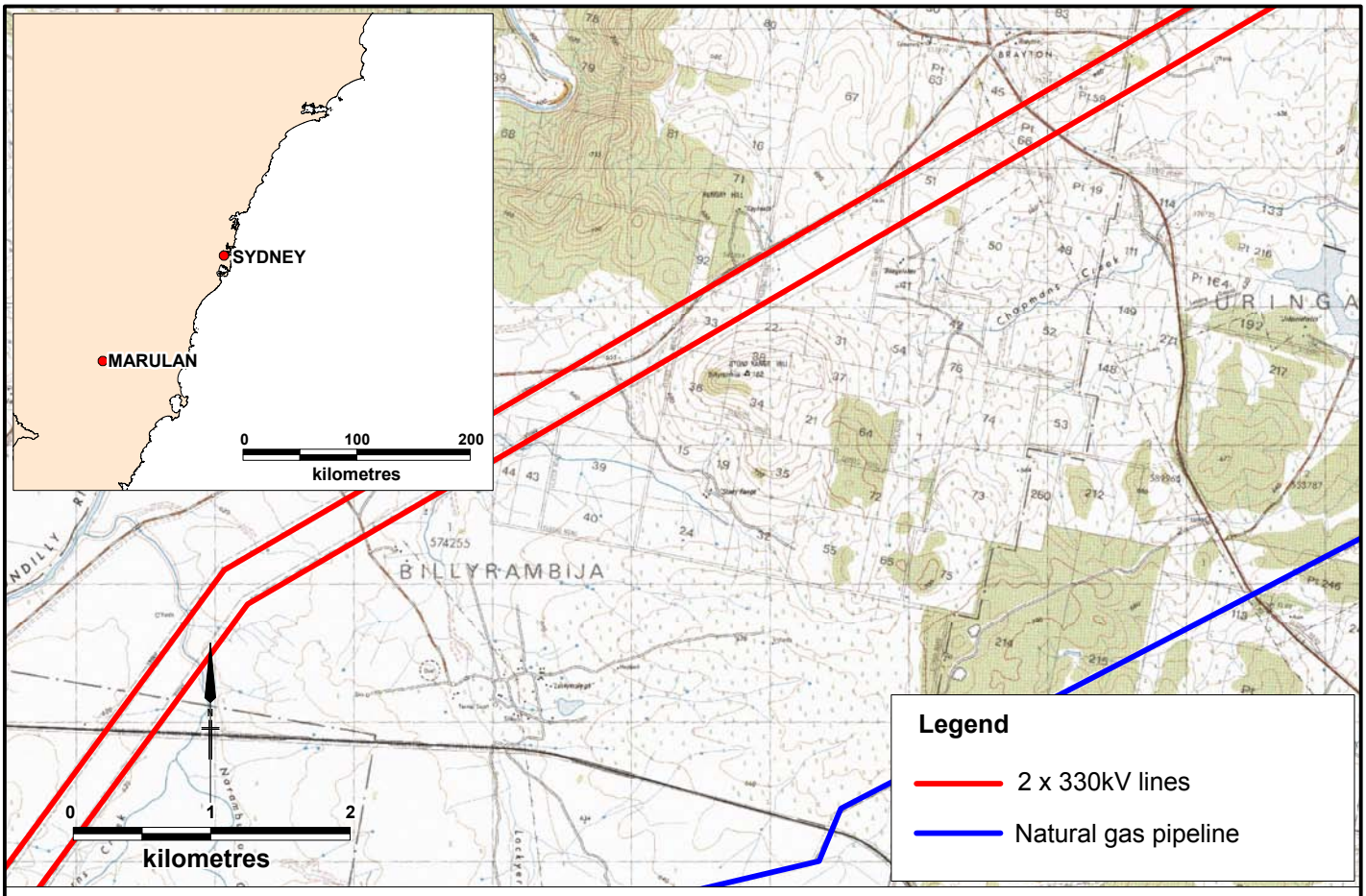
Performance

The effects of the local climate and altitude of Marulan on the performance of the turbines are listed in **Table 3-3**.

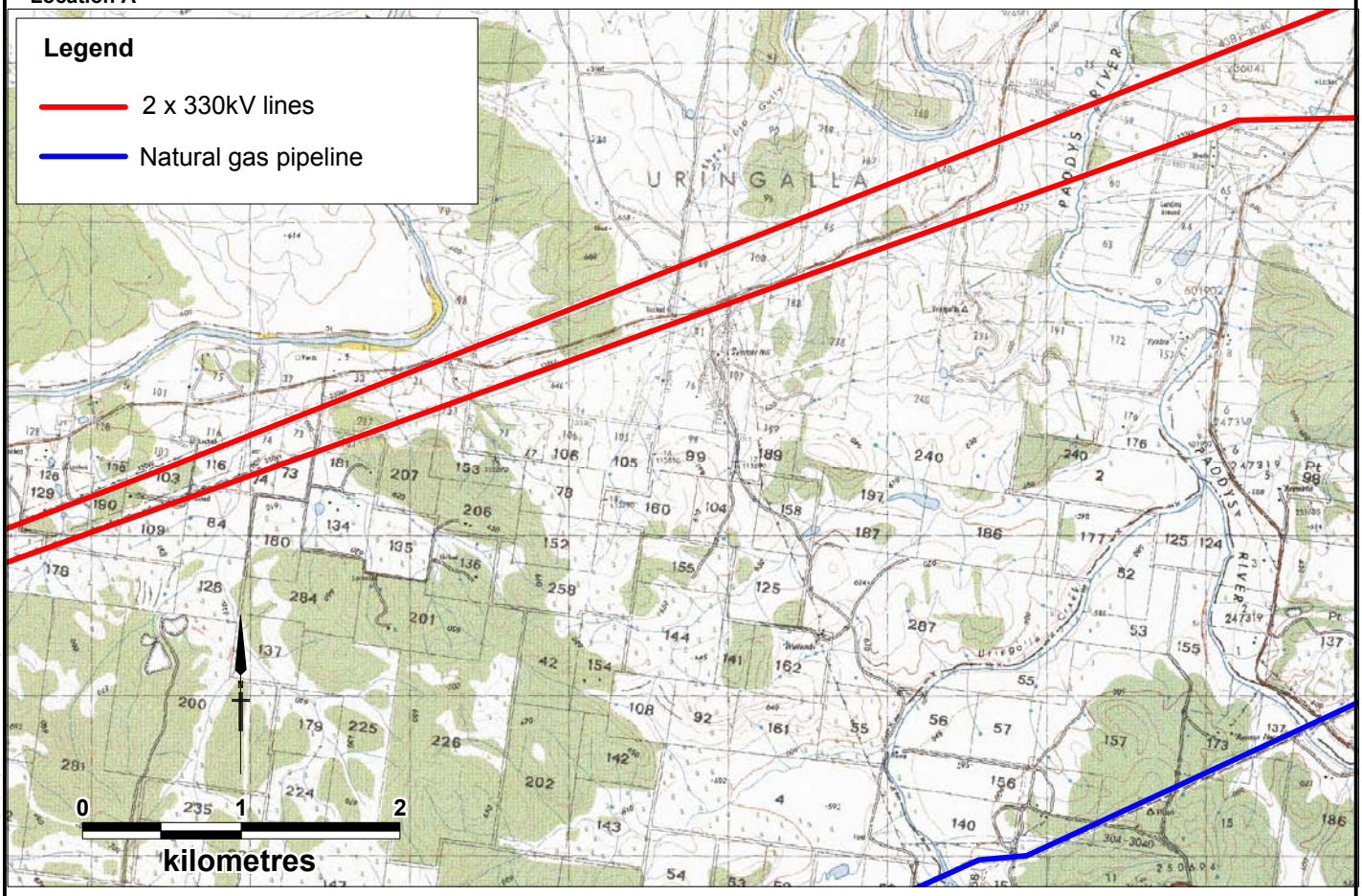
Table 3-3 Turbine Performance for Marulan locality

Feature	Value	Relative De-rating (%)
Altitude	660 m	- 6.5
Mean daily maximum	28.1 ^{o}C +	1.3
Total de-rating (%)[1]		**- 5.2**

[1] Note: compared to notional reference site



Location A



Location B

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Client: **AGL POWER GENERATION (NSW)**	Project: **AGL DALTON POWER PROJECT**	Title: **ASSESSMENT OF TARGET SITES - MARULAN**
URS	Drawn: AJW; Approved: FINAL; Date: 26/02/10; Job No: **43177401**; File No: 43177401-064.wor	Figure: **3-3**

Chapter 3 Project Alternatives

Gas infrastructure

The Moomba Sydney Pipeline crosses the Marulan area. The pipeline is located around 5 km from Location A and 7 km from Location B. No modification or supplementary compression would be required to meet the gas needs of the proposed power station.

There is no competitive tension with other gas or pipeline operators.

Electricity infrastructure

Two TransGrid 330 kV feeders cross Location A and there is a major switching station (Marulan 330 kV) located nearby. Location B is located on TransGrid's Marulan to Dapto 330 kV line.

Line congestion is likely to restrict export from a power station south of the Marulan substation. This would have to be investigated by load flow studies.

It is anticipated that a power station could connect directly to the Marulan 330 kV substation at location B, and is hence less likely to be constrained.

Water infrastructure

No available or significant water resource is located near to these sites.

NEM regions and constraints

The Marulan Switchyard is an important node in the NEM and to ensure a peaking plant remains in the same zone as the Newcastle / Sydney / Wollongong load, a direct connection to the switchyard or connection to the north is preferred. The Marulan area is in the NSW region and this is unlikely to change as a result of foreshadowed changes to NEM regional boundaries in the future.

A study of the electricity network efficiency and reliability (ROAM, 2006) found that compared to sites selected in Tomago, Munmorah and Leafs Gully, a site at Marulan would perform significantly worse from a system losses and reliability perspective and has higher potential for overload. A site in this region is subsequently more likely to be constrained during peak demand periods.

Land and availability

Private individuals own the main target land packages that would be suitable. There are very few residential dwellings in the area of interest, with only one dwelling within a 1 km radius of the proposed site.

Permitting and regulatory

The area of interest falls within the Goulburn Mulwaree Council. The land is zoned 1(a) general rural. Power generation is a permissible use with consent.

Competing developments

Similar gas power proposals are under development within Marulan. The electrical and gas connections may be constrained with additional gas power plant located in the area.

Other proposed developments in NSW are unlikely to constrain or otherwise impact a development in Marulan.

Preliminary Environmental Assessment

No other environmental issues have been identified that differ significantly from alternate sites.

3.4.5 Wagga Wagga

Wagga Wagga was considered as a location with gas and electricity infrastructure available although potentially constrained. The area is also close to good supplies of water.

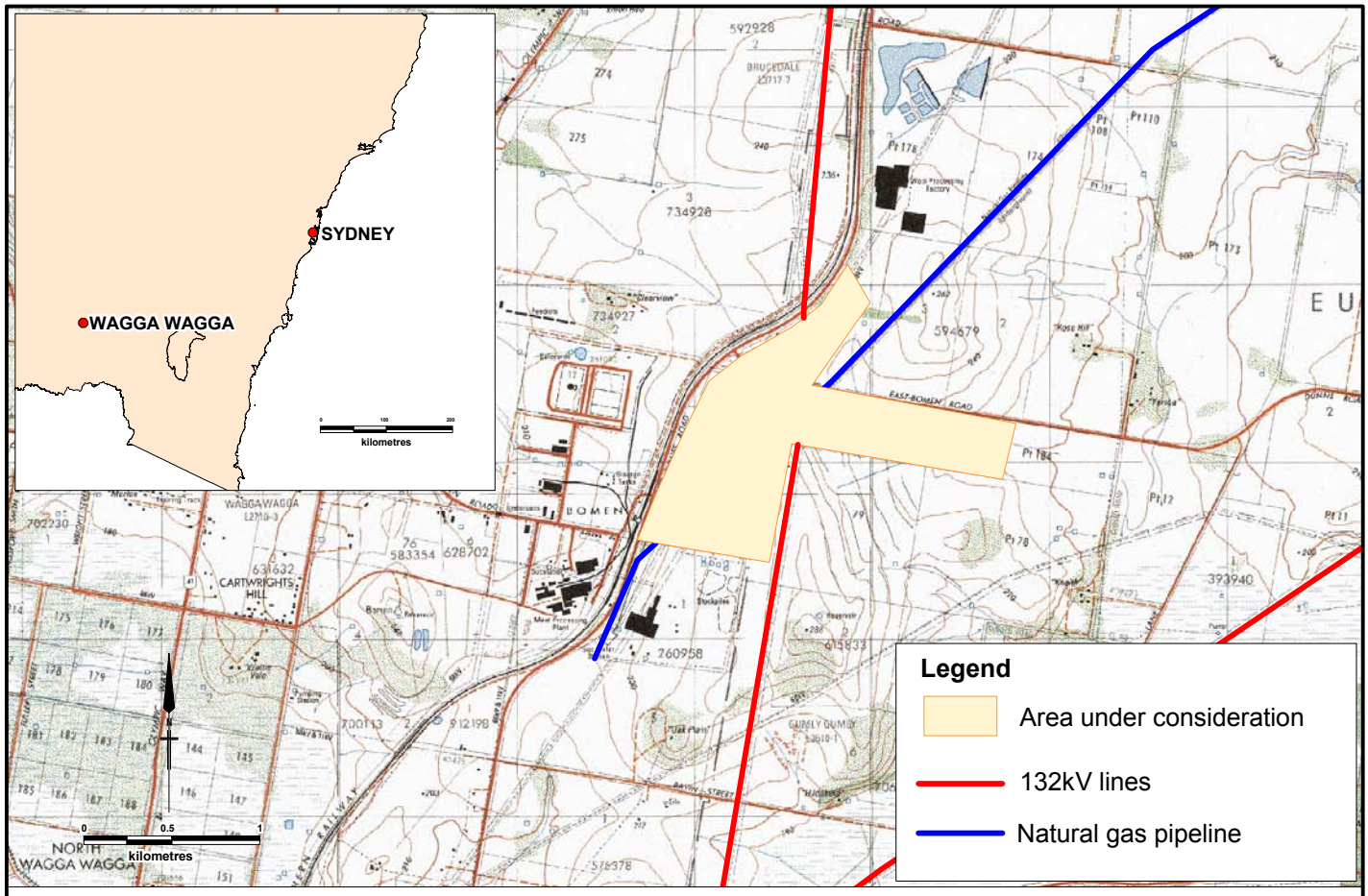
General

Wagga Wagga is located approximately 465 km southwest of Sydney. The area under consideration is within the industrial area at Bomen just north of Wagga Wagga. Refer to **Figure 3-4** for the areas under consideration.

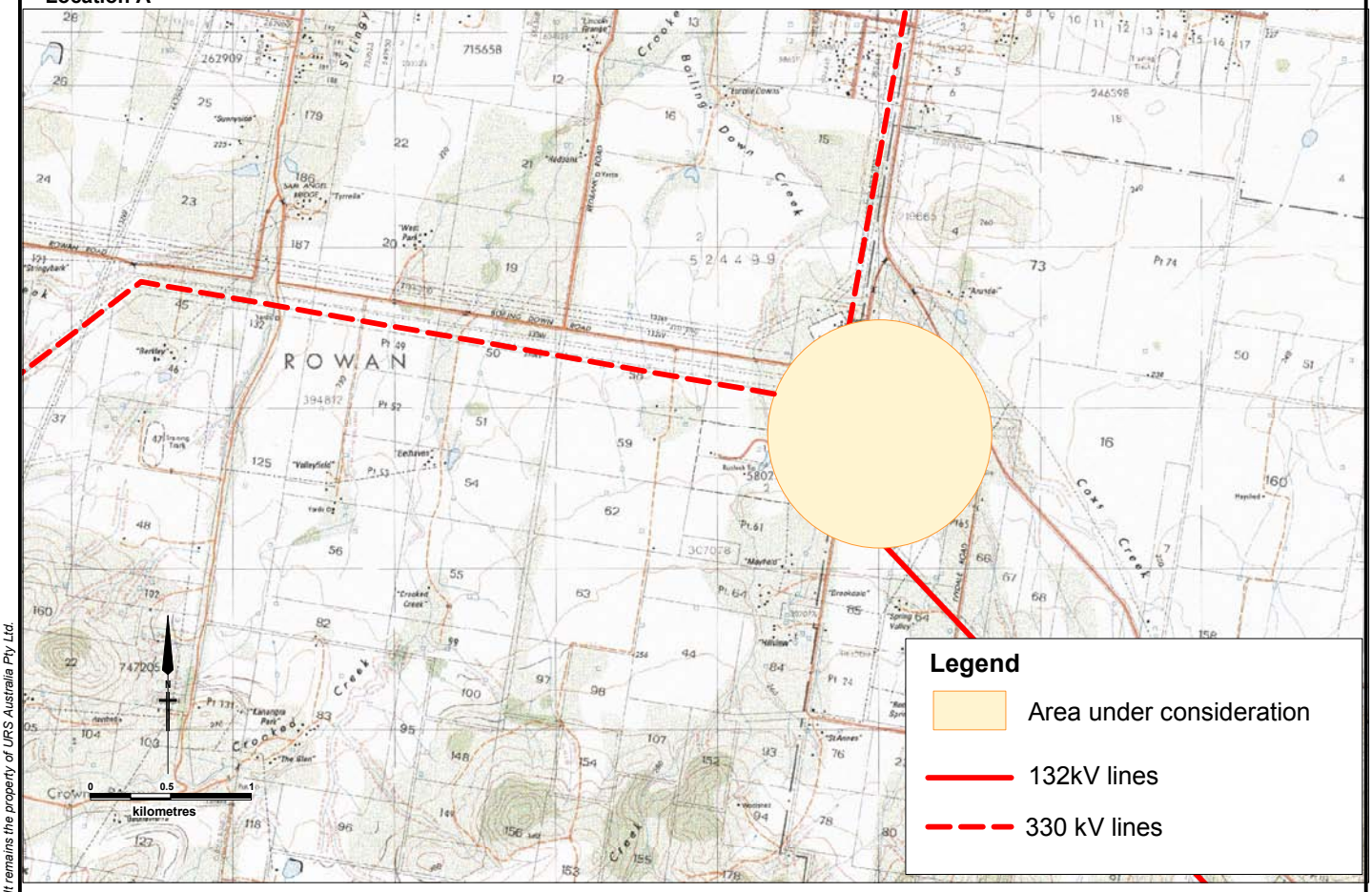
The area was considered due to its proximity to gas and electricity infrastructure, and the availability of water from the Murrumbidgee River.

Two locations have been identified as potential sites for development:

- Location A is in the Bomen industrial area; and
- Location B is adjacent to the Wagga Wagga 330 kV substation. This location has the potential to reduce electrical interconnection costs and increase export capacity, but requires additional expenditure for gas connection.



Location A



Location B

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Client: **AGL POWER GENERATION (NSW)**	Project: **AGL DALTON POWER PROJECT**	Title: **ASSESSMENT OF TARGET SITES - WAGGA WAGGA**
URS	Drawn: AJW; Approved: FINAL; Date: 26/02/10; Job No: **43177401**; File No: 43177401-065.wor	Figure: **3-4**

Performance

The effects of the local climate and altitude of Wagga Wagga on the performance of the turbines are listed in **Table 3-4**.

Table 3-4 Turbine Performance for Wagga Wagga locality

Feature	Value	Relative De-rating (%)
Altitude 240	m	-1.6
Mean daily maximum	31.4 ^{o}C -1.0	
Total de-rating (%)[1]		-2.6

[1] Note: compared to notional reference site

Gas infrastructure

APA Group's Victorian interconnector crosses the target area at Location A. A 17 km gas lateral would be required to connect Location B to the Victorian interconnector. There is no competitive tension with other gas or pipeline operators.

The gas network in this area would not require any immediate modification or supplementary compression to meet the gas needs of the proposed power station. However, in some cases an enhanced pressure service may be required which would be charged on an 'as-needed' basis.

Electricity infrastructure

Electrical interconnection at Wagga Wagga is more complex than at other sites. This is due to its location in the electrical network and the lack of 330 kV connection points. The Wagga area is located along the major transmission lines that connect the NSW region to the Snowy region and there are times when these lines do not have any additional capacity. This situation would result in a generator located in the Wagga area being constrained, and unable to export its full capacity onto the grid.

In addition to the network constraints in the Wagga area, there are very few suitable locations at which to connect at 330 kV, however there are several suitable locations for a connection at 132 kV. 132 kV lines have a nominal capacity of around 110 MVA per circuit, and therefore would only suit a relatively small power station with no capacity for expansion.

Location A is within the Bomen industrial zone. The proposed connection point is into the 132 kV lines that run from the Wagga 330 kV substation. The connection would require a 3.5 km extension of the existing 132 kV lines. The connection point would have a nominal capacity of 150 MW.

Location B is located adjacent to the Wagga 330 kV substation. The connection at 330 kV would require an additional bay at this substation. A connection at this point could accommodate the size of development being considered subject to network constraints.

Chapter 3 Project Alternatives

Water infrastructure

The Murrumbidgee River is located within 5 km of the Location A and within 12 km of Location B. A reasonably mature water trading and allocation market exists for securing water in the quantities required. Recycled water may also be available.

NEM regions and constraints

Whilst the Wagga Wagga area is currently in the NSW region this may change as a result of changes to NEM regional boundaries in the future. Wagga is a long distance from the demand centre of Newcastle / Sydney / Wollongong.

Land and availability

Wagga Wagga City Council owns the main target land packages. Very few residential dwellings are located within the area of interest.

Permitting and regulatory

The area of interest falls within Wagga Wagga City Council. The land is zoned rural. Power generation is permissible on land with this zoning with consent.

Competing developments

The AEMO Statement of Opportunities notes a publicly announced generation proposal in the Wagga Wagga area from Wambo Power Ventures (WPV) now known as NewGen. The proposed development is in the Uranquinty area south west of Wagga Wagga. This development could impose additional constraints on a development in this area.

Whilst no other specific developments are committed, it is understood that the Snowy Mountains Hydro Electric Scheme is considering repowering and developing additional hydro capacity. This could have a material impact on the ability of a development located in this area to export power. Additionally, development in this area is vulnerable to further development of electrical interconnectors and is reliant on ongoing development of the local transmission network and local load to secure its ability to export.

Preliminary Environmental Assessment

No other environmental issues have been identified that differ significantly from alternate sites.

3.4.6 Culcairn

Culcairn was considered as it is located at the end of APA Group's gas network and reasonable electrical infrastructure is available but no significant water sources. The site was assessed to see if it offered any advantages over Wagga Wagga or Albury.

General

Culcairn is located approximately 500 km southwest of Sydney, around halfway between Wagga Wagga and Albury. The area is rural. Refer to **Figure 3-5** for the area under consideration.

The area was considered due to its proximity to the Victorian interconnector, and was used to compare with Wagga Wagga and Albury. No specific location was identified for a development.

Performance

The effects of the local climate and altitude of the Culcairn locality on the performance of the turbines are listed in **Table 3-5**.

Table 3-5 Turbine Performance for Culcairn Locality

Feature	Value	Relative De-rating (%)
Altitude 210	m	-1.30
Mean daily maximum	31.2 ^{o}C -0.80	
Total de-rating (%)[1]		-2.10

[1] Note: compared to notional reference site

Gas infrastructure

The Culcairn area is the end of Australian Pipeline Trust's Victorian interconnector. The gas network at Culcairn would be subject to the same kinds of issues present at Wagga Wagga. An enhanced pressure service may be required to support a power station at this location.

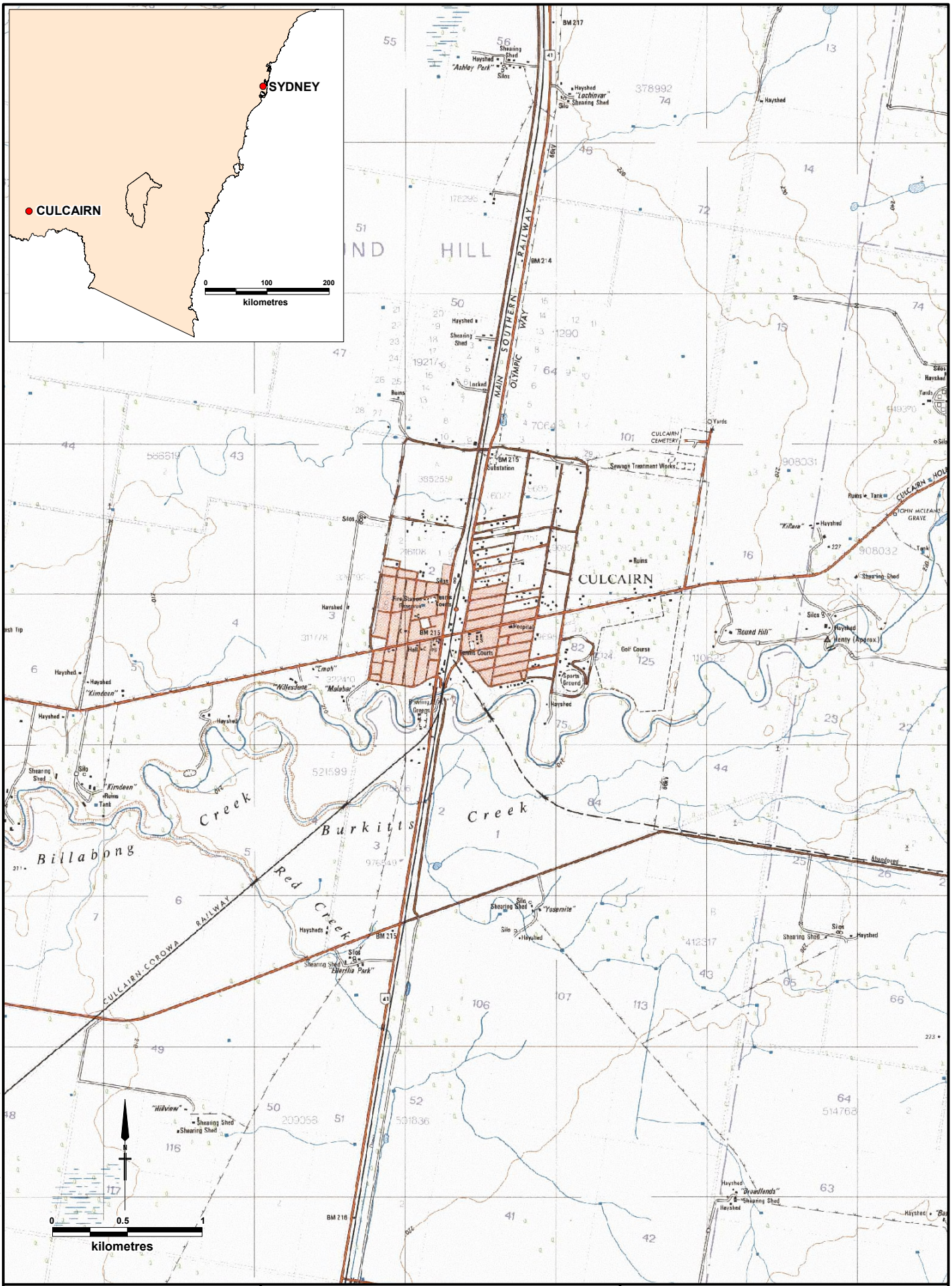
There is no competitive tension with other gas or pipeline operators.

Electricity infrastructure

132 kV transmission lines cross the Culcairn area. Nominal capacity of these lines is estimated at 110 MVA per circuit. A development at this location would be hampered both by a lack of capacity at the connection point, but also by network constraints that affect Wagga Wagga.

Water infrastructure

No significant water storage or rivers are located near this site.



Client: **AGL POWER GENERATION (NSW)**	Project: **AGL DALTON POWER PROJECT**	Title: **ASSESSMENT OF TARGET SITES - CULCAIRN**
URS	Drawn: AJW · Approved: FINAL · Date: 26/02/10 · Job No: **43177401** · File No: 43177401-060.wor	Figure: **3-5**

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NEM regions and constraints

The comments that have been made for Wagga Wagga in **Section 3.5.3** apply, namely:

- further studies would need to be undertaken to ascertain whether or not a development at this location would affect other market participants, and what effect the development would have on interstate and intrastate energy flows;
- it is expected that there would be scenarios under which the development would be unable to export at full capacity as a result of network constraints;
- whilst the Culcairn is currently in the NSW region this may change as a result of foreshadowed changes to NEM regional boundaries in the future; and
- long distance from the key demand area of NSW.

Land and availability

No target area has been identified in the Culcairn area, as the site is low in the list of priorities. No land shortages are foreseen in this area.

Permitting and regulatory

The area of interest falls within the Culcairn Shire Local Government Area (LGA). It is assumed that any identified land would be zoned rural.

Competing developments

The AEMO Statement of Opportunities notes a publicly announced generation proposal in the Wagga Wagga area from Wambo Power Ventures (WPV). The proposed development is in the Uranquinty area south west of Wagga Wagga.

Whilst no other specific developments are committed, it is understood that the Snowy Mountains Hydro Electric Scheme is considering repowering and developing additional hydro capacity. This could have a material impact on the ability of a development located in this area to export power. Additionally, development in this area is vulnerable to further development of electrical interconnectors and is reliant on ongoing development of the local transmission network and local load to secure its ability to export.

Preliminary Environmental Assessment

No other environmental issues have been identified that differ significantly from alternate sites.

3.4.7 North Albury

North Albury was identified for reasons similar to Wagga Wagga. Gas, electrical infrastructure and water are all available.

General

Albury is located approximately 554 km southwest of Sydney. The area is industrial. Refer to **Figure 3-6** for the areas under consideration.

The area was considered due to its proximity to gas and electricity infrastructure, and the availability of water from Lake Hume and the Murray River.

Performance

The effects of the local climate and altitude of North Albury on the performance of the turbines are listed in **Table 3-6**.

Table 3-6 Turbine Performance for North Albury Locality

Feature	Value	Relative De-rating (%)
Altitude 250	m	-1.80
Mean daily maximum	30.9 ^{o}C -0.60	
Total de-rating (%)[1]		**-2.40**

[1] Note: compared to notional reference site

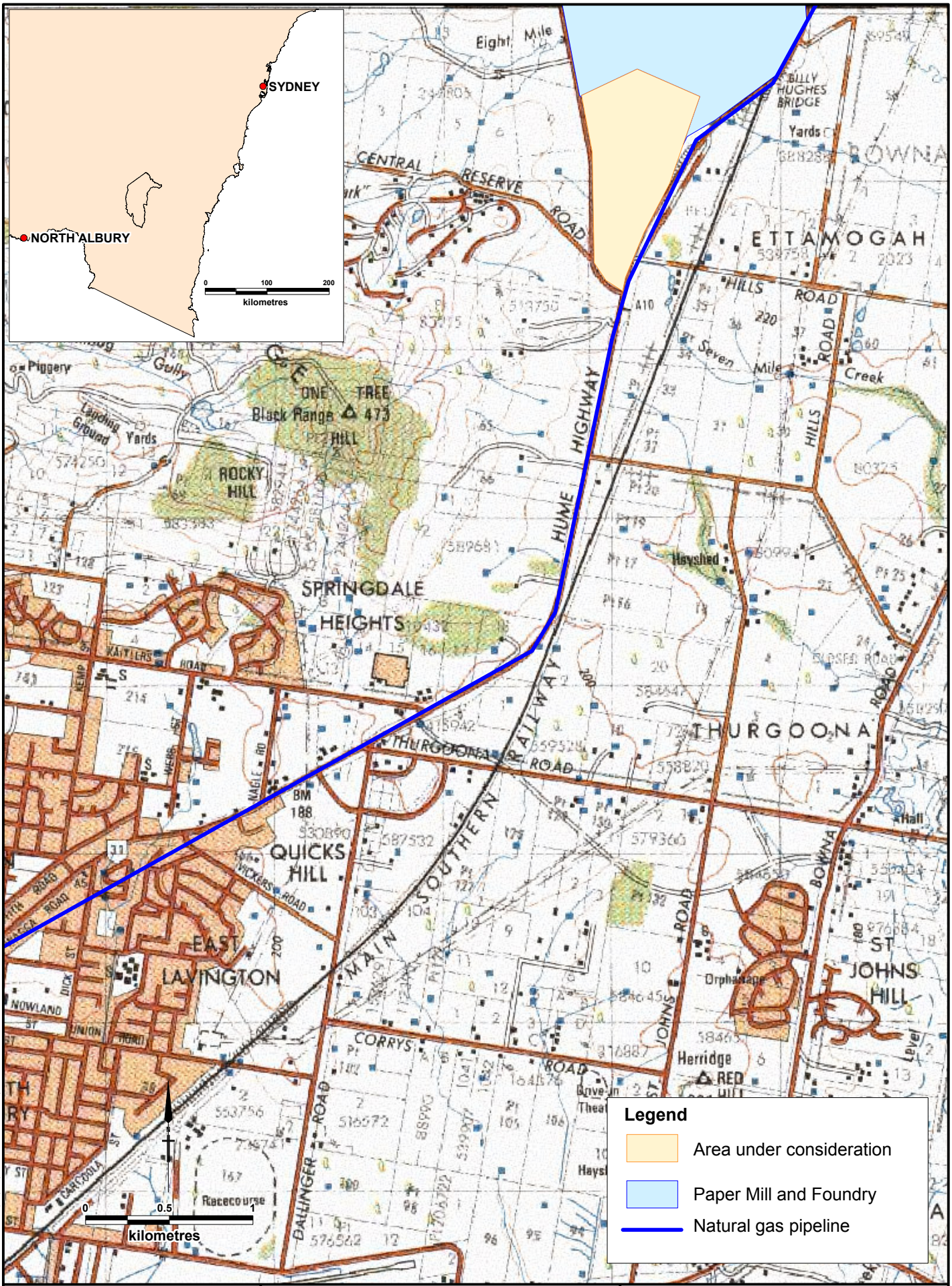
Gas infrastructure

The GPU GasNet pipeline feeds the Albury area. The GPU GasNet system can be constrained during winter as a result of a lack of compression at Wollert. It is expected that some additional compression would be required to deliver gas to Albury from Victoria. There is no competitive tension with other gas or pipeline operators.

Electricity infrastructure

TransGrid's Jindera – Norske Skog 132 kV transmission lines pass within approximately 14 km of the site. These lines have a capacity of around 220 MVA. Therefore, the 132 kV system would not allow for expansion of a power station.

It is possible to upgrade the existing 132 kV lines to 330 kV. This would enable expansion but carry a significant cost penalty.



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URS	Drawn: AJW; Approved: FINAL; Date: 26/02/10; Job No: **43177401**; File No: 43177401-061.wor	Figure: **3-6**

Chapter 3 Project Alternatives

Water infrastructure

Lake Hume and the Murray River are both located relatively close to the target area. Lake Hume is approximately 10 km, and the Murray River is only 5 km away.

As for Wagga Wagga, a reasonably mature water trading and allocation market exists for securing water in the quantities required.

NEM regions and constraints

It is expected that there would be scenarios under which the development would be unable to export at full capacity as a result of network constraints.

Furthermore, whilst the Albury area is currently in the NSW region this may change as a result of foreshadowed changes to NEM regional boundaries in the future. It is some distance from the key demand area of NSW.

Land and availability

The Albury Development Corporation and Norske Skog (the owner of the paper mill) own the main target land packages.

Permitting and regulatory

The area of interest falls within Albury City LGA. The land is zoned as an 'employment area'. This zoning places no specific restrictions on land use. All proposals are considered on their merits.

No known residents are located within 1 km of the area of interest; however there is a paper mill and foundry nearby.

Competing developments

The AEMO Statement of Opportunities notes a publicly announced generation proposal in the Wagga Wagga area from Wambo Power Ventures (WPV). The proposed development is in the Uranquinty area south west of Wagga Wagga. This development could impose additional constraints on a development in this area.

Whilst no other specific developments are committed, it is understood that the Snowy Mountains Hydro Electric Scheme is considering re-powering and developing additional hydro capacity. This could have a material impact on the ability of a development located in this area to export power. Additionally, development in this area is vulnerable to further development of electrical interconnectors and is reliant on ongoing development of the local transmission network and local load to secure its ability to export.

Preliminary Environmental Assessment

No other environmental issues have been identified that differ significantly from alternate sites.

3.4.8 Central Coast

The Central Coast was identified as a region to be assessed as the area has gas infrastructure and good electrical infrastructure. It was also important for AGL to understand the implications of locating a power station in this location as the NSW state owned generators have peaking power developments in this area.

General

The following sites have received development consent to develop a power station in the locations indicated:

- Munmorah: Delta Electricity's Munmorah power station is located 160 km north of Sydney.
- Tomago: Located just north of Newcastle, the area is within an existing industrial estate.

Refer to **Figure 3-7** for the areas under consideration.

Performance

The effects of the local climate and altitude of the Central Coast locality on the performance of the turbines are listed in **Table 3-7**.

Table 3-7 Turbine Performance for Central Coast Locality

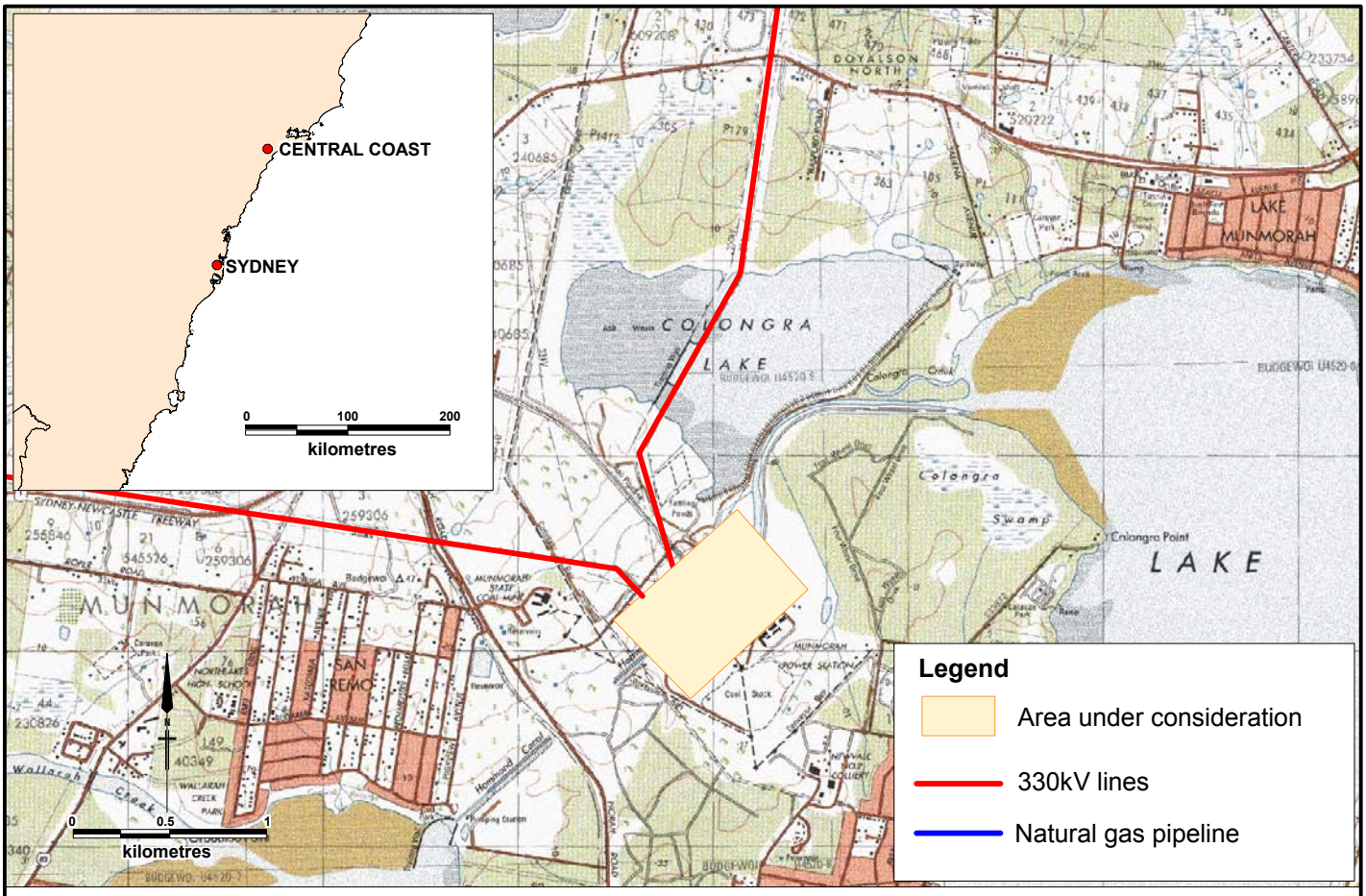
Feature	Value	Relative De-rating (%)
Altitude 20	m	+0.90
Mean daily maximum	27.4 ^{o}C +	1.80
Total de-rating (%)[1]		+2.70

[1] Note: compared to notional reference site

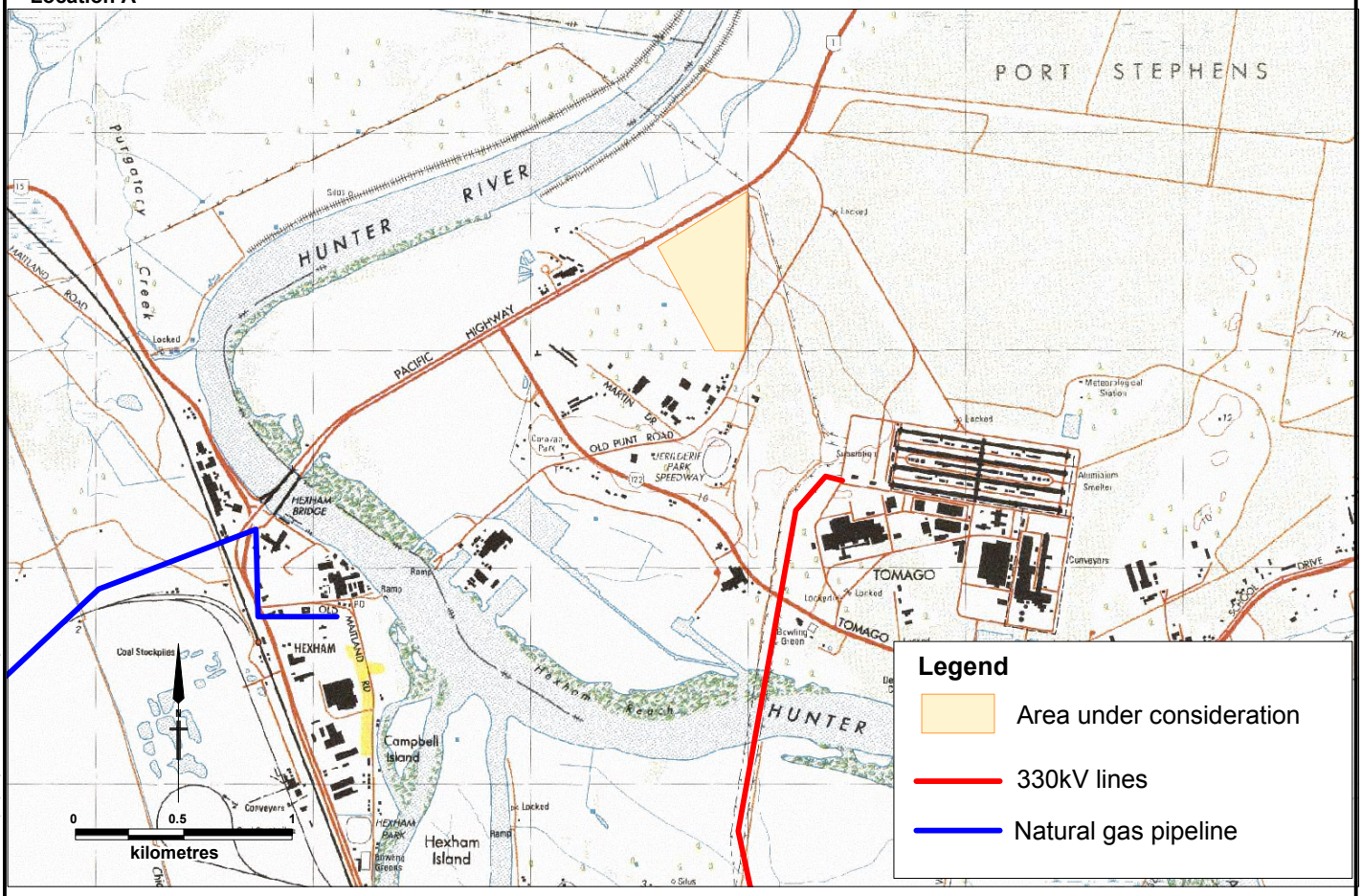
Gas infrastructure

The Central Coast / Newcastle area is serviced by the Newcastle to Sydney pipeline and is at the end of the gas network. The gas network in the region would require supplementary compression.

There is no competitive tension with other gas or pipeline operators from any committed or built pipeline.



Location A



Location B

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Client: **AGL POWER GENERATION (NSW)**	Project: **AGL DALTON POWER PROJECT**	Title: **ASSESSMENT OF TARGET SITES - CENTRAL COAST**
URS	Drawn: AJW; Approved: FINAL; Date: 26/02/10; Job No: **43177401**; File No: 43177401-066.wor	Figure: **3-7**

Electricity infrastructure

There are 330 kV transmission lines in the Central Coast region.

Water infrastructure

Water sources are available.

NEM regions and constraints

The connection of additional generation in the region according to TransGrid reports is limited to 300 MW until the network is upgraded.

Land and availability

The target land packages are owned either by Macquarie Generation (Tomago) or Delta Electricity (Munmorah Power Station). It is unlikely land would be made available to AGL.

Permitting and regulatory

Both sites already have the required planning approvals.

Competing developments

Other proposed developments in NSW are unlikely to constrain or otherwise impact a development in either location.

Preliminary Environmental Assessment

No environmental issues have been identified that differ significantly from alternate sites in EIS's prepared by the proponents.

3.4.9 Lithgow

NSW State and Regional Development identified Lithgow for assessment as both gas and electrical infrastructure is located there.

General

Lithgow is located approximately 152 km south-west of Sydney. The area is semi-rural with significant local coal fired power generation. Refer to **Figure 3-8** for the general area under consideration. The area was considered due to its proximity to gas and electricity infrastructure.

Performance

The effects of the local climate and altitude of Lithgow on the performance of the turbines are listed in **Table 3-8**.

Table 3-8 Turbine Performance for Lithgow Locality

Feature	Value	Relative De-rating (%)
Altitude 900	m	-9.70
Mean daily maximum	25.4 °C +	3.20
Total de-rating (%)[1]		**-6.50**

[1] Note: compared to notional reference site

Gas infrastructure

Lithgow is serviced by a spur line off the Moomba to Sydney pipeline at Young. The diameter of this pipeline is around 150 mm. Supplementary compression is being considered for the current loads in the area. The pipeline is not considered adequate to supply a power station development at Lithgow. Upgrade costs to cater for power generation are in the order of $100M.

There is no competitive tension with other gas or pipeline operators.

Electricity infrastructure

No specific feeders have been identified as points of electrical connection, however, there is 330 kV infrastructure in the area.

Water infrastructure

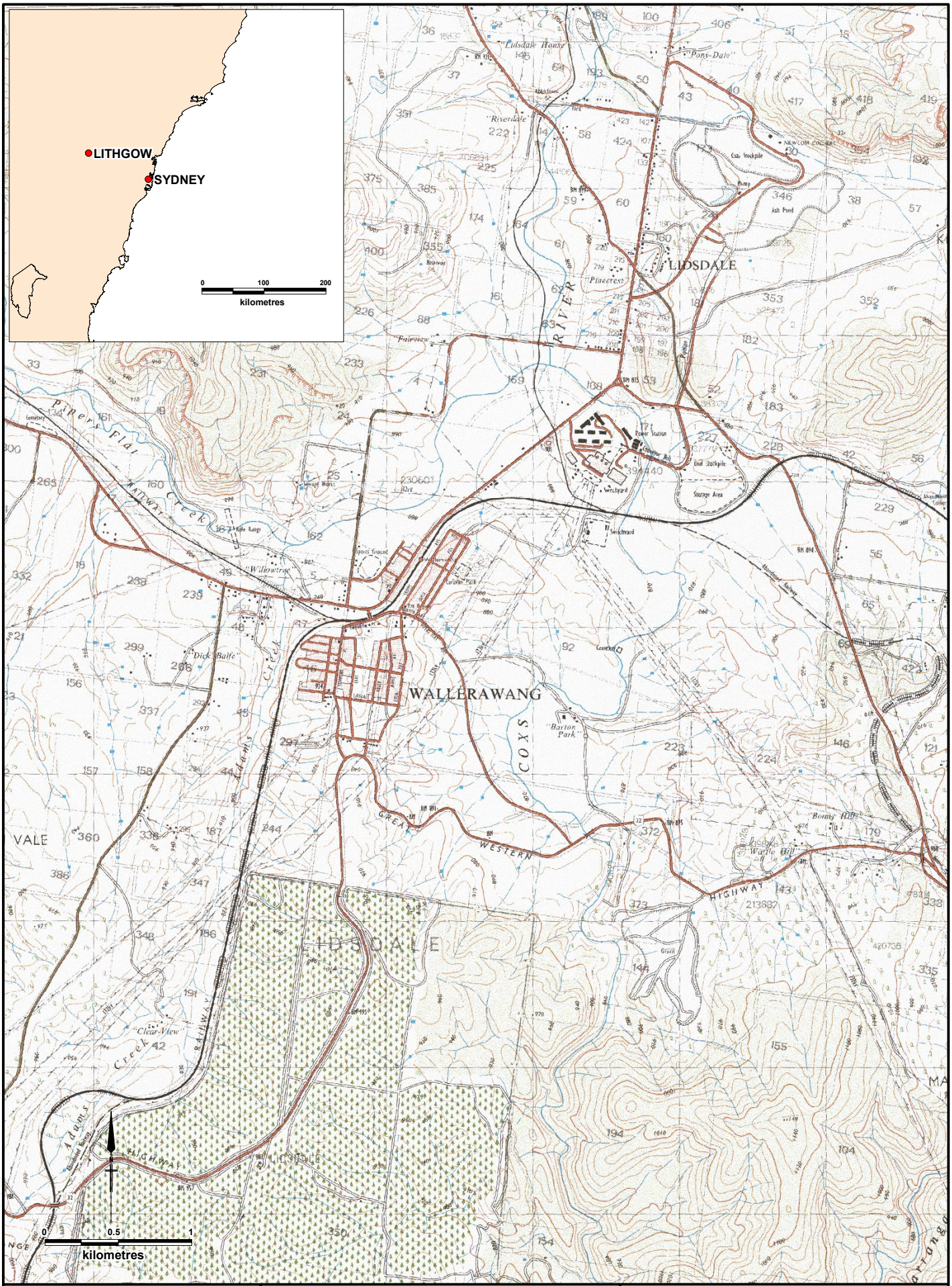
No water source has been identified although the existing power stations draw from local water supply schemes and the Cox's River.

NEM regions and constraints

No specific network constraints are anticipated for a development in this area.

Land and availability

No specific land has been identified for a development in this location given the high altitude and poor gas infrastructure.



Client: **AGL POWER GENERATION (NSW)**	Project: **AGL DALTON POWER PROJECT**	Title: **ASSESSMENT OF TARGET SITES - LITHGOW**
URS	Drawn: AJW | Approved: FINAL | Date: 26/02/10 Job No: **43177401** | File No: 43177401-062.wor	Figure: **3-8**

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3.4.10 Moss Vale

This region has the required infrastructure with a site having previously been investigated by others. Urban and rural residential density has since increased.

General

Moss Vale is located approximately 107 km south west of Sydney. Refer to **Figure 3-9** for the areas under consideration. The area was considered due to its proximity to gas and electricity infrastructure.

Performance

The effects of the local climate and altitude of Moss Vale on the performance of the turbines are listed in **Table 3-9**.

Table 3-9 Turbine Performance for Moss Vale Locality

Feature	Value	Relative De-rating (%)
Altitude 700	m	- 7.0
Mean daily maximum	25.8 ^{o}C +	2.9
Total de-rating (%)[1]		**- 4.1**

[1] Note: compared to notional reference site

Gas infrastructure

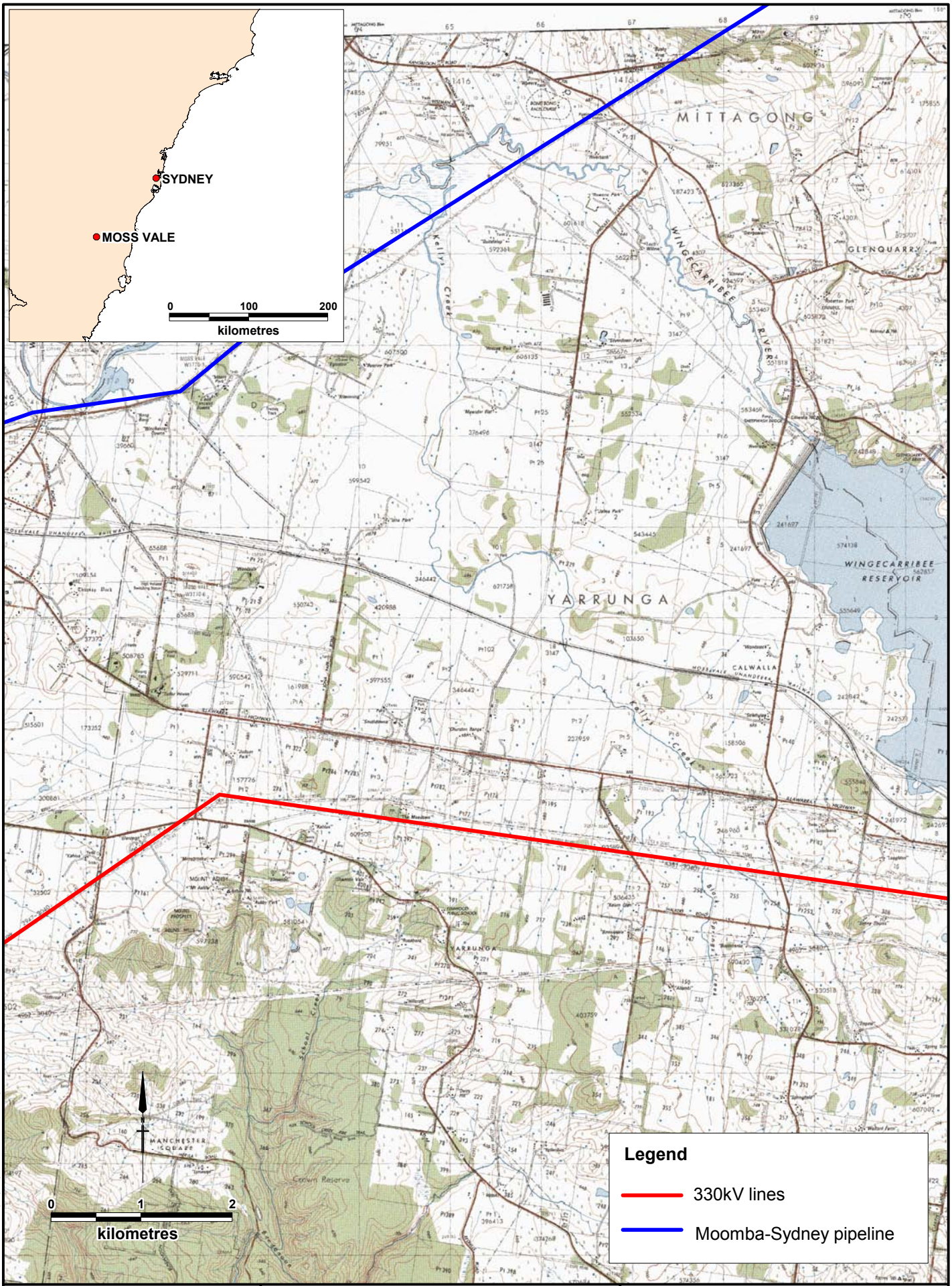
Moss Vale is located on the route of the Moomba to Sydney gas pipeline. There is no competitive tension with other gas or pipeline operators.

Electricity infrastructure

The Moss Vale area is crossed by TransGrid's Marulan - Dapto 330 kV feeder. This line may be subject to some congestion that could restrict export from a power station located in this area, however, this would have to be confirmed by load flow studies.

Water infrastructure

The Wingecarribee Reservoir is located near this site. Access to this resource is not known.



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Client: **AGL POWER GENERATION (NSW)**	Project: **AGL DALTON POWER PROJECT**	Title: **ASSESSMENT OF TARGET SITES - MOSS VALE**
URS	Drawn: AJW | Approved: FINAL | Date: 26/02/10 Job No: **43177401** | File No: 43177401-063.wor	Figure: **3-9**

NEM regions and constraints

The Moss Vale area is in the NSW region close to the Sydney load centre and its NEM region is extremely unlikely to change as a result of foreshadowed changes to NEM regional boundaries in the future.

Land and availability

Existing rural residential development may constrain power generation as residences generally exist at most within 500 m of each other. AGL determined a 500 m criterion for the minimum distance to residences for a power development. Site procurement would be difficult as a number of lots would be required plus easements for gas and transmission access.

Permitting and regulatory

The area of interest falls within the Wingecarribee Shire LGA. The land zoning has not been confirmed but is expected to be general rural. Power generation is expected to be a permissible use.

Competing developments

The AEMO Statement of Opportunities does not note any potential developments or expansions for the Moss Vale area.

Preliminary Environmental Assessment

Due to proximity of residential receivers, noise and visual impact will require additional mitigation to that normally anticipated for such a development.

No other environmental issues have been identified that differ significantly from alternate sites.

3.4.11 Canberra

Canberra was assessed as a region as it possesses the required infrastructure and also was the subject of discussions between ActewAGL and AGL regarding the siting of a small peaking power station. Refer to **Figure 3-10** for the areas under consideration.

General

Canberra is located approximately 281 km southwest of Sydney. Two locations were considered:

- Location A - One area under consideration was identified during the Hume power station development phase for ActewAGL. The proposed power station at this location was less than 100 MW.

- Location B - A second generic location was considered to the north of Canberra at the intersection of the 330 kV transmission lines and the Dalton offtake.

Performance

The effects of the local climate and altitude of Canberra on the performance of the turbines are listed in **Table 3-10**.

Table 3-10 Turbine Performance for Canberra locality

Feature	Value	Relative De-rating (%)
Altitude 575	m	- 5.5
Mean daily maximum	27.8 ^{o}C +1.5	
Total de-rating (%)[1]		**- 4.0**

[1] Note: compared to notional reference site

Gas infrastructure

A spur line from the Moomba Sydney pipeline at the Dalton offtake supplies Canberra.

The capacity of the spur line to take the additional load is not known but an enhanced pressure service is expected to be required. Supplementary compression has not been assumed.

There is no competitive tension with other gas or pipeline operators.

Electricity infrastructure

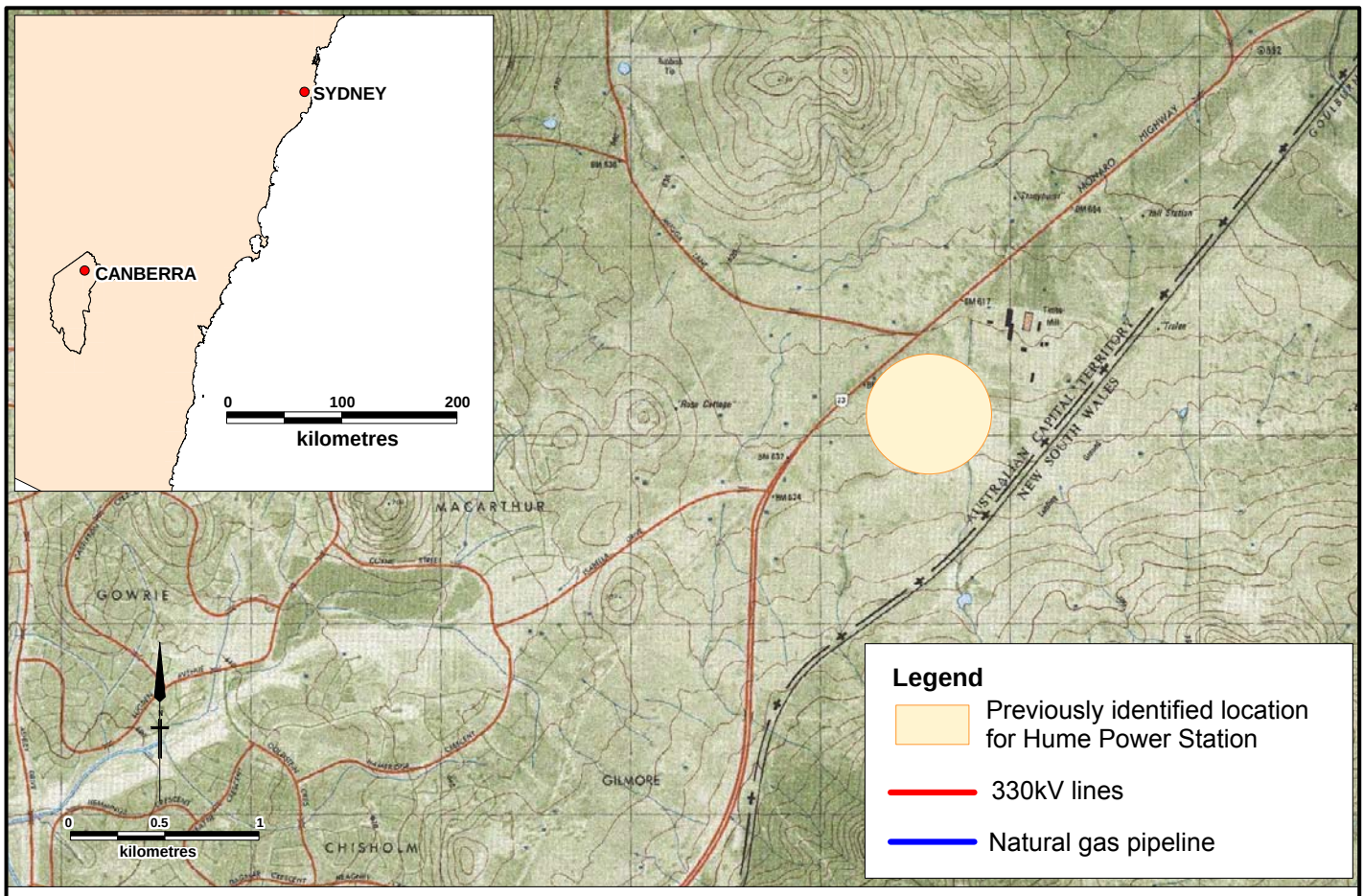
At Location A, it has been assumed that the power station would be connected into the 132 kV system. As noted elsewhere in this report, the 132 kV network has limited capacity. This limits the size of a power station in this area.

At Location B, a 330 kV connection has been assumed on the Canberra to Marulan line. A 330 kV connection is expected to be suitable for the size of development being considered subject to network constraints.

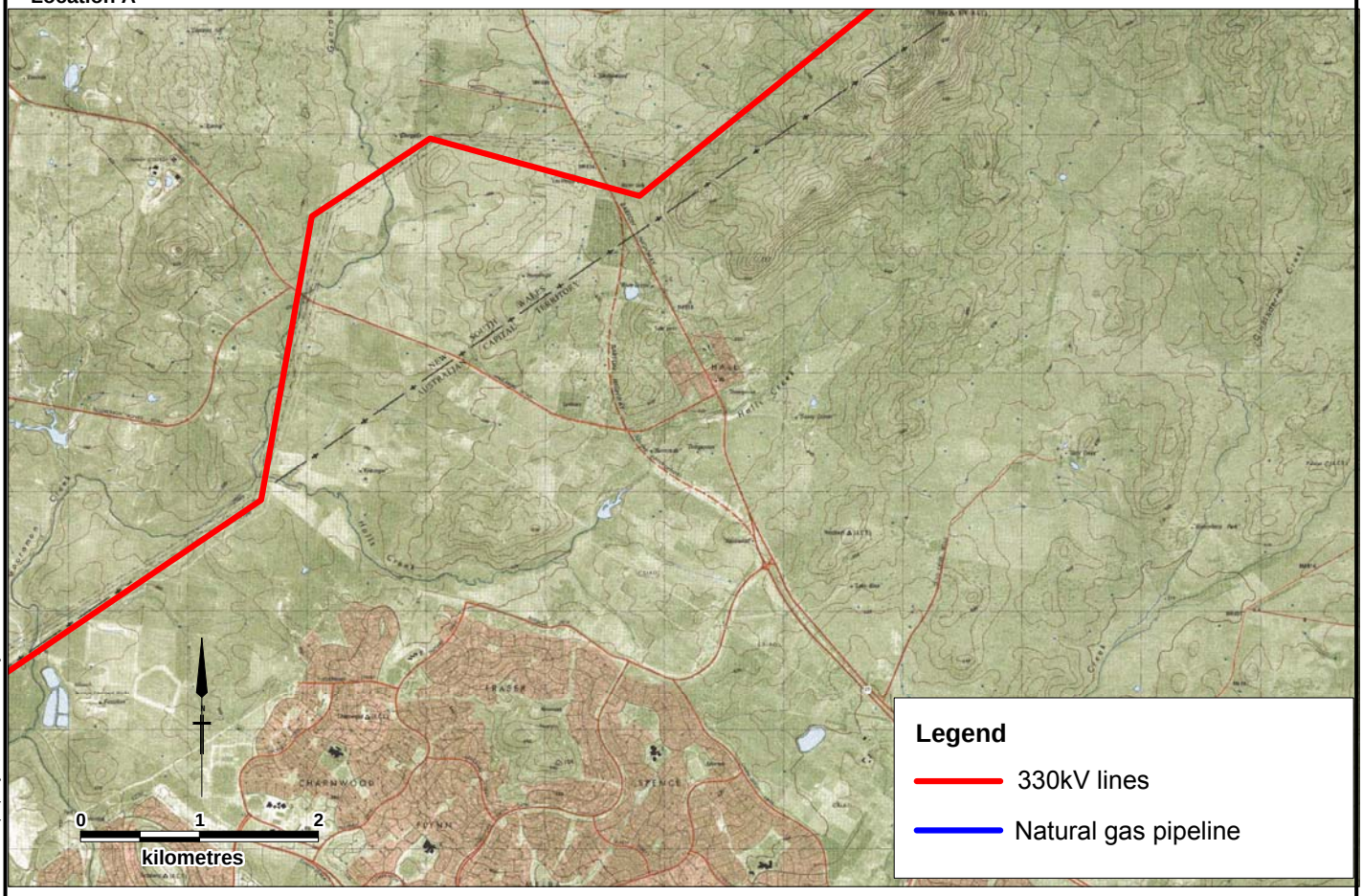
Water infrastructure

Location A is around 12 km north-west of Googong Reservoir. This reservoir could provide a source of water for a conversion to combined cycle generation technology.

Location B is not located close to a suitable reservoir.



Location A



Location B

Client: **AGL POWER GENERATION (NSW)**	Project: **AGL DALTON POWER PROJECT**	Title: **ASSESSMENT OF TARGET SITES - CANBERRA**
URS	Drawn: AJW/SB; Approved: KT; Date: 10/02/2011; Job No: **43177401**; File No: 43177401-067.wor	Figure: **3-10**

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NEM regions and constraints

It is expected that a power station development in this region would be constrained at times due to interstate or inter-regional power flows. Canberra is some distance from the key demand area of NSW.

Land and availability

Land is available at Location A. Land has not been selected at Location B.

Permitting and regulatory

Within the ACT, the permitting process should only require the usual development approvals through the Department of Planning and Land Management.

Competing developments

Whilst no other specific developments are known, it is understood that the Snowy Mountains Hydro Electric Scheme is considering re-powering and developing additional hydro capacity. This could have a material impact on the ability of a development located in this area to export power.

Preliminary Environmental Assessment

No environmental issues have been identified that differ significantly from alternate sites.

3.4.12 Nowra (Tomerong)

Tomerong is located south west of Nowra. In this vicinity, the EGP and 330 kV transmission are in close proximity in an area with few residences surrounded by national parks. Refer to **Figure 3-11** for area under consideration.

General

The area assessed is south west of Nowra, which is located, approximately 135 km south of Sydney.

The area of interest is located west of Tomerong at the junction of Turpentine and Braidwood roads. Water is not readily available at this site.

Performance

The effects of the local climate and altitude of Nowra (Tomerong) on the performance of the turbines are listed in **Table 3-11**.

Table 3-11 Turbine Performance for Nowra (Tomerong) Locality

Feature	Value	Relative De-rating (%)
Altitude 300	m	- 2.3
Mean daily maximum	25.8 ^{o}C +	2.9
Total de-rating (%)[1]		+ 0.6

[1] Note: compared to notional reference site

Gas infrastructure

The Eastern Gas Pipeline passes through the areas of interest. There is no competitive tension with other gas or pipeline operators.

Electricity infrastructure

The Nowra area is crossed by TransGrid's Canberra to Kangaroo Valley 330 kV feeder. No connection inquiry has been submitted but the feeder is lightly loaded and should have a capacity for up to 600 MW.

Water infrastructure

Tomerong is not located close to a ready supply of water although there is potential to connect to the Shoalhaven Water Reclaimed Effluent Management Scheme (REMS).

NEM regions and constraints

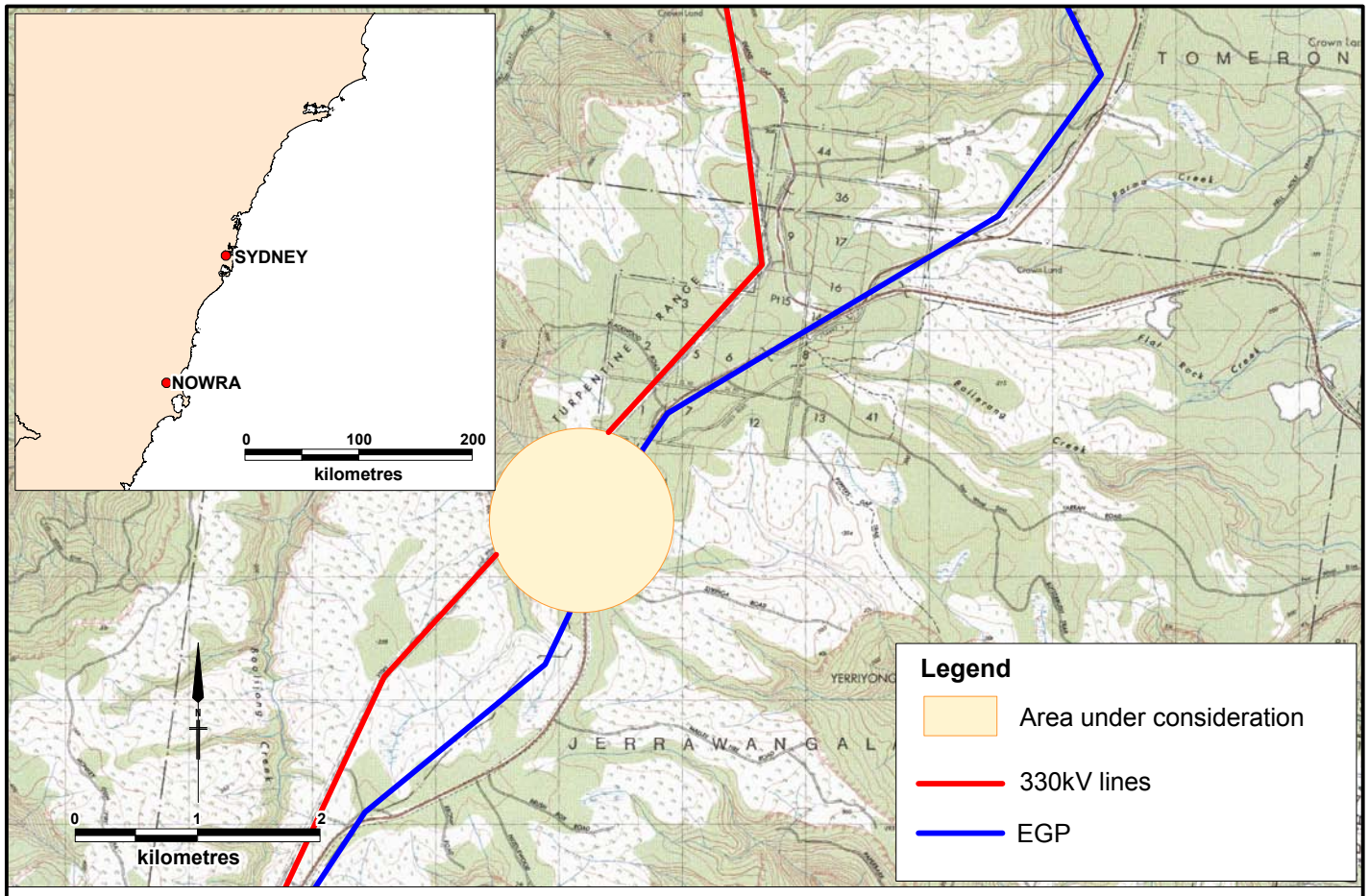
Impacts on interstate or intrastate energy flows, and on other participants, are not anticipated. The Nowra area is reasonably close to Wollongong and Sydney load centres, and its NEM region is extremely unlikely to change as a result of foreshadowed changes to NEM regional boundaries in the future.

Land and availability

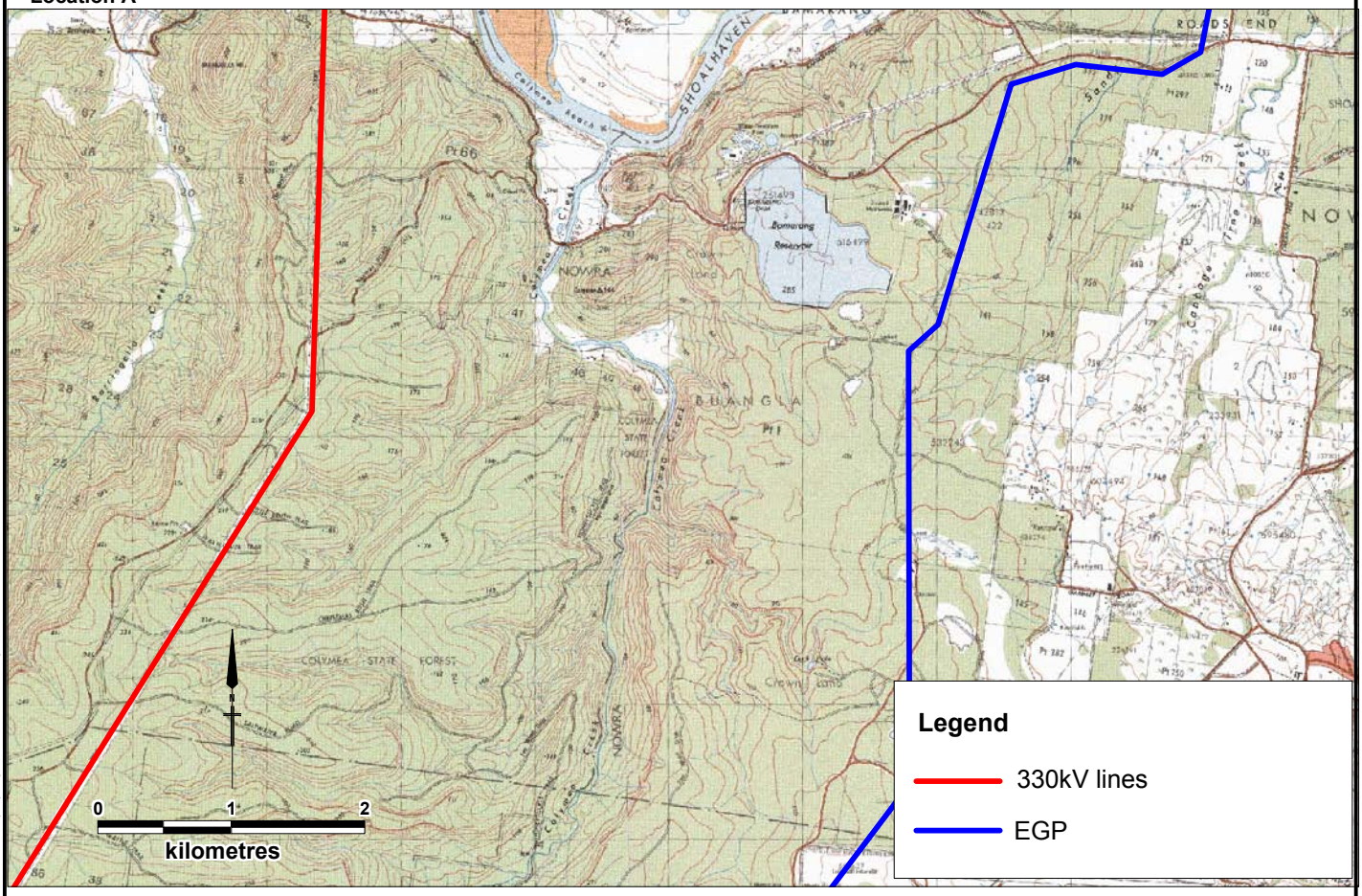
NSW State Forests is the owner of the majority of land around Tomerong that is not part of National Parks reserves. Procurement of crown land is complicated and the outcome is uncertain. Native title issues arise in this area and while not insurmountable, these issues take time to resolve. Easements across National Parks land for the transmission and gas connections are required plus substantial land clearing.

Permitting and regulatory

The area of interest falls within the Shoalhaven City LGA. Zoning allows utility installations with development consent.



Location A



Location B

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Client: **AGL POWER GENERATION (NSW)**	Project: **AGL DALTON POWER PROJECT**	Title: **ASSESSMENT OF TARGET SITES - NOWRA**
URS	Drawn: AJW; Approved: FINAL; Date: 26/02/10; Job No: **43177401**; File No: 43177401-069.wor	Figure: **3-11**

Competing developments

A site to the north adjacent to Bamarang Reservoir has been proposed for a gas-fired power station. The transmission connection for Bamarang is to the 132 kV network and does not constrain a development on the 330 kV network. The gas connection of Bamarang and the TRUenergy facility at Tallawarra may restrict the availability of gas at the site and supplementary compression may be required.

Preliminary Environmental Assessment

Due to potential sites being vegetated and proximity to national parks and reserves, a flora and fauna study will be required before seeking to procure a site in the area.

Existing access is via dirt/gravel roads although Main Road 92 is being upgraded. The impact on these roads will need review.

No other environmental issues have been identified that differ significantly from alternate sites.

3.4.13 Wollongong

The transmission substation that the Tallawarra proposal by TRUenergy would connect to is in Dapto. The Eastern Gas Pipeline and Alinta Gas Networks trunk line are in the vicinity.

General

The area of interest is south of Wollongong near Dapto. Refer to **Figure 3-12** for the general area under consideration.

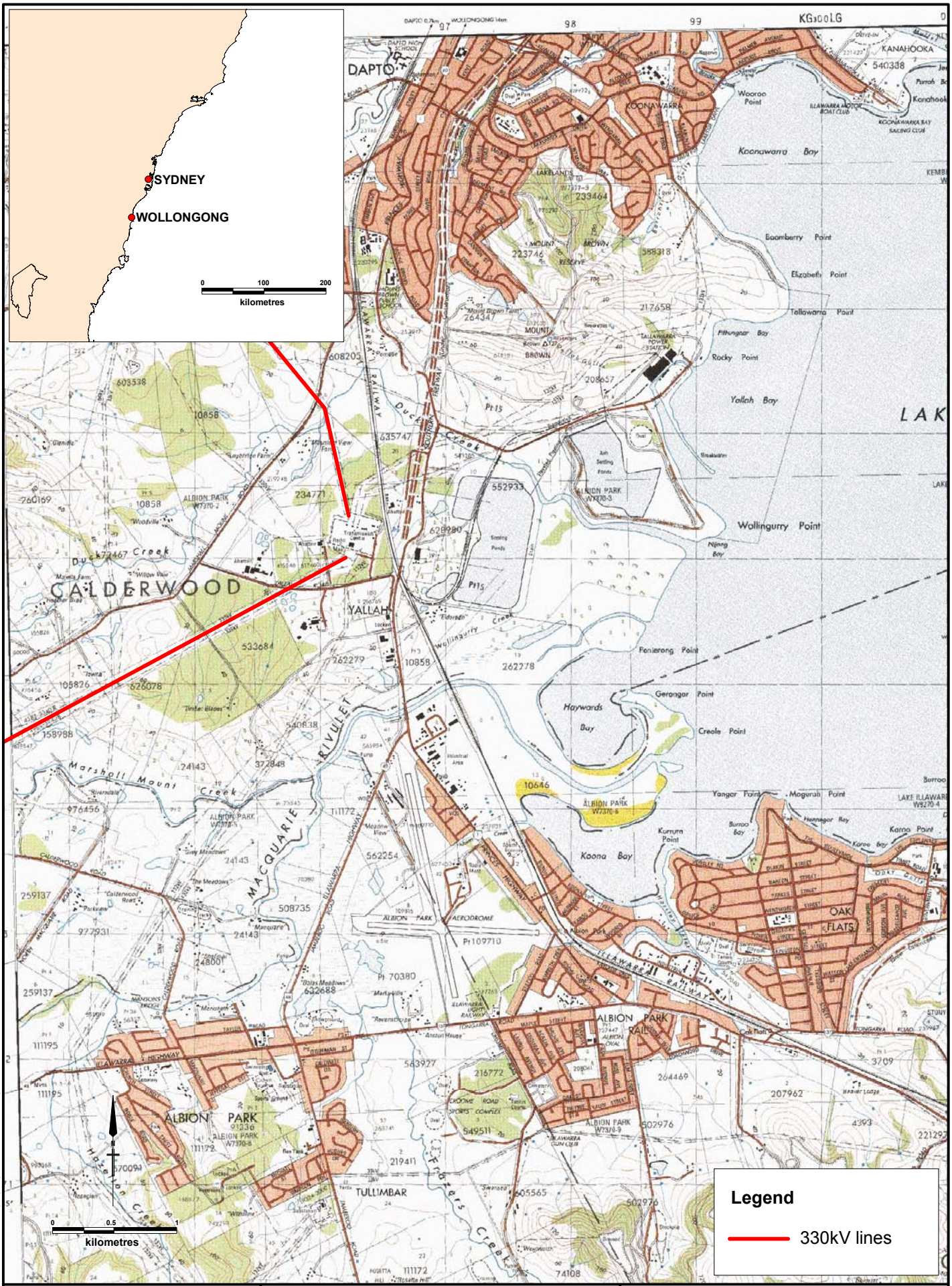
Performance

The effects of the local climate and altitude of Wollongong on the performance of the turbines are listed in **Table 3-12**.

Table 3-12 Turbine Performance Wollongong locality

Feature	Value	Relative De-rating (%)
Altitude 25	m	+ 0.0
Mean daily maximum	25.6 ^{o}C +	2.9
Total de-rating (%)[1]		+ 2.9

[1] Note: compared to notional reference site



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Client: **AGL POWER GENERATION (NSW)**	Project: **AGL DALTON POWER PROJECT**	Title: **ASSESSMENT OF TARGET SITES - WOLLONGONG**
URS	Drawn: AJW | Approved: FINAL | Date: 26/02/10 Job No: **43177401** | File No: 43177401-068.wor	Figure: **3-12**

Gas infrastructure

Both the Alinta Gas Network and the Eastern Gas Pipeline cross the Dapto / Wollongong area. This potentially provides gas on gas competition. However while the EGP is adjacent to the 330 kV Dapto substation the AGN pipeline is 12 km to the north in dense urban areas.

The gas network in the area would not require any modification or supplementary compression to meet the gas needs of the proposed power station.

Electricity infrastructure

The Dapto substation is in the vicinity of the gas pipelines with 330 kV incoming lines from Avon, Marulan and Kangaroo Valley. No connection inquiry has been submitted but connection direct to the substation is preferable in light of competing generators at Tallawarra and Kangaroo Valley and future development at Bamarang.

Water infrastructure

There is potential for water, recycled or potable, for a development in the area although existing recycled water capacity may already be allocated.

NEM regions and constraints

Impacts on intrastate energy flows, and on other participants, may occur with competing generators at Tallawarra, Kangaroo Valley and potentially Bamarang. Direct connection to the substation would be required to ensure no constraints to a plant's ability to export power occur, although this will need to be confirmed by studies.

The area is close to Wollongong and Sydney load centres, and its NEM region is unlikely to change as a result of foreshadowed changes to NEM regional boundaries in the future.

Land and availability

Existing rural residential development may constrain power generation as residences generally exist at most within 500 m of each other. The Wollongong region is mostly dense urban development between the Pacific Ocean and the Illawarra escarpment with extensive rural residential development around the Dapto substation making the locating of a suitable site unlikely given the number of sensitive receptors. Site procurement would be made more difficult as a number of small lots would have to be acquired plus easements for gas and transmission access.

Permitting and regulatory

The area of interest to the west of the Dapto substation falls within the Wollongong City LGA. The land is zoned non urban. This zoning allows utility installations with development consent.

Competing developments

The transmission connection for Tallawarra, Kangaroo Valley and Bamarang is to the Dapto substation. During peak times when load flows head north towards Sydney there is potential for transmission constraints. The gas connection of Bamarang and Tallawarra may restrict the availability of gas at the site and supplementary compression may be required.

Preliminary Environmental Assessment

Due to proximity of residential receivers, noise and visual impact will require additional mitigation to that normally anticipated for such a development.

The Illawarra is considered to be part of the Greater Metropolitan Region and the air shed interacts with Sydney. Impact on existing air quality will be scrutinised although as for Appin, air quality impacts are expected to comply with regulations.

No other environmental issues have been identified that differ significantly from alternate sites.

3.4.14 Site Assessment

Assessment Classification

All sites identified were assessed by AGL using a consistent methodology. Four factors were assessed on a qualitative basis (**Table 3-13**). AGL then presented these on a "traffic light" basis as follows.

Table 3-13 Assessment Classification

Site Status		
Feasible, full project needs able to be supplied with no significant costs over reference case	Feasible, but potential constraints or significant costs over reference case	Not feasible even with significant expenditure
GO ✓	*CAUTION* ●	*STOP* ✖

From the analysis for each site in previous sections, AGL compiled a summary in **Table 3-14**.

Table 3-14 Site Assessment Summary

Site	Gas Conn'n	Electrical Connection Feasibility	Land	Water	NEM Region Change Risk	Installed Capital Cost	Rank
Dalton	✓ MSP	✓	✓	✓	✓	102%	1
Nowra	✓ EGP	✓	●	●	✓	100%	2
Moss Vale	✓ MSP	✓	●	●	✓	109%	3
Wagga Wagga	✓ MSP	●	✓	✓	✓	104%	4
Central Coast	● Alinta	●	✓	✓	✓	108%	5
Canberra	● MSP offtake	✓	✓	●	●	106%	6
Culcairn	✓ MSP	●	✓	●	●	N/A	7
North Albury	● GPU	●	✓	✓	●	N/A	8
Wollongong	✓ EGP ✓ Alinta	✓	×	●	✓	100%	N/A
Marulan	✓ MSP	✓	✓	×	✓	104%	N/A
Lithgow	× Alinta	✓	✓	●	✓	N/A N/A	

This assessment highlights that for the majority of sites, capital costs are similar. In part, this arises from factors such as lower output being balanced by reduced gas transmission distances at some locations or higher land costs balanced by lower transmission connection costs. The main conclusion reached was that the assessment of ongoing costs and availability of infrastructure was important in assessing the viability of a site. Ongoing costs mainly relate to fuel costs and the ability to generate and benefit from competitive pressure on gas supply.

For the five top ranking sites, a qualitative assessment of environmental factors was conducted to ensure that all issues which may constrain the development were identified (**Table 3-15**).

Table 3-15 Alternate Site Preliminary Environmental Assessment

Site	Air Quality	Noise	Visual	Water Quality	Traffic	Flora and Fauna	Geotech
Dalton	✓	✓	✓	✓	✓	✓	●
Nowra	✓	✓	✓	✓	●	●	✓
Moss Vale	✓	●	✓	✓	✓	✓	✓
Wagga Wagga	✓	✓	✓	✓	✓	✓	✓
Central Coast	✓	✓	✓	✓	✓	✓	✓

Due to the large cost between the second and third ranked sites and constraints in infrastructure access for the fourth ranked site, Dalton and Nowra emerged as the two preferred sites in the AGL analysis.

3.4.15 Preferred Site Location

The key features of these two preferred sites are outlined in **Table 3-16**.

Table 3-16 Summary of Features of Preferred Sites

Infrastructure	Proposed Site	
	Dalton	Nowra - Tomerong
Electricity	On site connection to 330 kV to Bannaby. Direct connection to load centre. Future additional load connection up to 500kV.	Off site connection required to 330 kV to Kangaroo Valley.
Gas	Moomba Sydney pipeline connection within close proximity to site. Reliable, secure connection to a gas supply.	Off site connection to EGP pipeline connection only. Ahead of other loads such as Tallawarra.
Water	Variety of water options available upon preliminary analysis including connection to reticulated scheme, groundwater and rainfall storage.	20 km connection to recycled water supply.
Land	Large rural site. 1km to nearest house, 3km km to Dalton. Approx 1km to public road with topography and vegetation for screening. Expensive land. Some vegetation clearing required.	Adequate site, no urban areas nearby. Dirt road access, extensive vegetation clearing required for power station and easements. Relatively cheap land.

The area around the Nowra - Tomerong locale is primarily state forest or national park. As the potential Tomerong development corridor is up to 10 km, a site with broad acceptance may be achievable. However, land availability is restricted to Crown Land, requiring cooperation from the State Government. Native title claims exist in the area and may materially impact upon the acquisition of Crown Land.

Based on the factors listed in the above table, the Dalton area was ranked as the superior location for a gas-fired power station. Dalton is unique in that there is a corridor along which it is possible to locate a gas-fired power station where the necessary electricity network and a gas transmission pipeline within close proximity to the site. Additionally, the Dalton site is well screened in terms of exposure to possible noise and visual receptors, and the site is relatively flat with little native vegetation needing to be removed to construct and operate the facility.

All other locations investigated required either transmission or pipeline easements or were located such that impacts on the surrounding community would be unacceptable. As such, Dalton remains the preferred site.

The Dalton Site

Before settling on Dalton as the optimal site, AGL conducted a site study to verify that environmental impacts associated with the Dalton Power Project would be acceptable.

The study was conducted prior to securing the site and included:

- a flora and fauna preliminary assessment;
- planning review;
- water supply analysis; and
- geotechnical analysis.

These preliminary studies along with a review of surrounding land uses confirmed that the Dalton Site is the most appropriate location for a new AGL gas fired peaking power station. Detailed investigations into the potential environmental impact have been conducted as part of this Environmental Assessment.

3.5 Plant Footprint Considerations

As the Facility footprint would require a small portion (less than 5 %) of the site, positioning the power station within the wider site was addressed in detail. A Siting Study (Aurecon, 2009) was carried out in June 2009. A summary is presented below.

The Site Study considered seven development footprint locations with an approximate area of 450 x 350 m within the wider Site. The seven potential footprint locations are shown in **Figure 3-13**. The seven potential locations were assessed in terms of:

- land topography and aspect;
- ongoing land use and geotechnical suitability;
- accessibility for construction and operation;
- proximity to nearby structures and services;
- noise transmission;
- visual impacts;
- potential water supplies;
- water management;
- vegetation coverage; and
- waste management and handling.

As the Site is large in area, it has the potential for a number of potential sites for the proposed Facility. However it also has locations on the property where a power station would not be located as they are unsuitable for obvious reasons, such as the ground being too steep, when there are more suitable and gently sloping locations. The assessment then focussed on determining:

- if the potential site was practical and cost effective for the construction and operation of a power plant; and
- if the potential site minimises the likelihood of objections to the Project that may result in major - delays or not obtaining approval at all.

A summary of the key features of the site comparison for the seven alternative footprint locations is presented in **Table 3-17**.

Table 3-17 Site Assessment for Facility location within the Site

Criteria	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7
Disadvantages of the Site in comparison with alternatives	Access challenges. Close proximity to river. Visibility from surro**unding hills.	Proximity to boundary of wider Site.	Proximity to boundary. Potentially high visibility.	Proximity to boundary and Walshs Road. Proximity to neighbouring properties.	NIL Proximit	y to River. Visibility from surrounding hills.	This location has the highest percentage of vegetation on the Site.
Main advantages of the Site	No advantages over other sites.	Close to level site, well screened except for adjacent property towards the South. Requires shortest gas pipeline. Access is good.	Reasonably level with easy access.	Easy access.	Easy access, well screened and reasonably level.	Reasonably level with low proportion of tree cover.	Likely to be well screened.

The assessment did not determine a distinguishable advantage of any site over the alternatives for water and geology, the existing on-site and neighbouring land use, or potential air emissions implications for neighbours in the region. The assessment results were determined to a large extent by the existence of sensitive receptors (residences) in proximity to each site, the distances from closest structures, and the comparative number of potentially affected neighbours within a 1, 2 and 3 km radius of the proposed footprint location.

The preferred Dalton site (Site 5) was found to have ideal topography and aspect. The site is well screened from potential visual and aural receptors and no disadvantages were identified with the site in comparison to the alternative footprint locations assessed.

Impacts on biodiversity have been avoided where possible, through the following means.

- Locating the proposed development footprint to feature in areas where native vegetation is of poor condition.
- The development footprint has been located in previously and currently grazed areas that have lower ecological value.
- The boundary of the south-western portion of the footprint (adjacent to existing transmission lines) has been defined to avoid identified areas of Native Temperate Grassland EEC.

3.6 Access Road and Gas Pipeline Easement

The route for the access road and gas pipeline were developed iteratively through the process of the Environmental Assessment.

The considerations for routing the gas pipeline include:

- direct route between Facility and Moomba to Sydney Gas Pipeline to minimise cost and land disturbance and the number of bends required;
- engineering design feasibility considerations; and
- shortest length to minimise cost and land disturbance;
- land availability; and
- minimising vegetation clearance.

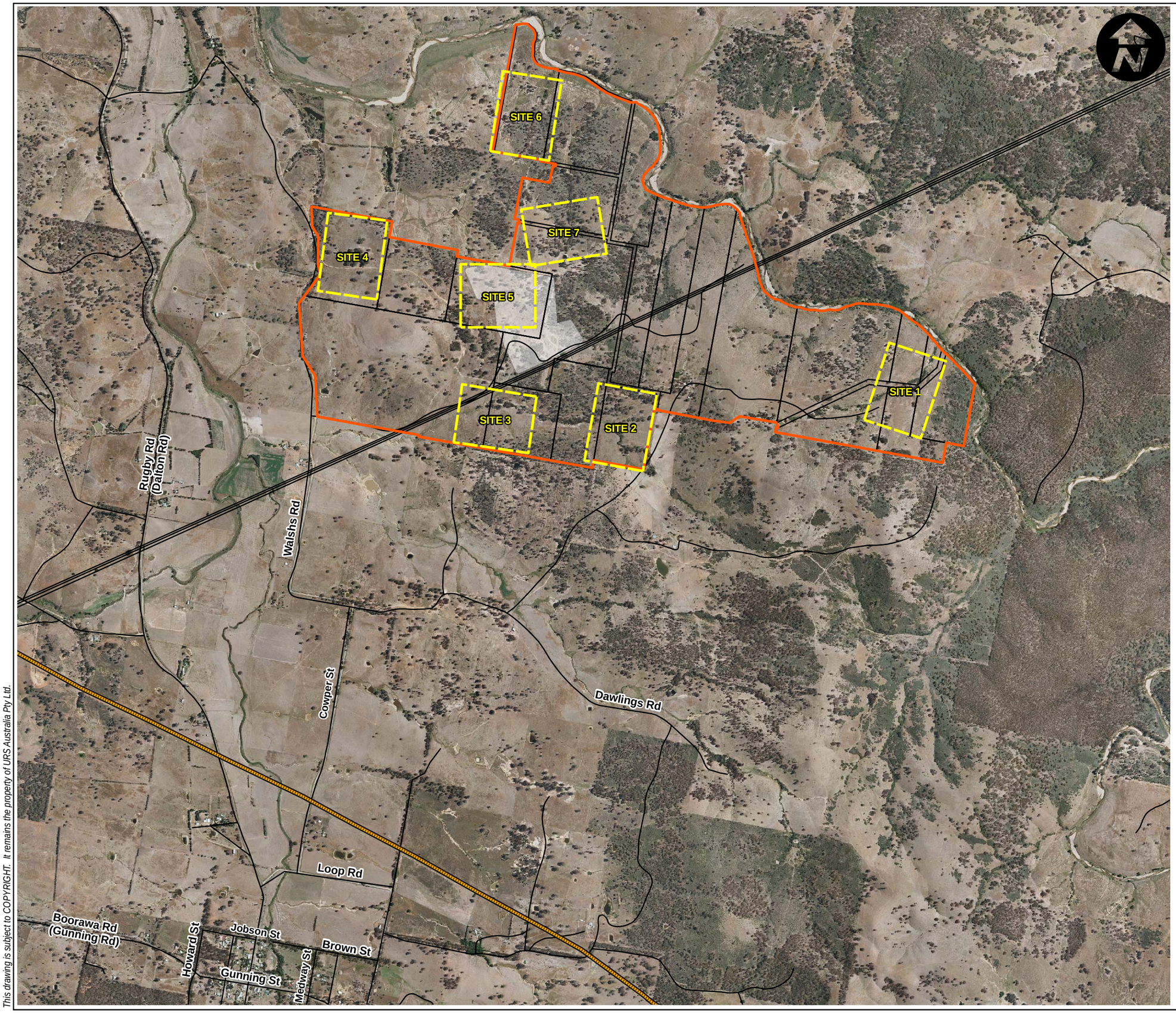
The considerations for routing the access road include:

- engineering design feasibility considerations; and
- minimising vegetation clearance.

The following options for the access road and gas pipeline were considered:

- Access Road Option 1;
- Gas Pipeline (northern portion) and Access Road Option 1;
- Gas Pipeline (northern portion) and Access Road Option 2;
- Gas Pipeline (southern portion) Option 1;
- Gas Pipeline (southern portion) Option 2; and
- Gas Pipeline (southern portion) Option 3.

Refer to **Figure 3-14** for the infrastructure options.



Legend

- AGL Site Boundary
- Possible powerstation locations
- Moomba-Sydney Pipeline
- Transmission Line

0 0.35 0.7 1.4

Kilometres

Source: AGL

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ALTERNATIVE FACILITY LOCATIONS WITHIN DALTON SITE

Figure: 3-13

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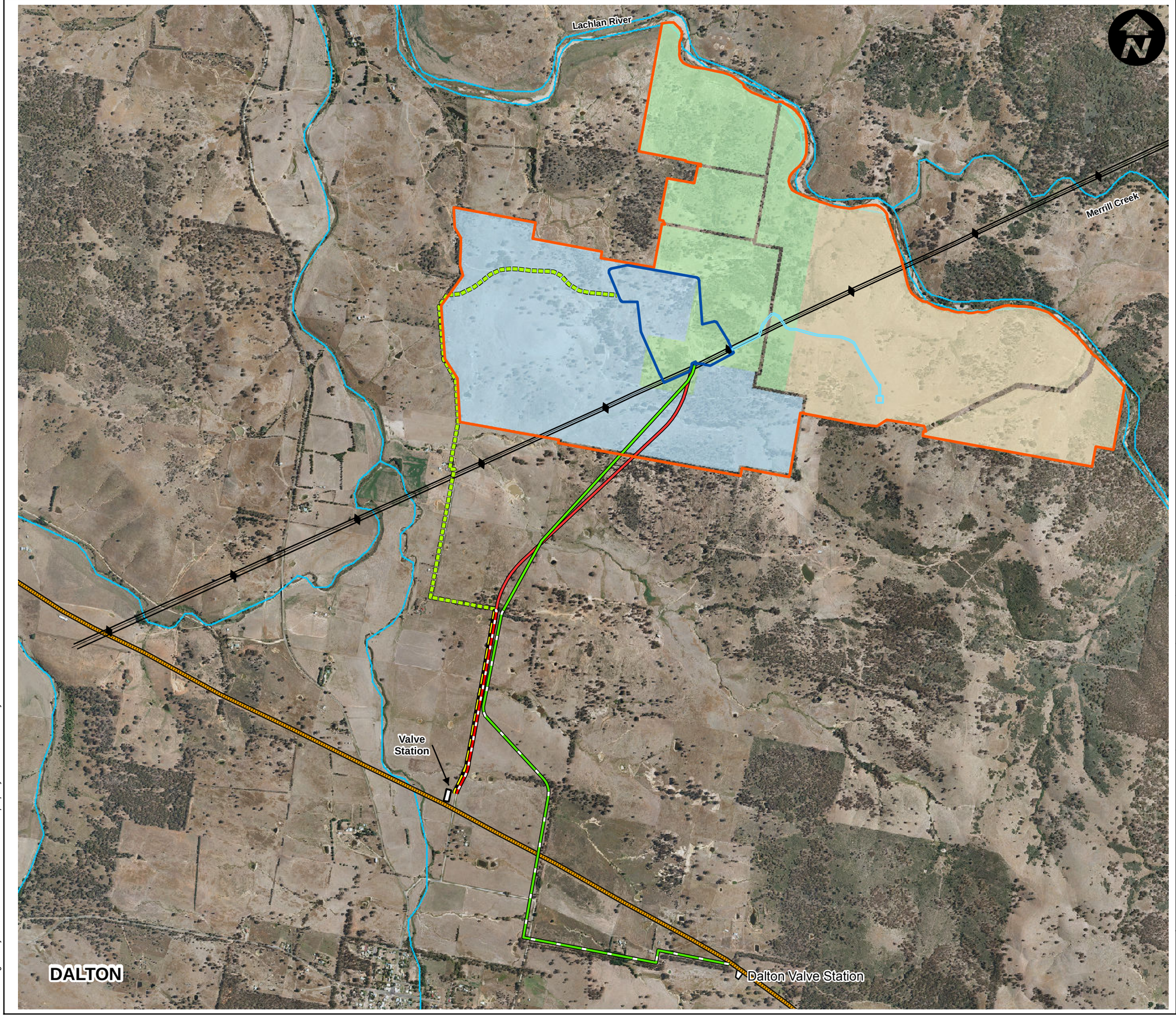

Legend

- AGL Site Boundary
- Plant Footprint
- Communications Tower and Hut Footprint
- Communications Tower Services and Access Track
- Moomba-Sydney Pipeline
- Transmission Line
- Riverview
- Holmes
- The Elms

Infrastructures Options:

- Option 1 - Access Road
- Option 1 - Gas Pipeline
- Option 2 - Gas Pipeline
- Option 3 - Gas Pipeline
- Option 1 - Gas Pipeline and Access Road
- Option 2 - Gas Pipeline and Access Road

0 1

Kilometres

Source: Aerial Image from AGL

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Job No.: 43177661	File No.: 43177661.062.mxd	

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INFRASTRUCTURE OPTIONS

Figure: 3-14

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3.6.1 Access Road Option 1

The initial access option investigated for the Project utilised the existing private road within the Site off Walshs Road to the west of the proposed Facility (refer **Figure 3-14**). Construction and operation traffic generated by the Project would access the Site by travelling north along Starrs Rd, turning west, then north into Walshs Road, then following this road as it turns and heads north. The existing private road within the Site approaches the Facility from the west. This option would require widening of Walshs Road at the northern end nearing the intersection with the private road into the Site.

Engineering investigation identified design difficulties with Option 1, particularly for the portion within the Site.

Vegetation mapping and surveys for this option identified the presence of two endangered ecological communities along this route:

- EPBC listed Natural Temperate Grassland; and
- TSC listed Box Gum Woodland.

Table 3-18 shows the areas of impact for Option 1 (Refer to **Figure 3-15**).

Table 3-18 Access Road Option 1 – Vegetation Areas

Endangered Ecological Community	Access Road Option 1
EPBC listed Natural Temperate Grassland	1 ha
TSC listed Box Gum Woodland	0.8 ha

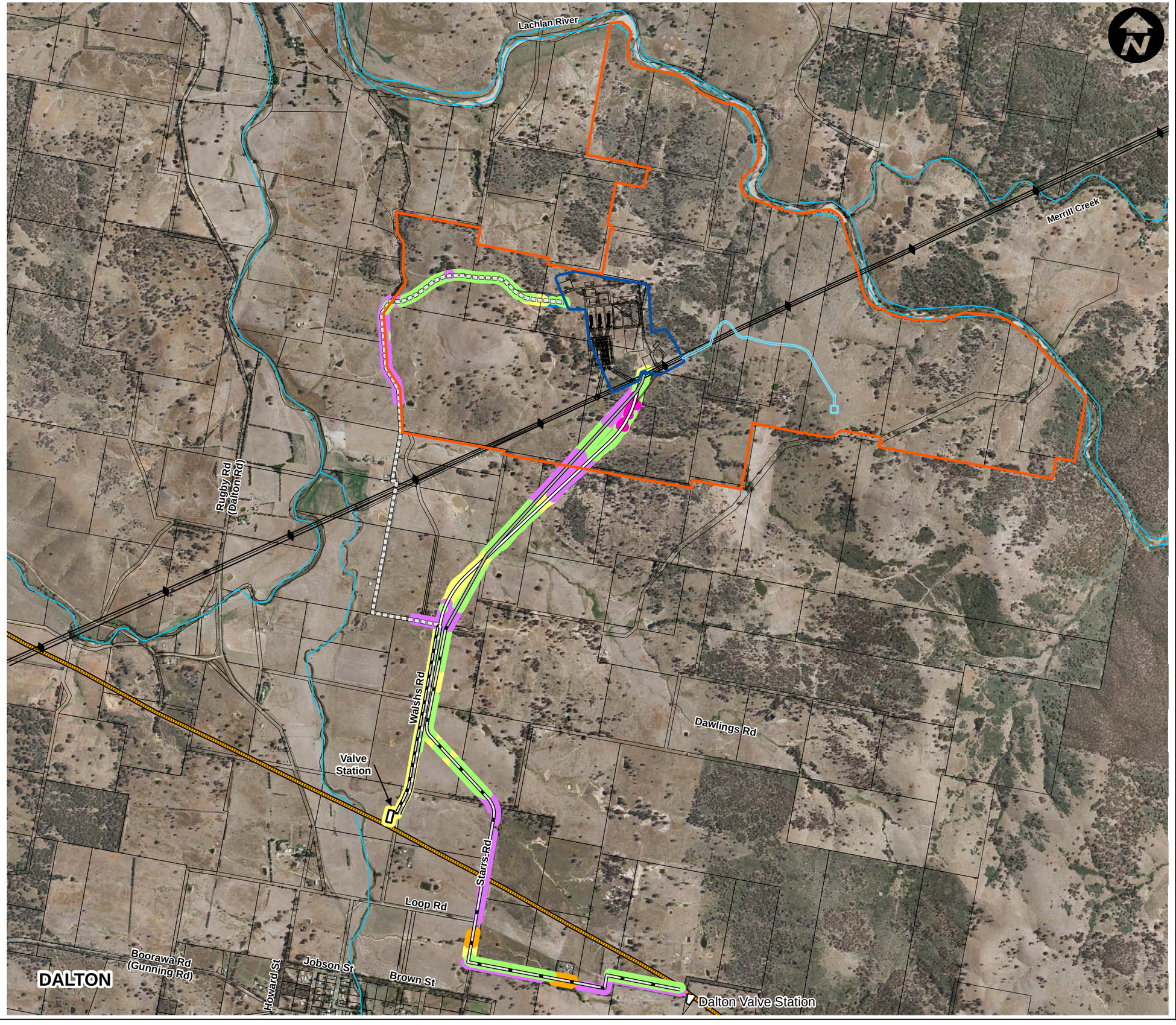
Note: Areas rounded to one significant figure

Therefore, based on design considerations and reducing the amount of clearing required, AGL considered alternative Site access options to reduce the area of permanent vegetation clearing required for the necessary road upgrade works.

It is noted that Access Road Option 1 would still require an additional area of impact to be considered for a gas pipeline in order to address the infrastructure requirements.

As the Gas Pipeline (northern section) would require an easement from the Moomba to Sydney Gas Pipeline to the Facility, AGL investigated an alternative option for the access road to be collocated with the gas pipeline. This would be achieved by widening the required easement from the intersection of Walshs Road (where this road turns west at a right-angle) to the Facility to facilitate both the pipeline and access road infrastructure.

It was considered that collocating the access road and Gas Pipeline (northern section) provided benefits in reducing the areas of clearing required and addressing the engineering constraints identified with Access Road Option 1.



Legend

- AGL Site Boundary
- Plant Footprint
- Communications Tower and Hut Footprint
- Communications Tower Services and Access Track
- Moomba-Sydney Pipeline
- Transmission Line

Infrastructures Options:

- Option 1 - Access Road
- Option 1 - Gas Pipeline
- Option 2 - Gas Pipeline
- Option 3 - Gas Pipeline
- Option 1 - Gas Pipeline and Access Road
- Option 2 - Gas Pipeline and Access Road

Vegetation Community:

- Box-Gum Woodland *
- Exotic Pasture
- Grey Box over Exotic Pasture
- Natural Temperate Grassland ^
- Red Stringybark-Yellow Box Woodland
- Willows/ Elms/ Birch Woodland

* TSC Act Listed Community
^ EBPC Act Listed Community

0 1
Kilometres

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INFRASTRUCTURE OPTIONS - VEGETATION COMMUNITIES

Figure: 3-15

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3.6.2 Gas Pipeline (northern portion) and Access Road Option 1

The Gas Pipeline (northern portion) alignment was developed with consideration to the most direct gas pipeline route to minimise the number of bends and land availability. Option 1 extends from the Facility footprint to the intersection where Walshs Road takes a 90° turn west. Additionally, this option considered the width required in order to co-locate the access road. The length of this option is 1.9 km and considered a 30 m wide easement.

Vegetation mapping and surveys for this option identified the presence of two endangered ecological communities along this route:

- EPBC listed Natural Temperate Grassland;
- EPBC listed Red Stringybark Woodland; and
- TSC listed Box Gum Woodland.

Table 3-19 shows the areas of impact for Option 1 (Refer to **Figure 3-15**).

Table 3-19 Gas Pipeline (northern portion) and Access Road Option 1 – Vegetation Areas

Endangered Ecological Community	Gas Pipeline (northern portion) and Access Road Option 1
EPBC listed Natural Temperate Grassland	3.2 ha
EPBC listed Red Stringybark Woodland	0.03 ha
TSC listed Box Gum Woodland	2.2 ha

Note: Areas rounded to one decimal place

As this option was developed initially only for the gas pipeline (northern portion), consideration of collocation with the access road identified engineering design constraints. Additionally, AGL considered that based on the areas of clearing, more refinement was required of the likely footprint rather than an assumed footprint.

Based on these considerations, AGL investigated an alternative option.

3.6.3 Gas Pipeline (northern portion) and Access Road Option 2

Gas Pipeline (northern portion) and Access Road Option 2 was considered in preliminary engineering design to refine Gas Pipeline (northern portion) and Access Road Option 1. Option 2 similarly extends from the Facility footprint to the intersection where Walshs Road takes a 90° turn west with a modified alignment. The length of this option is 1.9 km. This option considered the likely footprint as an easement ranging between 10 and 45 m to account for areas of cut and fill. This differs from Option 1 which considered an overall 30 m width.

Vegetation mapping and surveys for this option identified the presence of two endangered ecological communities along this route:

- EPBC listed Natural Temperate Grassland;
- EPBC listed Red Stringybark Woodland; and
- TSC listed Box Gum Woodland.

Table 3-20 shows the areas of impact for Option 2 (Refer to **Figure 3-15**).

Table 3-20 Gas Pipeline (northern portion) and Access Road Option 2 - Vegetation Areas

Endangered Ecological Community	Gas Pipeline (northern portion) and Access Road Option 2
EPBC listed Natural Temperate Grassland	1.8 ha
EPBC listed Red Stringybark Woodland	0.02 ha
TSC listed Box Gum Woodland	1.2 ha

Note: Areas rounded to one decimal place

Option 2 was considered advantageous in light of the engineering design constraints identified for Option 1 as well as the reducing the areas of clearing of significant vegetation.

3.6.4 Gas Pipeline (southern portion) Option 1

AGL's initial preference was to utilise the existing valve station at Dalton as the off-take point from the Moomba to Sydney Gas Pipeline. The initial gas pipeline option investigated for the Project involved utilising the existing Dalton Valve Station located off Bush Lane. As shown in **Figure 3-14**, Option 1 followed the Bush Lane road reserve west to Starrs Road, where it continued along the eastern side of Walshs Road to the intersection where Walshs Road takes a 90^{o} turn west where it then meets the Gas Pipeline (northern portion). The total length of the pipeline for Option 1 is approximately 3.4 km and considered an easement width of 30 m.

Vegetation mapping and surveys for this option identified the presence of two endangered ecological communities along this route:

- EPBC listed Natural Temperate Grassland; and
- TSC listed Box Gum Woodland.

Table 3-21 shows the areas of impact for Option 1 (Refer to **Figure 3-15**).

Table 3-21 Gas Pipeline (southern portion) Option 1 - Vegetation Areas

Endangered Ecological Community	Gas Pipeline (southern portion)- Option 1
EPBC listed Natural Temperate Grassland	3.1 ha
TSC listed Box Gum Woodland	1.7 ha
Exotic Pasture	0.9 ha

Note: Areas rounded to one decimal place

Due to large areas of significant vegetation required for this option particularly the EPBC listed Natural Temperate Grasslands, AGL considered alternative routes and investigated options requiring a new off-take and valve station on the Moomba to Sydney pipeline.

3.6.5 Gas Pipeline (southern portion) Option 2

In order to avoid the endangered ecological communities as much as possible, AGL investigated the possibility of creating a new off-take and valve station on the Moomba to Sydney Gas Pipeline. AGL confirmed the technical and commercial feasibility of providing a new connection point. This led to AGL considering constructing a new purpose built valve station further west along the Moomba to Sydney Gas Pipeline. Although there would be additional cost involved with a new valve station, Option 2 has the advantage of avoiding endangered ecological communities as much as possible and reducing the pipeline length to further reduce areas of clearing.

Option 2 extends from a new off-take and valve station from the Moomba to Sydney Gas Pipeline. The valve station is located adjacent to Walshs Road. Option 2 is located in the eastern roadside easement of Walshes Road to the intersection where Walshs Road takes a 90^{o} turn west to meet the Gas Pipeline (northern portion). Option 2 is 1.1 km and considers an easement of 5 m.

Vegetation mapping and surveys for this option route identified the presence of one endangered ecological communities along this route:

- EPBC listed Natural Temperate Grassland.

However, the area of clearing of Natural Temperate Grassland was less than for Option 1. This option also eliminated the need for clearing TSC listed Box Gum Woodland.

Table 3-22 shows the areas of impact for Option 2 (Refer to **Figure 3-15**).

Table 3-22 Gas Pipeline (southern portion) Option 2 - Vegetation Areas

Endangered Ecological Community	Gas Pipeline (southern portion)- Option 2
EPBC listed Natural Temperate Grassland	0.1 ha
TSC listed Box Gum Woodland	0.0 ha
Exotic Pasture	0.4 ha

Note: Areas rounded to one decimal place

Although this option required a reduced area of clearing of Natural Temperate Grassland, alternative options were considered to reduce this further.

3.6.6 Gas Pipeline (southern portion) Option 3

Gas Pipeline (southern portion) Option 3 utilised the new valve station considered in Option 2. In order to avoid vegetation in the eastern roadside easement of Walshs Road, Option 3 is located in the western side roadside easement of Walshs Road. Option 3 is 1.1 km and considers an easement width of 5 m.

This option eliminated the need for clearing EPBC Natural Temperate Grassland.

Table 3-23 shows the areas of impact for Option 3 (Refer to **Figure 3-15**).

Table 3-23 Gas Pipeline (southern portion) Option 3 - Vegetation Areas

Endangered Ecological Community	Gas Pipeline (southern portion)- Option 3
EPBC listed Natural Temperate Grassland	0 ha
TSC listed Box Gum Woodland	0 ha
Exotic Pasture	0.8 ha

Note: Areas rounded to one decimal place

Option 3 was considered optimal for the Gas Pipeline (southern portion) as it contained the largest areas of exotic pasture and eliminated the need for clearing Natural Temperate Grassland.

3.6.7 Conclusion

The access road and gas pipeline route were developed iteratively over through the process of the Environmental Assessment.

Table 3-23 provides a summary of the areas of vegetation for each option considered. The preferred option is shown shaded.

Table 3-24 Summary of infrastructure options

Option	Area (ha)					
	Natural Temperate Grassland	Red S'Yellow Box Woodland	Box Gum Woodland	Exotic Pasture	Grey Box over Exotic Pasture	Willow / Elms/ Birch Woodland
Listing	**EPBC**	**EPBC**	**TSC**	**-**	**-**	**-**
Access Road Option 1	1	0.8		0.1	0.2	
Northern portion						
Gas Pip eline (northern portion) and Access Road - Option 1	3.2 2.2		0.03	0.2		
Gas Pip eline (northern portion) and Access Road - Option 2	1.8	1.2	0.02	1.2		
Southern Portion						
Gas Pipeline (southern portion) Option 1	3.1	1.7		0.9		0.5
Gas Pipeline (southern portion) Option 2	0.1	0		0.4		
Gas Pipeline (southern portion) Option 3				0.8		

Note: Areas rounded to one decimal place

Table 3-24 shows that as the options were refined, the area of EPBC listed Natural Temperate Grassland and TSC listed Box Gum Woodland reduced in the following areas of note:

- For the Gas Pipeline (northern portion) and Access Road, the area of EPBC listed Natural Temperate Grassland was reduced significantly and TSC listed Box Gum Woodland was reduced to a lesser extent.
- For the Gas Pipeline (s outhern portion), the ar ea of EPBC lis ted Natural Temperate Grassland was reduced to zero.

Impacts on biodiversity have been avoided where possible, through the following means.

- Positioning of the valve station and gas pipeline to avoid EECs where possible.
- Positioning of the ga s pipe line and access road to re duce overall i mpact in te rms of vegeta tion clearance.

Gas Pipeline (northern portion) and Access Road Option 2 and Gas Pipeline (southern portion) Option 3 were chosen as the preferred alignments as it had the following benefits:

- reducing the areas of clearing of
  - EPBC listed Natural Temperate Grassland; and
  - TSC listed Box Gum Woodland.
- advantages of collocating the road and the gas pipeline together; and
- addressing engineering design constraints.

Gas Pipeline (northern portion) and Access Road Option 2 and Gas Pipeline (southern portion) Option 3 is the alignment assessed in **Chapters 7-18** of this Environmental Assessment. It is noted that beyond this chapter these options are referred to as Gas Pipeline (northern portion) and Access Road and Gas Pipeline (southern portion).

3.7 Communications Tower and Infrastructure

3.7.1 Communications Tower

The proposed Communications Tower is required to be located in an area of elevated topography with respect to topography immediately surrounding the Site (ie. It needs to be on a hill).

Based on this consideration, two areas alternative sites were identified as suitable as possible locations for the tower (refer to **Figure 3-16**):

- A site east of the Facility footprint (Location 1); and
- A site west of the Facility footprint (Location 2).

The site west of the Facility footprint contains significant areas of endangered ecological communities (Box Gum Woodland and Natural Temperate Grassland). Additionally, this area is proposed to be used by AGL as a Biodiversity Offset Area for this Project.

In light of these considerations, the Communications Tower was located to the east of the Facility footprint (Location 1 on **Figure 3-16**). This is the location that has been used throughout this Environmental Assessment.

3.7.2 Infrastructure associated with the Communications Tower

The communications tower requires a number of associated infrastructure elements including underground services and an all weather access track. This infrastructure requires a 4-6 m wide route from the Power Plant site to the Communications Tower. This would be located wholly within a 10 m wide corridor considered as part of this environmental assessment. The considerations for locating the infrastructure included:

- utilising existing tracks where possible to reduce works required;
- preliminary engineering consideration including topography;
- avoidan ce of significant areas of vegetation.

Based on these considerations, two potential routes were identified (refer to **Figure 3-16**):

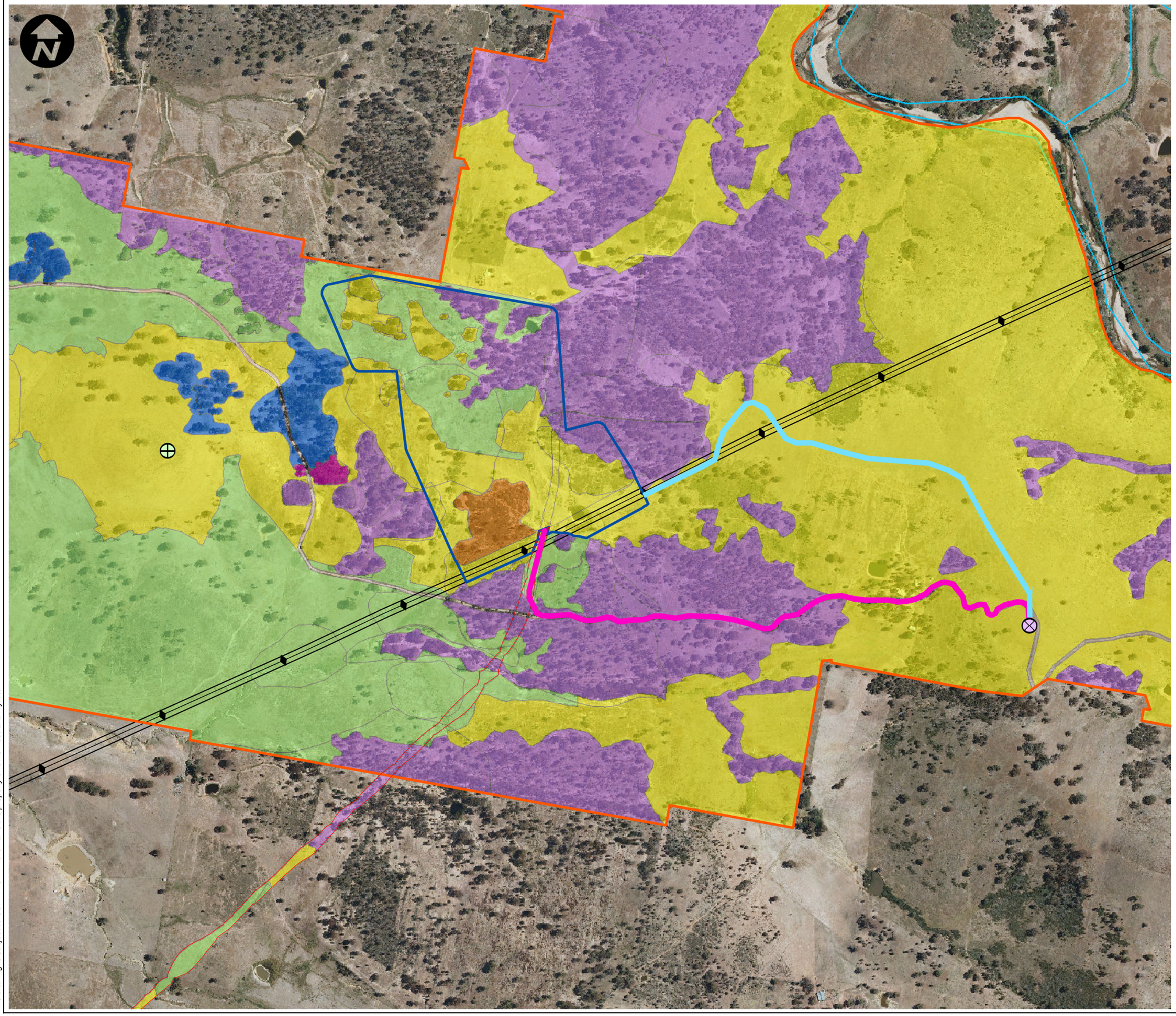
- northern route; and
- south ern route.

The southern route is located along an existing track and has the advantage of requiring less earthworks for road grading for the access road although requiring some vegetation clearing to widen

the existing track. However, as shown on **Figure 3-16,** the route passes through areas of endangered ecological communities (Box Gum Woodland and Natural Temperate Grassland).

As the works for the southern route would require vegetation clearing, the northern route was the preferred location to avoid clearing these endangered ecological communities. Although the northern route requires additional road grading as it is not a currently formed track, the northern route is located wholly within exotic pasture as shown on **Figure 3-16**.

In light of these considerations, the infrastructure (access track and underground services) for the Communications Tower would be located in the northern route (refer to **Figure 3-16**). This is the location that has been considered throughout this Environmental Assessment.



Legend

- AGL Site Boundary
- Plant Footprint
- Gas Pipeline (northern) and Access Road
- Gas Pipeline (southern)
- Moomba-Sydney Pipeline
- Transmission Line
- Communications Tower Location Option 1
- Communications Tower Location Option 2

Communications Tower Services and Access track Options:

- Northern Route
- Southern Route

Vegetation Communities (URS):

- Natural Temperate Grassland^
- Box Gum Woodland*
- Grey Box over Exotic Pasture
- Red Stringybark over Exotic Pasture
- Disturbed Shrubland
- Exotic Pasture

* TSC Act Listed Community
^ EBPC Act Listed Community

0 100 200 400
Metres

Source: Aerial Image from AGL

Drawn: SB	Approved: RCS	Date: 27/06/2011
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Title

COMMUNICATION TOWER ALTERNATIVES

Figure: 3-16

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3.8 Plant Technology Options

3.8.1 Emission Reduction and Control Options

Opportunities for NO_X Reduction and Offsetting

Photochemical smog is associated with elevated concentrations of nitrogen oxides (NO_x) and ozone. Whilst reduction in NO_x emissions from the proposed development can be directly related to reduction in ground level concentrations of NO_x, the same relationship cannot be expanded to ozone. This is because ozone is formed through reactions associated with NO_x and volatile organic compounds (VOCs) under the influence of ultraviolet light. The formation of ozone can potentially be mitigated through the reduction of NO_x and / or VOC emissions in the local airshed, but the priority pollutant in terms of mitigation strategy is dependent on whether the oxidative capacity of the specific airshed is NO_x or VOC limited.

Avenues for viable mitigation and offsetting of these compounds have been investigated. Research has presented the following possible scenarios for the proposed development broadly relating to the following two categories:

- NO $_x$ emission source control options; and
- other NO_x control options.

Options researched within each of these areas are discussed below.

NO_x Emission Source Control Options

Emissions from gas turbines are discussed in detail in **Chapter 7** *Air Quality*. The discussion of emission control options in this section has focussed on NO_x control technologies. Uncontrolled NO_x emissions from gas turbine technology are typically around 200 ppm. Various emission control technologies to reduce NO_x emissions below this level are discussed below.

- **Water / steam Injection**

One of the earlier forms of NO_x control is the injection of water or steam into the flame area of the combustor to lower the flame temperature and reduce thermal NO_x formation. Emissions of NO_x for this technology are approximately 42 ppm. The application of this technology for this project is limited by limited NO_x reduction compared to other technology available, the cost of purification of water; and the requirement to conserve water where possible.

- **Dry Low NO_x (DLN) Combustors**

DLN combustor technology premixes air and a lean fuel mixture that significantly reduces peak flame temperature and thermal NO_x formation. Conventional combustors are diffusion controlled where fuel and air are injected separately. When DLN technology is implemented NO_x emissions range from 9 to 25 ppm depending on plant and operating conditions. All gas turbine manufacturers guarantee emissions of 25 ppm when operating conditions are reached at over 50 % load. DLN technology is widely used for the gas turbine technology being considered for the Dalton Power Project and is constantly being developed.

- **Catalytic Combustion**

Development of catalytic combustion is not yet commercialised in the marketplace for the gas turbines with generation capacity greater than 15 MW. Catalytic technology features “flameless” combustion that occurs in a series of catalytic reactions to limit the temperature in the combustor. Catalytic combustion reduces NO_x emissions to 3 ppm. This technology is not suitable for Dalton Power Project as each of the turbines would require a capacity between 125 and 300 MW.

- **Selective Catalytic Reduction**

Post-combustion NO_x control can be achieved using selective catalytic reduction (SCR) to achieve NO_x emissions of as low as 3 ppm in some situations.

Ammonia is injected into the flue gas and reacts with NO_x in the presence of a catalyst to produce nitrogen and water. However, this process also produces exhaust emissions of ammonia (known as ammonia slip), and has potential for accidental release of stored ammonia and issues with disposal of spent catalyst. This creates another potential environmental impact in the form of particulate emissions along with transport and storage of ammonia at a site adjacent to the Lachlan River.

When operated in simple cycle mode the use of high temperature SCR or dilution to air to reduce exhaust temperature is required. SCR is generally not applied to the large frame turbines in open cycle mode due to the high temperature mode of operation. It is technically feasible to use high temperature SCR technology but to date this has only been successfully implemented on turbines less than 50 MW in generation capacity. This is achieved by mixing the high temperature exhaust with fan forced cool air and often water to reduce the temperature at the SCR to within the operating limit of the catalyst used. AGL has contacted gas turbine suppliers and associations and has identified that there was a single large frame open cycle gas turbine (Alstom 13E2) test plant in Japan installed in 1994. This plant had a horizontal exhaust stack and a very large ducting system was constructed to allow large volumes of cool air and spray water to be injected to reduce the exhaust temperature to levels that could be managed by the SCR system. It is believed no further attempts to install SCR systems on large frame turbine units in open cycle applications have been made since then.

AGL received a budget quotation for the supply only of SCR technology for a 600 MW, four unit plant for $25 million local supply to Texas in the United States, but was unable to receive any quotations for a complete installed system with a performance guarantee of NO_x reduction to 5 ppm (or any other performance guarantee). Very conservatively assuming the total cost of a complete installed system to be $25 million with $0 per annum operating cost, amortised over the life of the plant, and allowing for 0.5 % operating losses, the annualised cost of SCR technology to achieve further NO_x reduction is over $7,000 per tonne of NO_x removed. This is based on 15 % operation every year, which is unlikely.

If the peaking plant operated on average for only 5 % of the time the cost rises dramatically to $20,000 per tonne of NO_x removed. Anecdotal advice from those with SCR experience indicates the cost is more likely to be closer to $50,000 per tonne of NO_x removed, if a SCR system could be proven functional on large OCGT frame turbines.

In considering this technology AGL has referred to the NSW Government's Action for Air Plan (1998) that states a *"commitment to achieve NO_x reductions with the least cost to industry and maximum flexibility"* while recognising the *"complexity of the air chemistry involved in the production of ozone and nitrogen dioxide, which makes it extremely difficult to specify appropriate levels of NO_x for any airshed"*.

The NSW Government, through OEH, charges a load based licensing fee for emissions such as NO_x that is intended to reflect the cost to the environment of pollutant emissions. The OEH booklet on load based licensing states *"Operators are now free to decide how to manage their own pollution control affairs. Government is imposing environmental performance standards (and a fee structure) but not defining the specific pollution control mechanism."* (NSW EPA 2001). For NO_x emissions, AGL determined the load based licensing fee that would apply to this development is $220 per tonne (higher in summer months).

Furthermore, AGL sought advice from OCGT suppliers and determined that SCR was not installed on any of the turbines of the same type proposed for Dalton in open cycle peaking applications operating internationally or nationally.

- **Other NO_x Control Options**

The following NO_x control options (other than source control) were researched for their potential applicability to the Project:

NO_x Cap and Trade Scheme.

Offsetting VOC emissions through vapour recovery units.

Third party Selective Catalytic Reduction (SCR).

Retrofitting or replacing vehicles.

a) NO_x Cap and Trade Scheme

Currently, offsetting of NO_x emissions is undertaken overseas through cap and trade schemes, emission credit schemes and other similar programs. Participation in a NO_x cap and trade scheme, or similar, would be appropriate in reducing NO_x and ozone levels within the regional air shed. However AGL considers that such a program would need to exist at a state or regional level, be regulatory policy, and also be government driven.

NO_x cap and trade type schemes may be a more feasible option. Currently NO_x trading schemes exist throughout the world. Research was undertaken on these schemes in the United States of America and Europe.

Chapter 3 Project Alternatives

The United States has established "The NO_x Budget Trading Program" which focuses on addressing the NO_x emissions in the north-eastern and mid-western states. These emissions are transported across state lines and contribute to ozone pollution problems in neighbouring states. The USEPA has allocated a "NO_x Budget" to states under a rule called the NO_x State Implementation Plan (SIP). Each state was required to achieve this cap by 2007. The plan allowed the states to meet the goal through interstate trading programs or management of their own state-wide sources. Through the program, "…*states have achieved significant reductions in ozone season NO_x emissions since the baseline years 1990 and 2000. All states have achieved reductions since 1990 as a result of programs implemented under the Clean Air Act Amendments, with many states reducing their emissions by more that half since 1990*"[1]. Similar cap and trade, or NO_x tax systems are also being implemented on a state basis.

The South Coast Air Quality Management District (SCAQMD) in Southern California participates in an emission credit scheme. Proponents can purchase Emission Reduction Credits (ERCs) to offset emissions of either NO_x or VOCs. Proponents that reduce their emissions can sell their credits back, thus giving an incentive to actively reduce emissions. Grants are also available in areas such as California to help proponents deal with the cost of emission reduction. The Carl Moyer Programprovides grants to proponents to retrofit, or replace diesel engines with cleaner ones. In its first seven years, the program provided $170 million to fund the clean-up of about 7,500 engines, *"resulting in about 24 tons per day of NO_X emissions reduction throughout California[2]"*.

Europe has offsetting schemes that include NO_x funds to combat the heavy cost of NO_x offsetting (i.e. Gothenburg Protocol (1999)). Europe also has a focus on vehicle emissions and the use of Selective Catalytic Combustion for vehicles.

In its position in implementing an offset program, AGL considers it more appropriate that a state or regional system be implemented, rather than tackling individual proponents and proposals. Such a scheme could give NSW (or an airshed within) an allowable NO_x emission limit, and decide what constraints would be imposed on individual businesses. AGL would be supportive towards participation in such a system provided there was government leadership and contribution, so as to ensure that the most practicable and reasonable solution is achieved.

In a manner similar to the proposed emissions trading scheme for greenhouse gases[3], a NO_x cap and trade or similar program would provide a potentially effective means of reducing / offsetting NO_x emissions, i.e. it is considered ineffective to address regional issues on a proposal by proposal basis.

By providing a new scheme incorporated at a state or regional level, a mechanism (which provides an economic signal for emission reduction) could be implemented. AGL considers that such a scheme would require being policy and government driven in order to ensure an effective program is implemented.

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[1] US EPA, NO_x Budget Trading Program: 2005 Program Compliance and Environmental Results
[2] Carl Moyer Program Guidelines, Air Resources Board California Environmental Protection Agency, 2008
[3] Australian Government, *Carbon Pollution Reduction Scheme Green Paper,* July 2008 http://www.climatechange.gov.au/greenpaper/summary/pubs/greenpaper-summary.pdf

b) Offsetting VOC Emissions through Vapour Recovery Units

Given that both NO_x and VOC emissions contribute to ozone levels within the local air shed, offsetting of VOC emissions could also be proposed. Offsetting VOC emissions could be achieved through the installation of Vapour Recovery Units (VRUs) at local fuel stations / depots. As outlined in the (then) DEC discussion paper: *Action for Air: Improving Air Quality through Vapour Recovery at Service Stations* (August, 2007), Sydney already has Stage 1 vapour recovery at most service stations, and the evaluation of Stage 2 vapour recovery technology has been considered since 2002. It is uncertain how much contribution AGL could have through this mechanism, given that the mechanism is already being conducted. Further, if this program is already anticipated to be completed and has already been included in an offsetting program, then if AGL were to contribute and allocate its contribution as an offset, it would be considered as double counting.

Alternatively VOC offsetting could be achieved through retrofitting existing large VOC storage tanks or fuel storage tanks with vapour recovery units. However given that there are no regulatory obligations for AGL to reduce other parties' emissions, such an option is voluntary. Implementing this option would be commercially difficult for AGL to administer and track effectiveness of implementation.

c) Third Party Selective Catalytic Reduction (SCR)

Given the limitations on the application of SCR at Dalton, offsetting third party NO_x emissions through the installation of a SCR unit at another suitable facility is another identified option. However, given that no viable AGL facilities are available within the local area, this measure would need to be implemented outside of AGL. This is considered outside of the typical scope for offsetting, and given external commercial interests, the offset provided has limitations in its accountability.

d) Retrofitting or Replacing Vehicles

NO_x and / or VOC offsetting could be conducted through participation in a scheme or program to retrofit or remove vehicle fleets with appropriate control technology or emission reduction technology (i.e. new engines, new emission standards or conversion from petroleum to natural gas or LPG). Offsetting through removing or retrofitting vehicles may appear to be a viable option, however given the differing nature of car exhaust fumes and gas turbine emissions, there is no guarantee or evidence that this will effectively offset or reduce NO_x levels.

The retrofitting of vehicle pollution controls to meet appropriate new emissions standards is not necessarily going to result in a net reduction or offset in local NO_x (or ozone) levels. The European Conference of Ministers of Transport (ECMT) published a document titled *Reducing NO_x Emission on the Road* (ECMT 2006), detailing NO_x emissions in relation to European standards. The European standards are currently adopted within Australia, and are anticipated to be updated consistently to keep in line with new European releases. ECMT (2006 p.3) states "*Air quality, however, has not improved as much as predicted with the tightening of emissions standards, especially in respect of nitrogen oxides (NO_x). One reason for this is the gap between the performance of emission control measures during type approval tests and their effectiveness under real operating conditions*". This offsetting scheme presents significant risk given that significant financial resources would be required.

Furthermore, as outlined by the European Federation for Transport and Environment (T&E Bulletin No. 146, European Federation for Transport and Environment, Brussels Belgium), although there has been a reduction in NO_x emissions under test cycle conditions, there has not been a significant reduction in NO_x emissions in "real world" conditions.

Additionally, there are potential differences in the dispersive nature of gas turbine emissions, as compared to vehicle emissions, which may have implications for the amount of emissions offset.

Replacing inefficient vehicles has also been considered. In September 1994, the Cogeneration Plant at Smithfield proposed by Smithfield Power Partnership, was the subject of a Commission of Inquiry where NO_x offsets were raised[4]. The report of the Commission of Inquiry stated that:

> *"The EPA also refer to potential offset schemes such as car pooling, public transport, alternative technologies, and economic incentives to reduce nitrogen dioxide emissions. I discuss these matters in this report concluding that the offset schemes will either have very limited effect, or increase hazard and risk above guideline levels, or they require further assessment as to their potential environmental, developmental and economic impacts. However, I recommend that the DoP consider requiring Pratt Industries to reduce its nitrogen oxide emissions by installing suitable burners in its Ruston gas turbine when such burners are available possibly in 1996. The nitrogen dioxides emissions from the integrated facility can be reduced by 10 % using this approach and it appears the most cost effective means to reduce nitrogen oxides."*
>
> Further comment is made:
>
> *"The EPA also suggested the Company could reduce NO_x emissions at other industries or purchase old cars (cash for clunkers) to reduce vehicle pollution. These latter schemes are referred to as economic incentives by the EPA…*
>
> *I am not persuaded that the economic strategies put forward by the EPA are appropriate at this time. The evidence does not establish their environmental or cost effectiveness nor does it canvass potential social and commercial implications. I do not support a requirement that the Company be subject to such economic incentives in the absence of policy and comprehensive analyses and strategies for their implementation".*[5]

3.8.2 Selected NO_x Control Mechanism

In some limited international jurisdictions requirements to consider what is Best Available Control Technology (BACT) for a particular installation have been required and regulators have published guidelines on how this requirement is to be considered.

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[4] Office of the Commissioners of Inquiry for Environment and Planning, Report to the Honourable Robert Webster Minster for Planning and Minister for Housing – Cogeneration Plant at Smithfield proposed by Smithfield Power Partnership, Kevin Cleland Commissioner Commissioners of Inquiry for Environment and Planning, September 1994, page iv.
[5] *Ibid,* page 22.

In NSW, regulations, guidelines or definitions, are not available for BACT. In those jurisdictions that do define BACT it is generally considered to be the best performing cost effective control technique that has been achieved in practice for the category or class of source.

While SCR technology may result in slightly lower NO_x emissions, the implementation of catalyst technology to reduce NO_x will correspond to a rise in airborne emissions of ammonia. This is considered to be a pollutant in its own right by forming additional particulate pollution. In essence, with SCR technology, one pollutant is reduced while another is increased.

It is not considered that SCR technology would be determined BACT at Dalton on the basis that:

- there are no additional exceedances of air quality criteria additional to that already experienced will occur as a result of this proposal;
- the high cost of implementation is disproportionate to the benefit;
- infrequent operation of a peaking power plant results in a low annual emission level of NO_x which is below that legislated in most parts of the world where such regulations exist;
- SCR technology has not practically been achieved on large simple cycle gas turbine units such as those proposed for Dalton;
- DLN has been accepted on smaller open cycle gas turbine units (with standard emission of 25 ppm @ 15 % O_2) in areas where BACT is legislated; and
- the potential for increased particulate emissions when using SCR technology.

This conclusion is supported by the understanding that no gas turbine development in Australia has been required to implement SCR technology, even those in metropolitan areas.

Dry Low NO_x (DLN) emission technology presents the most viable NO_x emission technology and is widely used on turbines of the size proposed for Dalton Power Project and is considered BACT for such turbines. All gas turbine manufacturers will guarantee emissions of 25 ppm at operating conditions over 50 % load, which also ensures that regulatory emissions limits are complied with. It is also of note that while not guaranteed, depending on plant and operation conditions, NO_x emissions down to 9 ppm may be achieved. DLN technology was proposed for the recently approved Leafs Gully Power Project.

Whilst DLN technology is considered the most appropriate technology for the Project, emissions of NO_x will still occur and consideration has been given to further reduce or offset these emissions. Other than source control, further reductions at the source would only be achievable if AGL was committed to develop further technological improvements beyond commercially available and proven technologies. Based on the options for NO_x reduction (other than source control) presented, it is considered that the most effective NO_x offset and reduction scheme, would be regulatory policy, namely a NO_x cap and trade scheme. Given the consideration of the Emission Trading Scheme to reduce greenhouse gas emissions, a similar framework for NO_x emissions would allow industry a consistency in approach in addressing emission reduction and also provide a 'level playing field' for all industry participants.

3.8.3 Inlet Air Cooling and Densification

AGL has considered the following options for inlet air cooling and densification:

- evaporative cooling of the gas turbine inlet air cooling; and
- high fogging, for densification of gas turbine inlet air.

Overview of Inlet Air Cooling and Densification

The ambient conditions under which a gas turbine operates have a noticeable effect on the power output. At elevated inlet air temperatures, the power output decreases. The power output decreases due to the decreased air flow mass rate or density (the density of air declines as temperature increases). Conversely, the power output increases when the inlet air temperature is reduced. At inlet air temperatures of near 38°C, power output can drop to as low as 90 % of ISO-rated power for typical gas turbines.

At cooler temperatures of about 4 to 10°C, power can increase to as high as 105% of ISO-rated power. ISO-rated power refers to the power rating of the turbine at an ambient temperature of 15 °C, relative humidity of 60% and ambient pressure at sea level.

The density of air also decreases at altitudes above sea level. Consequently, power output decreases with an increase in altitude.

The decreased power output of gas turbines at high ambient temperatures means that gas turbine performance is at its lowest at the times power is often in greatest demand and most valued (in the local context). Cooling the air entering the turbine by 4 to 10°C on a hot day, thus increasing the air density, can increase power output by approximately 1 to 3%. The decreased power resulting from high ambient air temperatures can be mitigated by inlet-air cooling, including evaporative cooling.

The density of the inlet air can also be increased by directly spraying very finely dispersed water ('fog') into the inlet air stream. This is referred to as 'high fogging'.

Evaporative Cooling

Water flows over baffles and air is drawn into the gas turbine inlet through the baffles. The air is cooled by evaporation as it passes over the baffles. Evaporation of the water reduces the temperature and increases the density of the air, allowing the gas turbine to operate at a higher output. After traversing the baffles the remaining water is collected in a sump and then recycled to the top of the baffles. Water is continually added to replace the evaporated water.

As water evaporates there is an increase in the concentration of dissolved salts (total dissolved solids or TDS). To control the salt concentration and to prevent scaling of the system (precipitation of salts), some water is continually bled off or 'blown down' from the sump. The blow down rate is adjusted to

keep the concentration of dissolved salts below the threshold for scaling to occur. The blow down water is proposed to be discharged to an evaporation pond.

The operation of inlet air coolers is generally only required in warmer weather, typically in summer and to a lesser extent in spring and autumn. However, the lack of availability to supply process water beyond the nominated demand would not affect the ability of the plant to operate and supply power, merely the efficiency of that generation.

High Fogging

Inlet air densification by high fogging, if installed, would provide power generation efficiency benefits over and above inlet air cooling alone. This has benefits independent of air temperature and, if high fogging is installed, would be applied all year round. The extremely fine water droplets are entrained with the turbine inlet air and thus enter the turbine. The water therefore needs to be of extremely high quality, i.e. very low dissolved solids (TDS) concentration, referred to as deionised water, to prevent erosion and deposition of scale on the surfaces within turbines.

Ion-exchange (I-X) or electro-deionisation (EDI) would be required as one of the pre treatment processes (regardless of the supply source) if high fogging is applied. High fogging has a higher water demand and if this option is selected, a brine concentrator would be required in the process to reduce the wastewater output and reduce the resultant evaporation pond size.

3.8.4 Conclusion

AGL is currently considering both options for inlet air cooling and densification. These options have differing water demands with high fogging having a higher water demand. Both options are discussed further in **Chapter 14** *Water Management*. For the purposes of this Environmental Assessment, it is currently proposed that the site water supply would be on-Site groundwater extraction, supplemented by offsite tankering. The final arrangements would be subject to further feasibility assessment. Further consideration, if necessary, may be given in the detailed design stage regarding piping from these sources, however, this Environmental Assessment does not address the broader environmental impacts associated with construction and operation of a water supply pipeline from these sources.

3.8.5 Water Source and Treatment Alternatives

A number of potential water sources for the Dalton Power Project have been considered. The possible options may include one or a combination of:

- utilising existing Upper Lachlan Council water supply;
  - Dalton potable supply;
  - Gunning potable water supply; and
  - Gunning Sewage Treatment Plant.
- Lachlan River off take via a new offtake;

- local groundwater (via extraction bores);
- delivering water to site by truck; and
- harvesting and recycling water;
  - stormwater runoff harvesting;
  - roof runoff harvesting; and
  - water use minimisation and recycling.

The power plant water supply is likely to require a treatment plant on site to provide the different levels of water quality necessary for a power plant and ancillary purposes including drinking water for the site staff. It should be noted that the Facility can operate without water, other than for domestic purposes, during period of water shortage or where there are restrictions.

Potential water sources include securing supply from existing Upper Lachlan Council, accessing groundwater resources, and bringing water to site in large tankers have been considered. The final water supply arrangement for the site may be a hybrid of different sources.

Water Supply

A summary of the water supply options is presented in **Table 3-25**. More detailed discussion of each option is provided in **Chapter 14.**

Table 3-25 Summary of Water Supply Options

Water Supply Options	Advantages	Disadvantages	Conclusion
Dalton potable water supply (groundwater)	Existing water supply in reasonable proximity to site	Likely to be insufficient excess capacity to be the main water supply for the site Marginal water quality as a potable water supply without further treatment (though fine for further treatment to process water)	May be an option as a supplementary supply but unlikely to be sufficiently available excess capacity to be the main supply.
Gunning potable water supply (Lachlan River offtake)	Council extraction entitlement held, which is well in excess of site needs.	Source is 15 km from the site (if piping). There is a suggestion that there is potential water supply constraints associated with the available water from the river.	Potential option as a primary water supply source but further investigation is required to determine feasibility.
Gunning treated sewage effluent (recycle water)	Initial indications are that there may of the order of 40ML of excess effluent, which is sufficient for all of or a reasonable proportion of site needs	Source is 15 km from the site (if piping). Recycled water quality is not yet clear, but there is likely to be a higher pretreatment requirement. Microbiological quality risks will need to be managed.	Potential option as a supplementary water supply source but further investigation is required to determine feasibility.
Direct Lachlan River offtake	River in reasonable proximity to the site.	Suggestions that the supply may be seasonally constrained. Entitlement would need to be acquired. Diversion infrastructure required. Marginal water quality as a potable water supply without further treatment (though fine for further treatment to process water)	Not initially attractive relative to other options and would only be considered further if primary options prove unviable.
Groundwater extraction	Groundwater is available in the area. Although, relatively, local aquifers are not high yielding it is reasonably possible that the sufficient groundwater supply could be acquired from a number of bores on or nearby the site.	Entitlement would need to be acquired within the existing cap. Further investigations, including drilling, would be required to locate extraction bores, with no guarantee of success. Groundwater TDS may be higher than other potential supplies.	Potential option as a primary water supply source but further investigation is required to determine feasibility.

Water Supply Options	Advantages	Disadvantages	Conclusion
Tankered water (from sources identified above or another source beyond the immediate region)	Water can be sourced and is a guaranteed supply	Relatively large overall water demand to supply by tankering. Therefore large number of trips per year and potentially relatively expensive.	This is currently the only guaranteed water supply, and although other options would be considered and may be implemented, provision will be made for receiving tankered water.
Roof runoff harvesting	Reasonably good quality water.	Yield small relative to over water demand	This would be implemented as part of the design to provide supplementary water.
Stormwater runoff harvesting	Available onsite.	Could impact on downstream waterways, which has not been assessed. Objective to retain post development hydrology as close as possible to pre-development.	Not currently proposed.

For the purposes of this Environmental Assessment, it is currently proposed that the site water supply would be on-site groundwater extraction, supplemented by offsite tankering. AGL is currently investigating options for obtaining the relevant permits and licensing arrangements for the transfer of existing groundwater entitlements for the Project. AGL has located numerous water licences for sale and therefore has a high level of certainty that sufficient water licencing requirements could be met for the project.

The final water sourcing arrangements would be subject to further feasibility assessment, and further consideration would be given during the detailed design stage regarding piping from these sources. This Environmental Assessment does not address the broader environmental impacts associated with construction and operation of a water supply pipeline from these sources.

Water Treatment

As discussed previously, the overall water supply requirement to meet the water demands nominated in **Chapter 4** and **14** is a function of the pretreatment requirements of the water supply and of any wastewater treatment and recycling proposed. The potential levels of pretreatment for different supply options is summarised in **Table 3-26.** More detailed discussion of each option is provided in **Chapter 14.**

Table 3-26 Summary of Potential Pretreatment Requirements for Water Supply Options

Indicative Pretreatment Requirement	Water Supply Source			
	Groundwater	Surface Water	Recycled Sewage Effluent	Potable Water
Prefiltration - multimedia pressure filters - gravity sand filters - membrane filters - cartridge filters Possibly after pre-aeration/oxidations and/or coagulant and flocculant dosing	✓	✓	✓ (high level of prefiltration)	
Desalination - reverse osmosis (RO) - elecro-dialysis reversal (EDR)	✓	Possible but unlikely	Possible but unlikely	
Deionisation (for process water supply only) - ion-exchange - electro-deionisation (EDI)	✓	✓	✓	✓

Each of the potential pretreatment processes has an associated wastewater stream. The water supply would therefore need to accommodate these losses to meet the Facility demands. This Environmental Assessment has considered the water requirements for the above pretreatment options.

3.9 Do Nothing Scenario

Both AEMO in its SOO and the NSW Government in its Green Paper have demonstrated an ongoing need for additional electricity generation in NSW. Furthermore, as the time approaches where new generation is required, AGL is experiencing rising costs of wholesale electricity while managing electricity sales to consumers at a fixed, regulated price. This brings forward for AGL the need for new peaking generation compared to the AEMO SOO forecast that is based on the timely delivery of new generation to the market to avoid supply disruptions.

As Australia's largest energy retailer, AGL is well positioned to develop new peak generation capacity that, in addition to ensuring reliable supplies of electricity during peak demand times, manages the costs and risks of its retail portfolio.

Chapter 3 Project Alternatives

3.10 Project Alternatives Conclusion

In summary:

- Of the options considered for power generation, open cycle gas turbines are ideal to meet peak load demand and generally represent best practice technology for this type of use. The turbine would be fired by natural gas only.
- AGL has undertaken a comprehensive review of alternative sites in NSW at Dalton, Marulan, Moss Vale, Wollongong, Nowra, Wagga Wagga, Canberra, Lithgow, Albury and the Central Coast. No other region has the same concentration of gas pipelines, transmission and water as has the Dalton site. Although it is possible to build connections to electricity, gas and water infrastructure these normally impose a burden on the community through which they pass and are cost prohibitive.
- The proposed footprint within the Dalton Site was assessed as the favourable facility footprint from seven alternatives due to ideal topography and aspect. The site is well screened from potential visual and aural receptors.
- The proposed access road and pipeline infrastructure options and the location of the communications tower and associated infrastructure represent the best alternatives for the Project in terms of minimising the potential area of disturbance and in consideration of engineering constraints.
- Dry Low NO_x (DLN) technology has been selected as the most appropriate technology to limit NO_x emissions.

Within the Dalton area, the Dalton Site was found to be most favourable as connection to the 330 kV transmission line and Moomba to Sydney Gas Pipeline are both located within close proximity to the Development Site. The Site is well removed from public viewing points and has sufficient extent to allow adequate buffer distances between the plant and from neighbouring boundaries.

Project Description – Summary of Key Outcomes

AGL proposes to construct and operate a gas turbine power station with a nominal generating capacity of up to 1500 MW. Each gas turbine unit includes the gas turbine itself, a generator and a high voltage transformer with air coolers and filters on the inlet. A gas receiving and conditioning station would be required to ensure flow and pressure control, isolation and filtration.

The Facility may be operated remotely with staff working during day shifts and on call at other times. During operation, between five and ten staff would be employed. Construction for each stage would occur over an approximate 24 month period. The successful contractor would prepare detailed construction programs and plans.

The Dalton Power Project would be constructed in two stages. The total Project would involve the installation of up to six gas turbines with a nominal generating capacity of up to 1500 MW. AGL is seeking approval for both stages of the Project as part of this current application.

The constituent elements of the Dalton Power Project would include the proposed power station; an approximately 3 km lateral gas pipeline connection from the power station to an existing natural gas supply pipeline located to the south of the Site; access road to the Site, a communications tower connected to the Facility via underground services and an access track and a connection between the power station and the existing high voltage transmission system on Site requiring one or two transmission towers within the existing 330 kV transmission line easement.

The Project would involve the construction and operation of the following infrastructure:

Gas Pipeline (northern portion) and Access Road

The Facility would be fuelled by natural gas from a lateral gas pipeline connection to the Moomba to Sydney Gas Pipeline to the south of the Site. The northern portion of this pipeline into the Facility would be developed within a shared easement with a new road to be constructed from the intersection of Walshs Road where the road makes a right angle turn west. The length of the gas pipeline (northern portion) and access road would be 1.9 km (to the edge of the Facility footprint) and the maximum area of the easement footprint would be approximately 4.2 ha. The width of this shared easement and ranges between 10 and 45 m in width, and would require the permanent removal of some vegetation.

Gas Pipeline (southern portion) and Valve Station

The southern portion of the gas pipeline would be constructed within the western easement of the existing Walshs Road reserve. The southern portion of the gas pipeline would extend from a proposed valve station adjacent to the Walshs Road easement to the Moomba to Sydney Gas Pipeline, and would connect with the northern portion of the gas pipeline into the Facility where the proposed new road meets Walshs Road. The length of the gas pipeline (southern portion) would be 1.1 km and the maximum area of the easement footprint would be 0.6 ha (or 0.8 ha including the valve station).

Chapter 4 Project Description

The gas pipeline (northern and southern portions) would be an underground line (except at entry and exit points) and would be located within an easement of approximately 5 m.

AGL proposes the construction of a valve station as the connection point from the Moomba to Sydney Gas Pipeline. The valve station would be set back 25 m from Walshs Road and would occupy and area of approximately 0.22 ha. The area would be fenced off from public access.

Communications Tower Infrastructure

A communications tower would require construction and establishment beyond the Facility footprint. The tower would be approximately 60 m in height, and would be located on an elevated area approximately 1.5 km to the east of the Facility. The tower would be connected to the Facility via underground services and a new access track.

Electrical Infrastructure

The electricity generated by the Facility would be fed into the high voltage transmission network located within the Site via a new connection facility built in stages. To facilitate this connection, one or two additional transmission towers would require construction within the existing 330 kV transmission line easement. The positioning of the tower(s) would be determined during the detailed design stage. The structure(s) would be in the height range of 30 – 40 m and would be located within the existing transmission line easement which forms part of the southern boundary of the Development Footprint.

Other Project Components

Some small amounts of chemicals and oil would be required on-site for use in the Dalton Power Project. Chemical storage would comply with statutory requirements. Water would be stored on-site in tanks for process, domestic and fire fighting uses.

Water and Wastewater Management

A number of feasible options exist, and are being considered, for the water source and treatment for the Facility.

Site water could be sourced from a range of sources including: tankering (by road) water to the Site; groundwater extraction; and via the augmentation of the Dalton or Gunning supply and/or from the Gunning Sewerage Treatment Plant if the water quality is suitable and sufficient water quantities are available.

It is currently proposed that the site water supply may be offsite tankering to meet the essential base domestic and utility water demands, and some or all of the process water demands (depending upon the development option adopted). During further design and development of the power station, further investigations will be conducted on the additional water supply options, with on-site groundwater extraction and/or Upper Lachlan Shire Council water supplies the current preferred options, to meet the full nominated site water supply requirements. The final arrangements would be subject to further feasibility assessment.

Process wastewater would be generated at the Facility by the process of blow down from evaporative air inlet coolers which cool the gas turbine air intake. Blow down water would be collected in evaporation ponds lined with a synthetic liner (such as high density polyethylene) to minimise the risk of the saline blow down water escaping into the natural groundwater system.

Clean rainwater collected from the power plant catchment area would be directed to a sedimentation pond and associated earth bund and diversion drain. The outlet of the stormwater system would be designed to maximize the dispersion of these high flows and thereby minimise their potential to cause soil erosion downstream.

Surface water from the plant footprint such as wash water from turbine washing and cleaning of other components, rainfall runoff from bunded plant areas of the plant footprint, and accumulated water within bunds would be directed through oil and grit traps designed to remove any oil and minimise suspended solids to an acceptable level prior to discharge to the sedimentation pond. This system would also be fitted with a gross pollutant trap to collect any large material mobilised by stormwater.

Chapter 4 Project Description

4.1 Overview

4.1.1 General

AGL proposes to build a gas-fired power plant (known as the Dalton Power Project) at a site north of Dalton, NSW. The Dalton Power Project would be constructed over two stages, resulting in a maximum installation of six turbines with a nominal generating capacity of 1500 MW at the completion of both stages.

AGL is seeking approval for both stages of the Project as part of this current application.

Stage 1 would initially result in the construction of a gas turbine power station with a nominal generation capacity of between 250 and 780 MW. The first stage would consist of the installation of two to four “E” class turbines, or two to three “F” class units. Each “E” class turbine would have a capacity of between 125 and 200 MW each run in open cycle mode, and each “F” class turbine would have a nominal generation capacity range between 200 and 320 MW.

Stage 2 of the Project would involve the incorporation of additional open cycle gas turbine units into the power station to bring the maximum number of turbines to six, and the total maximum generating capacity to 1500 MW. Proceeding with Stage 2 would be likely to be contingent upon the proposed upgrade by TransGrid of the 330 kV transmission line from the Bannaby substation to Yass.

It is envisaged that the Facility would operate in open cycle mode during times of peak electricity demand, typically for less than 15 % of the year (refer also to **Section 2.5**).

Natural gas would be supplied to the Facility via the construction of a gas pipeline extension from the Facility to the existing Moomba to Sydney Gas Pipeline which is located approximately 4 km to the south of the Site.

The proposed gas pipeline connection would be located underground and would be approximately 3 km in length from the proposed valve station to the Facility (calculated to the edge of the Facility footprint). The valve station would occupy an area of approximately 0.22 ha and would connect the Moomba to Sydney Gas Pipeline to the proposed gas pipeline (southern portion) at a location 25 m to the west of Walshs Road.

4.2 Development Area

The Site is located approximately 4 km north of Dalton, and approximately 12 km north west of Gunning in south western NSW (refer to **Figure 4-1**). The Development Area comprises rural land holdings and includes the titles listed in **Table 4-1**.

Table 4-1 Titles for Development Area

Lot identifier	Owner	Comment	Proposed Use
Lot 115,249,252,253,305,307 in DP754111	AGL Formerly "The Elms"		Part infrastructure - gas pipeline (northern section) and access road; transmission connection Part Facility footprint Part access track and underground services to communications tower
Lot 14, 183,184,187,200,283,306 in DP 754111; and Lots 1 & 2, DP 126122	AGL Formerly The "Holmes"		Part infrastructure - gas pipeline (northern section) and access road; transmission connection Part Facility footprint
Lot 116, 321, 322, 162, 317, 318 in DP754111	AGL Formerly "Riverview"		Traversed by transmission line Communications tower and part access track and underground services.
Lots 21,186 and 251 in DP754111; Lot 1 DP 126119	AGL		Part infrastructure - gas pipeline (northern section) and access road
Walshs Road easement and parts of Lots 30 and 31 in DP754111	AGL; the Crown; Baines and Baines		Part infrastructure -gas pipeline (southern portion)
Lot 30 in DP754111	AGL		Valve station

The Dalton Power Project would be constructed and operated within an approximately 26 ha footprint within a 508 ha site area. AGL has purchased 573 ha of land in total (shown in **Figure 1-2**, **Chapter 1**). However for the purposes of the Environmental Assessment, the 508 ha boundary encompassing the estates formerly known as “Riverview”, “Holmes” and “The Elms” is considered as the Site. The remaining area owned by AGL is land in proximity to and through which ancillary infrastructure would traverse.

The Site currently operates as a rural landholding with sheep and cattle grazing. The majority of the Site is cleared with some areas of woodland in the centre of the Site. Main improvements include existing buildings, dams and sheds.

Developments immediately surrounding the Site are predominantly rural enterprises. The Lachlan River forms the northern boundary of the Site.

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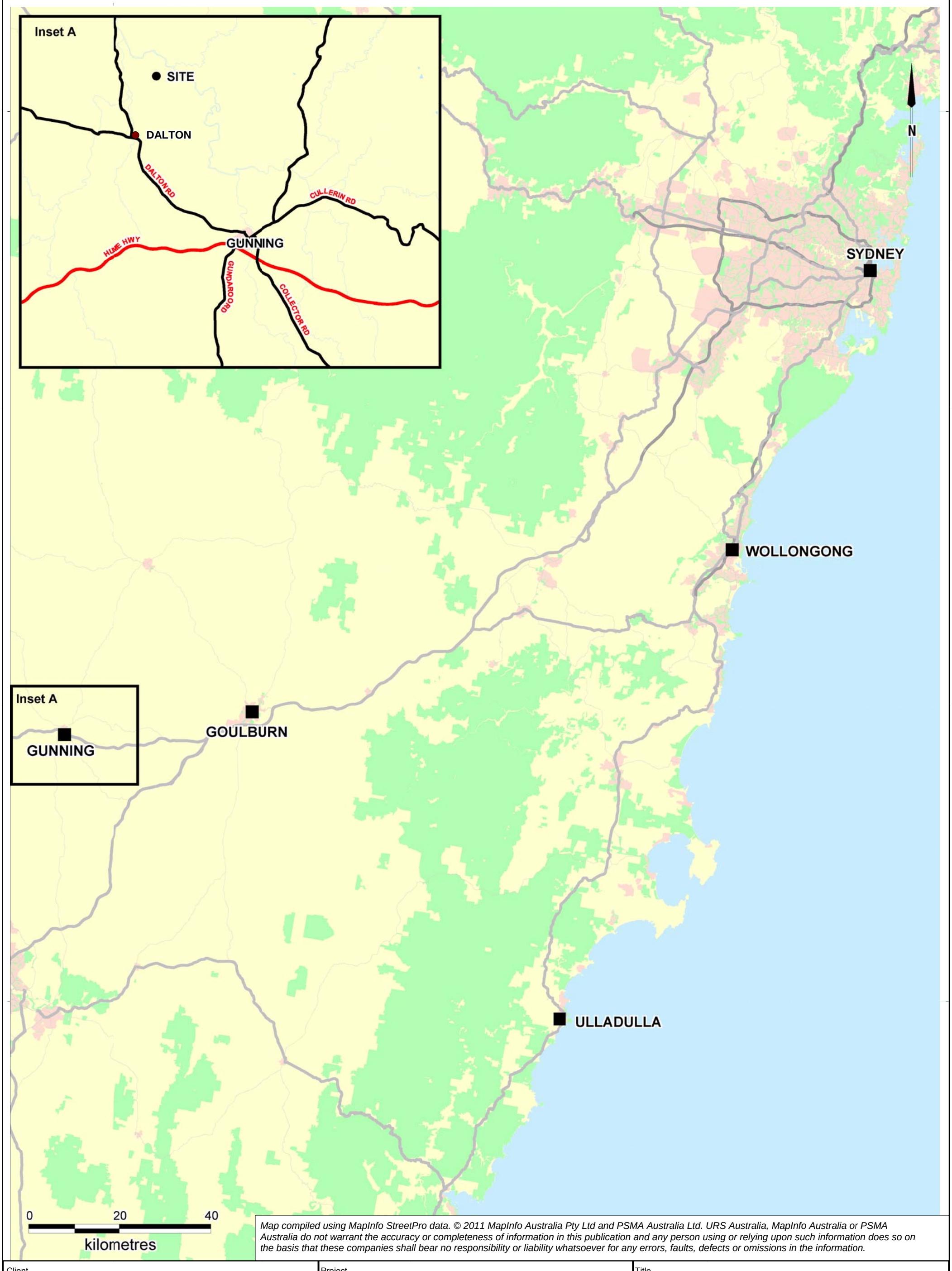

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Client: AGL POWER GENERATION (NSW)	Project: AGL DALTON POWER PROJECT	Title: **PROPOSED SITE**
URS	Drawn: SB/AY · Approved: KT · Date: 22/02/2011 · Job No: **43177661** · File No: 43177661.048.wor	Figure: **4-1** · Rev: A · **A4**

4.3 Facility

4.3.1 Proposed layout and key components

Approximately 26 ha of the 508 ha of the Site is required for the Dalton Power Project. The Dalton Power Project comprises the following key components:

- Facility:
  - power plant comprising up to six gas turbines, generators and ancillary plant;
  - high voltage switchyard comprising high voltage transformers and switchgear;
  - transmission line connection to the 330 kV network;
  - control room, administration, amenities, car parking and workshop facility;
  - connecting gas pipelines, gas receiving station and gas conditioning station;
  - fire protection tank(s);
  - pro cess water tank(s);
  - domes tic/rainwater tank(s);
  - domestic wastewater treatment and disposal system;
  - sedimentation pond and associated earth bund and diversion drain;
  - evaporation pond;
  - air compressor plant;
  - swit chroom;
  - buildings;
  - emergency generator and transformers; and
  - land scaping.
- Infrastructure within Site:
  - a gas pipeline and access road easement connecting the Site to Walshs Road;
  - transmission connection to existing transmission lines within the Site (requiring the construction of one or two new steel lattice transmission towers);
  - communications tower connected to the Facility via underground services and an access track;
  - communications hut (3m x 3m) adjacent to the communications tower; and
  - security and general fencing and gatehouse.
- Infrastructure beyond the Site:
  - portion of the gas pipeline (northern section) and access road to connect to the gas pipeline (southern section);

- gas pipeline (southern section) to be incorporated into the western side of the existing road reserve along Walshs Road; and
- new valve station at the connection point of the proposed pipeline infrastructure with the Moomba to Sydney Gas Pipeline.

The proposed Site layout of the Dalton Power Project is presented in **Figure 4-2**. An indicative arrangement of key components within the Facility footprint is presented in the Indicative Site Concept Plan, **Figure 4-3.**

4.3.2 Staging and Process Description

The Dalton Power Project would be constructed in two stages, and would involve the installation of up to six gas turbine units, and would have a total nominal generating capacity of up to 1500 MW. AGL is seeking approval for both stages of the Project as part of this current application.

The vendors for the gas turbine units would be determined through a tendering process. The potential units would be assessed on the basis of proven levels of efficiency, reliability and operability. It is envisaged that the gas turbines would be proprietary units, provided by manufacturers. Precise outputs would only be known once the tendering process is completed. A nominal output of 1500 MW has been provided for the purposes of this Environmental Assessment. **Figure 4-4** illustrates the general process flow description for a functioning gas fired power station.

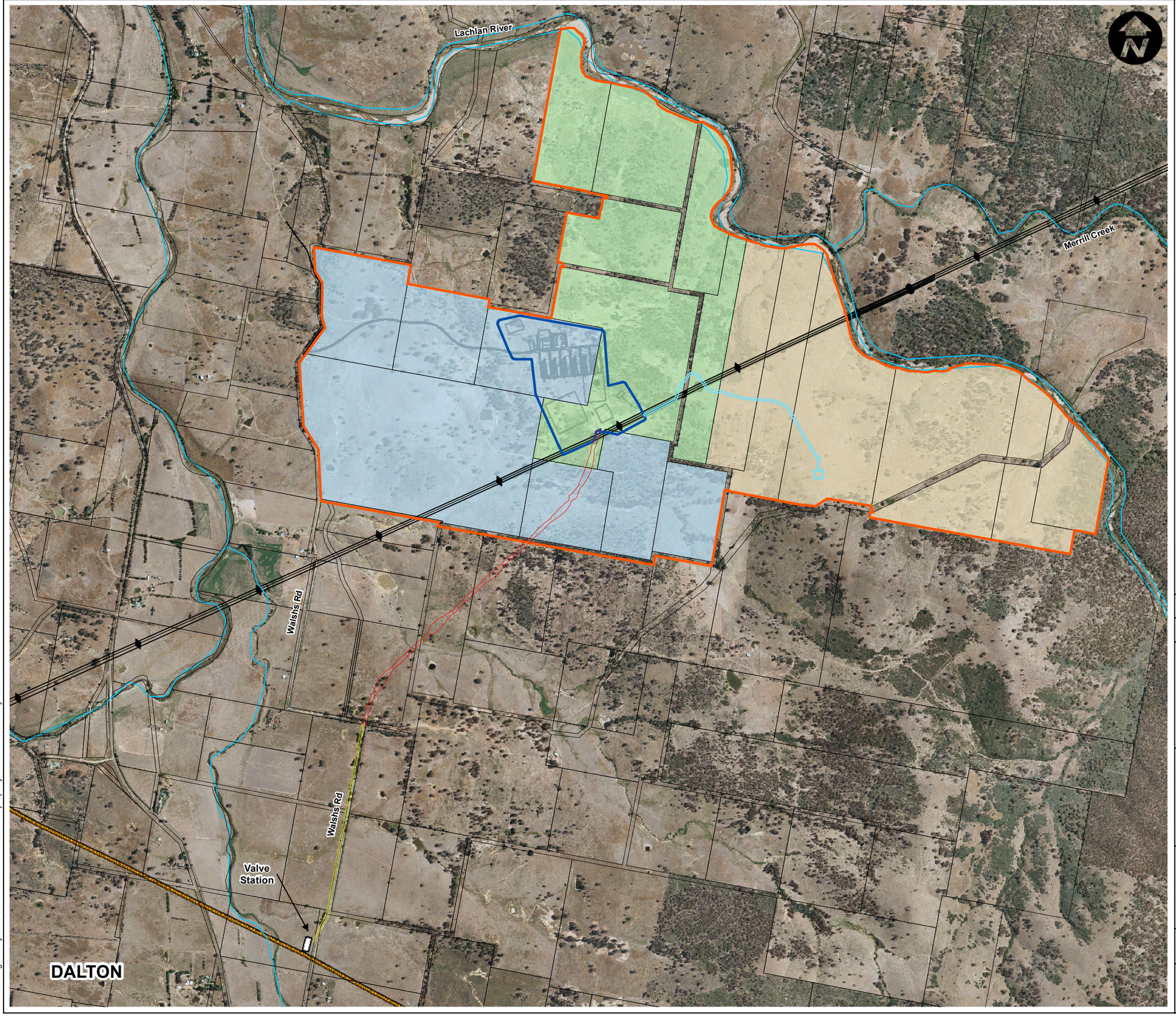
4.3.3 Gas Turbines

The Facility would be constructed over two stages:

- The first stage would initially consist of:
  - between two and four “E” class turbines, with capacity between 125 MW and 200 MW, each run in open cycle mode, **or**
  - two to three “F” class machines with a generation capacity of between 200 MW and 320 MW each, up to a maximum of 780 MW.
- The second stage would result in the residual generating capacity being completed, with a maximum of six turbines on site generating up to nominally 1500 MW.

Each gas turbine generator unit consists of three main items being the gas turbine, generator and high voltage transformer. In each gas turbine, air is drawn in through filters to remove particulate matter and is compressed. The compressed air flows into the combustion chambers where natural gas is injected and burnt, increasing the temperature to approximately 1100 – 1200 ^{o}C.

The combustion products from the combustion chambers enter the turbine area and expand to atmospheric pressure, reducing in temperature to around 550 ^{o}C. As the gas expands, it drives each turbine, which in turn drives the compressor and an electrical generator. From the turbine, the heated exhaust gases pass through a silencer unit and are discharged through a stack. The combustors feature Dry Low NO_x technology to produce very low NO_x emissions.



Legend

- AGL Site Boundary
- Plant Footprint
- Gas Pipeline (northern) and Access Road
- Gas Pipeline (southern)
- Communications Tower and Hut Footprint
- Communications Tower Services and Access Track
- Moomba-Sydney Pipeline
- Transmission Line

0 1

Kilometres

Source: Aerial Image from AGL

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Job No.: 43177661	File No.: 43177661.036.mxd	

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DALTON POWER PROJECT

Title

PROPOSED SITE LAYOUT

Figure: 4-2

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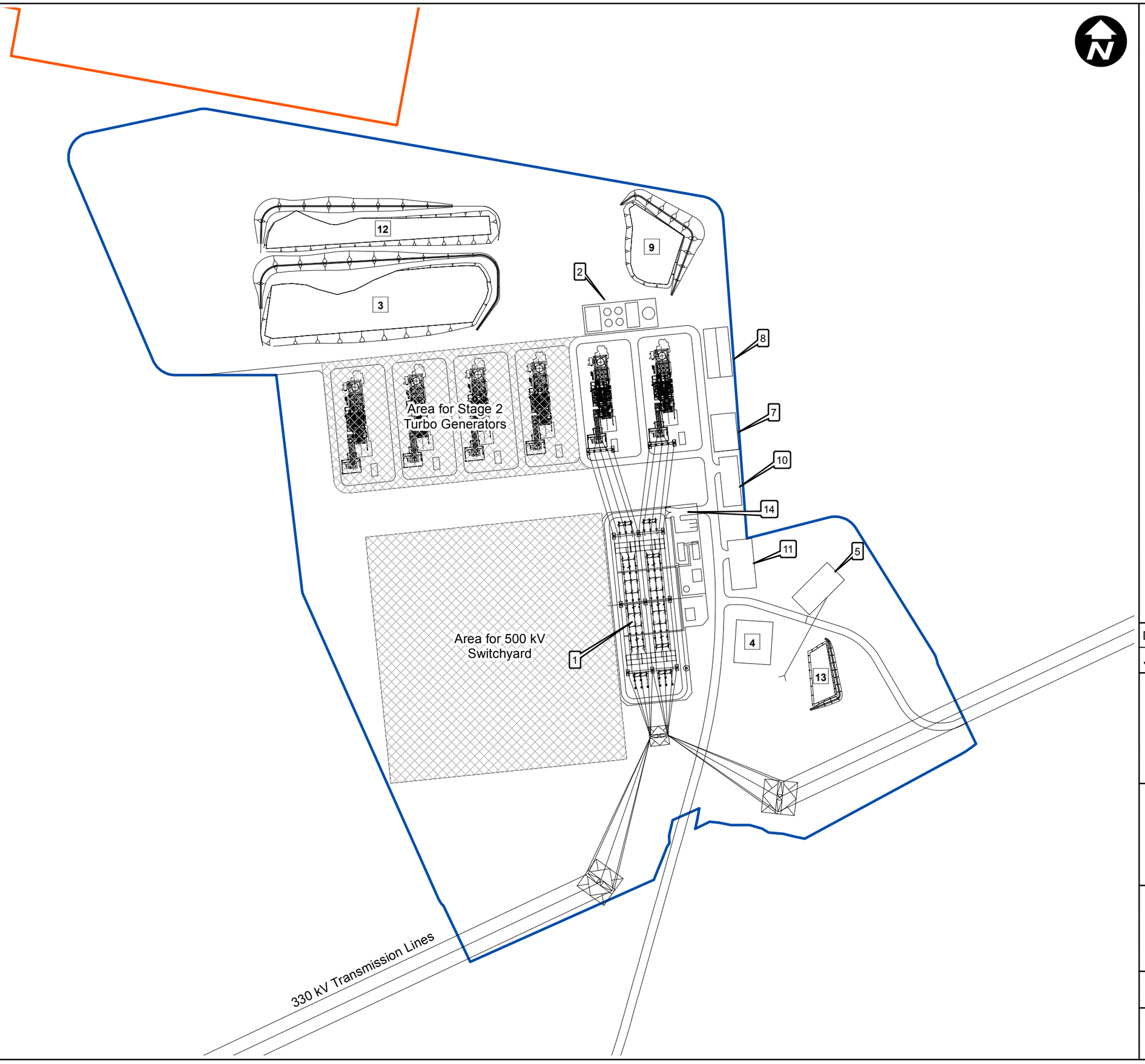

Legend

- Site Boundary
- Plant Footprint

1 Switchyard
2 Water Treatment Plant
3 Evaporation Pond (Stage 1)
4 Storm Water Pond
5 Gas Receiving Facility
6 Workshop / Store
7 Control Building
8 Administration Building
9 Sedimentation Pond
10 Staff and Visitor Carpark
11 Contractor Carkpark
12 Evaporation Pond (Stage 2)
13 Sedimentation Pond
14 Switchyard Access Road

0 100
Metres

Source: Translated from ENV002.dwg (Aurecon)

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INDICATIVE SITE CONCEPT PLAN

Figure: 4-3

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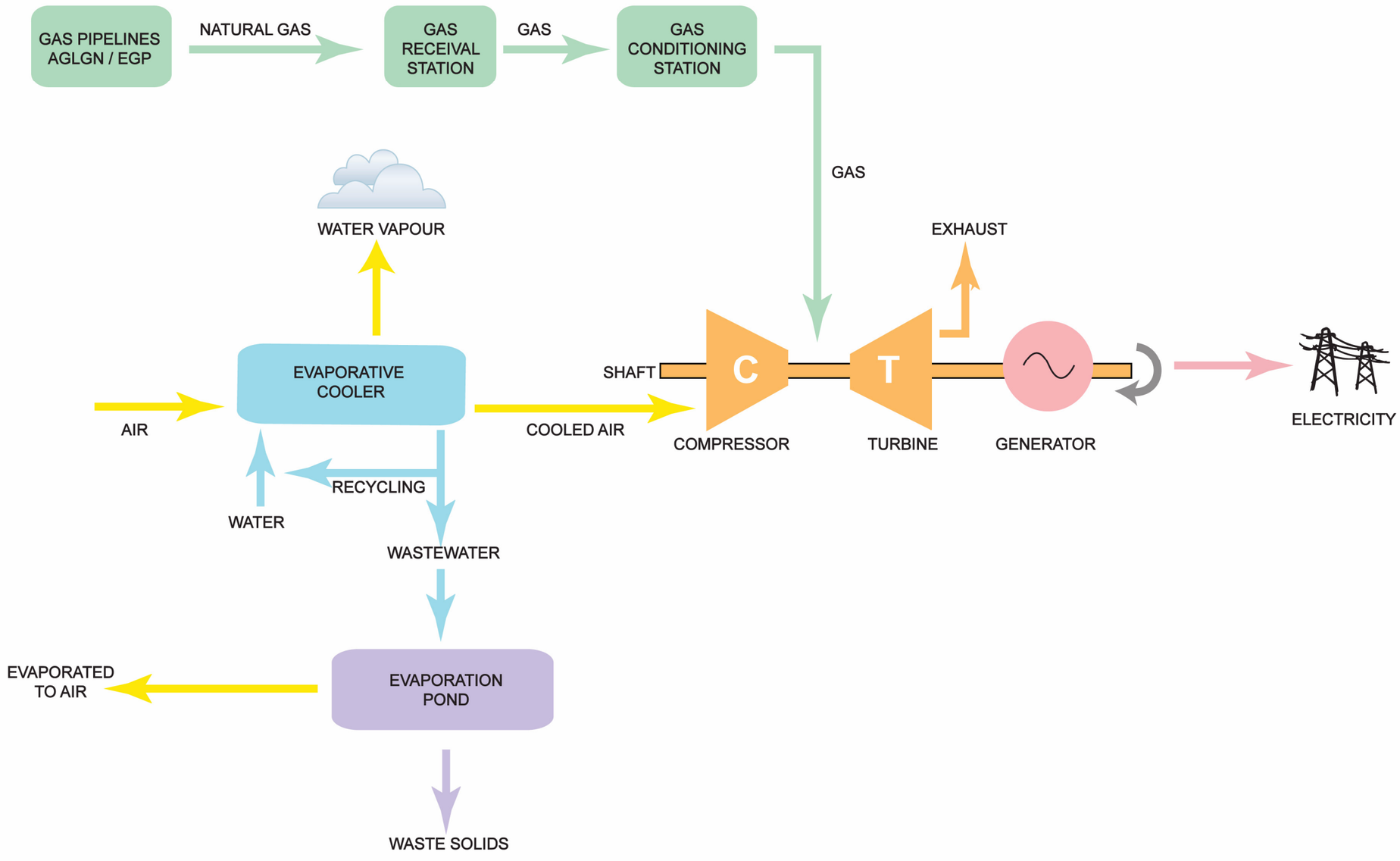

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Title

PROCESS FLOW DIAGRAM

Figure: **4-4**

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The height of the exhaust stacks could be up to 46m but likely in the order of 28 to 30 m. The height of the stack is primarily determined by the silencer design. Ancillary plant and buildings would be up to 20 m in height. **Figure 4-3** provides the indicative site concept plan. The outcome of the tendering process would determine the preferred manufacturer and layout.

4.3.4 Inlet Air Cooling and Densification

The following options are being considered:

- high fogging, for densification of gas turbine inlet air;
- evaporative cooling of the gas turbine inlet air cooling.

However, the lack of availability to supply process water beyond the nominated demand (or even any) would not affect the ability of the plant to operate and supply power, merely the efficiency of that generation.

The ambient conditions under which a gas turbine operates have a noticeable effect on the power output. At elevated inlet air temperatures, the power output decreases. The power output decreases due to the decreased air flow mass rate or density (the density of air declines as temperature increases). Conversely, the power output increases when the inlet air temperature is reduced. At inlet air temperatures of near 38°C, power output can drop to as low as 90 % of ISO-rated power for typical gas turbines.

At cooler temperatures of about 4 to 10°C, power can increase to as high as 105 % of ISO-rated power. ISO-rated power refers to the power rating of the turbine at an ambient temperature of 15 °C, relative humidity of 60 % and ambient pressure at sea level.

The density of air also decreases at altitudes above sea level. Consequently, power output decreases with an increase in altitude.

The operation of inlet air coolers is generally only required in warmer weather, typically in summer and to a lesser extent in spring and autumn. The decreased power output of gas turbines at high ambient temperatures means that gas turbine performance is at its lowest at the times power is often in greatest demand and most valued (in the local context). Cooling the air entering the turbine by 4 to 10°C on a hot day, thus increasing the air density, can increase power output by approximately 1 to 3%. The decreased power resulting from high ambient air temperatures can be mitigated by inlet-air cooling, including evaporative cooling.

The density of the inlet air can also be increased by directly spraying very finely dispersed water ('fog') into the inlet air stream. This is referred to as 'high fogging'. Ion-exchange (I-X) or electro-deionisation (EDI) would be required as one of the pretreatment processes (regardless of the supply source) if high fogging is applied.

In the water supply and demand scenario for a high fogging option, the potential wastewater volume would be such that evaporation ponds alone as the primary wastewater concentration method becomes less attractive. In this context, based on preliminary assumptions of treatment technologies and wastewater volumes, a brine concentrator may be required to concentrate the wastewater and recover water for recycle. The concentrated brine would either be directly tankered offsite or discharged to an evaporation pond.

4.3.5 Fuel

The fuel for the turbines would be natural gas supplied by a lateral gas pipeline to the existing Moomba to Sydney Gas Pipeline. The new lateral gas pipeline would be located underground, extending from the proposed valve station adjacent to the Moomba to Sydney Gas pipeline, along the western side of the Walshs Road easement, and extending north east within the proposed gas pipeline (northern portion) and access road easement to be developed to the Facility.

The Moomba to Sydney Gas Pipeline would deliver gas at a maximum pressure of 6 MPa to the gas receiving station where it would be reduced to 3.5 MPa or lower prior to injection into the gas turbine.

Safety features at the gas receiving station include automatic shutdown due to low pressure. There would also be manual shut down (i.e. isolating manually) at the pipeline off take. Methods to prevent pipeline leaks would include:

- coating on external surfaces;
- regular patrolling of pipeline; and
- cathodic protection for external corrosion.

These methods would be detailed in a plan for pipeline protection.

4.3.6 Gas Conditioning Station

The gas conditioning station is the connection of the supply of gas into the power station. The final location would be determined during detailed design.

The following equipment would be located in the pipeline delivery facility:

- header pipeline connecting the conditioning station to each of the gas turbines;
- actuated isolation valve installed at the inlet facility;
- gas filtration, heating and pressure regulation equipment;
- over pressure protection and pressure relief systems; and
- process control and communications equipment.

The header pipeline connects the pressure regulation station to the inlet gas manifold at the gas turbines. The length and diameter of the header pipe would be determined in the detailed design phase and would be designed to comply with the requirements of Australian Standard *AS4041 Pressure Piping*.

Safety features would be installed to provide overpressure protection. The delivery facility would incorporate equipment to vent gas from the connecting pipeline if required for maintenance or in an emergency situation. In the event of a plant trip signal and the sudden reduction in gas demand, pressure protection mechanisms would need to be in place to protect pipe work from overpressure between the pressure regulation and station and the gas turbine facility. These mechanisms would be determined in the detailed design phase but would include a pressure relief valve and / or control valves and slam-shut valves.

4.3.7 Gas Receiving Station

The receiving station regulates the gas entering the power station. The inlet facility would contain the following equipment:

- gas filtration, custody transfer, flow control and metering;
- process control and communications equipment; and
- pipeline connection to the gas conditioning station.

This station would be fenced.

4.3.8 Electrical Generators

Attached to each gas turbine is an electrical generator that generates electricity when rotated by the turbine. The generators are large items of plant, assembled off-site and delivered in one piece.

4.3.9 Emergency Generator

An emergency generator would be available as back up to ensure an uninterrupted power supply for plant start up. This emergency generator would use diesel. A diesel tank of up to 10,000 L would supply this generator. The diesel tank would be managed in accordance with the requirements of the *Occupational Health and Safety Act 2000* and the *Occupational Health and Safety Regulation 2001*. Diesel is a class C1 combustible liquid and not listed in the Australian Dangerous Goods Code. The diesel tank would be installed in accordance with relevant WorkCover requirements and Australian Standard *AS1940:2004 Storage and Handling of Flammable and Combustible Liquids*.

Although diesel is not classified as a hazardous material; it is combustible. The diesel tank, associated pipelines and fittings would be constructed in accordance with relevant Australian Standards and regular inspection and/or testing shall be conducted by a licensed contractor.

Diesel would not be used as a fuel for the turbines.

4.3.10 Transformers and High Voltage Switchyard

The electrical transformers step the voltage from the generator at around 16 kV to 330 kV. Each gas turbine generator set would be connected to a switchyard operating at 330 kV. The transformers would have appropriate switchgear to ensure safe and reliable connection to the electricity network.

The switchyard is proposed to be located adjacent to the power plant and transmission line traversing the Development Site. During the Connection Application process and ongoing consultation with TransGrid, the switchyard design will be further refined to address network issues.

4.3.11 Transmission Tower(s)

The electricity generated by the Facility would be fed into the high voltage transmission network located within the Site via a new connection facility that is proposed to be built in stages. To facilitate this connection, one or two additional transmission towers would require construction within the existing TransGrid 330 kV transmission line easement. The positioning of the tower(s) would be determined during the detailed design stage. The structure(s) would be in the height range of 30 – 40 m and would be located within the existing transmission line easement which forms part of the southern boundary of the Development Footprint.

Indicative dimensions of transmission line structures (suitable for a 330kV transmission line) are outlined below.

Table 4-2 Indicative Tower Configuration

	Steel Lattice Tower
Average Height Range	30 – 40 m
Dimensions of base	9.5 m x 4.75 m to 12.3 m x 12.3 m depending on design configuration
Max Height to cross-arm	31 m
Cross-arm width	22 m – 30 m
Foundation Type	Typically bored footing or mass concrete footing
Typical foundation depth	2 - 2.5 m
Typical average span across level ground	200 – 400 m

4.3.12 Communications Tower

A communications tower would be located beyond the Facility footprint. The tower would be approximately 60 m in height, and would be located on an elevated area approximately 1.5 km to the east of the Facility.

Infrastructure for the communications tower includes:

- underground services - electricity and communications;
- access track to the tower from the Facility; and
- communications hut (dimensions 3m x 3m).

The underground services would be collocated in the same alignment as the access track. The footprint of this access track is 10 m wide allowing for construction activities including trenching for the services and grading the access track (refer to **Figure 4-2**).

The tower would be approximately 60m in height, and would be a steel lattice structure with a base of approximately 10 m by 10 m. The communications hut would be located adjacent to the tower and would be an approximately 3 m by 3 m structure. A footprint of 40 m by 40 m has been allowed for the location and construction of the tower and hut (refer to **Figure 4-2**).

Ground disturbing activities associated with this infrastructure would be limited to the excavation of a narrow trench, and grading of surface material to form a suitable access track to the communications tower location. The ground disturbing works anticipated for the tower assembly would be to establish footings for the structure and the communications hut. This infrastructure has been sited to avoid the need for any vegetation clearing beyond exotic pasture communities.

4.3.13 Buildings, Amenities and Security

A number of buildings would be constructed within the plant footprint. Buildings would include buildings for administration, amenities, control room facilities, security gatehouse, workshops, and storage facilities (refer to **Figure 4-3.** This represents a preliminary, and indicative, site layout arrangement that will be finalised post approval). The plant footprint would be surrounded by a fence. Lighting would be installed for safe working and security purposes and would be designed such that light is contained within the Site.

4.4 Water and Wastewater

4.4.1 Water Demand

Table 4-3 outlines the breakdown of indicative water requirements for specific uses within the Facility, outlining indicative water requirements for nominal 750 MW (Stage 1) and 1500 MW (Stage 2) plant options on the basis of supply of the process water demands for 438 hours (5 % of the year).

It is important to note that the lack of availability to supply process water beyond the nominated demand (or even any) would not affect the ability of the plant to operate and supply power, merely the efficiency of that generation. The only water that is essential to facilitate operation is fire water (to fill the tanks), some utility water and a domestic water supply i.e. less than 3 ML/a.

The demands nominated in **Table 4-3** are indicative only and would be refined in later stages of facility design. AGL has considered a range of options for generator cooling water. Further refinement of these options by AGL has narrowed the options to:

- E Class turbines (up to 4 per stage of development) that operate with high fogging all of the time (if water is available), and evaporative cooling in hot weather, and
- F Class turbines (up to 3 per stage of development) that use evaporative cooling only in hot weather.

If high fogging is not included, the overall water demand, as can be seen in **Table 4-3** would be substantially reduced (by about 78 %, noting also that there is one less turbine in the F-Class case).

Also, if high fogging is not included, then it is possible to supply high quality (low total dissolved solids) potable water as make-up to the inlet air evaporative coolers rather than the nominated deionised water.

Table 4-3 Indicative water demand requirements

Water Demands	Total Amount (ML/year)						Water Quality Requirement
	E Class Turbines with evaporative cooling and high fogging		F Class Turbines with evaporative cooling only		Minimum Demand (no evaporative cooling or high fogging demand		
	Nominal 750MW Installed Capacity (Stage 1)	Nominal 1500MW Installed Capacity (Stage 2)	Nominal 750MW Installed Capacity (Stage 1)	Nominal 1500MW Installed Capacity (Stage 2)	Nominal 750MW Installed Capacity (Stage 1)	Nominal 1500MW Installed Capacity (Stage 2)	
High fogging water (for turbine inlet air densification)	39.1	78.2	- - - -				Deionised water
Evaporative cooler water (for turbine inlet air cooling)[&]	12.0 24.0	10.0 20.0			-	-	Deionised water or high quality (low TDS) potable water*
Potable water	0.2 0.3	0.2		0.3 0.2	0.3		Potable water
Gas turbine compressor wash	0.4 0.8	0.4 0.8 0.4				0.8 Potabl	e water
Other utility water	1.0 1.5	1.0		1.5 1.0	1.5		Filtered raw water or potable water
Fire fighting system[#]	0.0 0.0	0.0		0.0 0.0	0.0		Filtered raw water or potable water

Water Demands	Total Amount (ML/year)						Water Quality Requirement
	E Class Turbines with evaporative cooling and high fogging		F Class Turbines with evaporative cooling only		Minimum Demand (no evaporative cooling or high fogging demand		
	Nominal 750MW Installed Capacity (Stage 1)	Nominal 1500MW Installed Capacity (Stage 2)	Nominal 750MW Installed Capacity (Stage 1)	Nominal 1500MW Installed Capacity (Stage 2)	Nominal 750MW Installed Capacity (Stage 1)	Nominal 1500MW Installed Capacity (Stage 2)	
Landscaping# 0.0		0.0 0.0 0.0 0.0 0.0					Raw or potable water (depending upon dissolved solids of raw water)
Annual Water Demand	**52.7**	**104.7**	**11.6**	**22.6**	**1.6**	**2.6**	

Notes: * High quality (low total dissolved solids) potable water can be used for this demand, but if deionised water is required for high fogging and a deionised water supply would therefore be produced, it is preferable to also supply this water quality for this demand.

There is a 3 ML firewater demand to initially fill up the fire water tanks that would need to met over and above the annual demand. Topping up these tanks associate with minor firewater use eg equipment testing, is assumed to be met from the utility water demand. Similarly, a small amount of landscaping water might be required during establishment, but would not be an ongoing demand.

& For the high fogging case, (ie E Class generators) this assumes that the make-up will be deionised water, and for the F-Class case, that the make-up will be high quality potable water, which has an associated higher blowdown rate due to the higher make-up water TDS.

The water requirement nominated in **Table 4-3** is the demand only and the water supply requirement for the Facility would be higher and dependent upon the water supply source and the extent of wastewater treatment and recycling incorporated into the design. Different water sources would have different qualities and therefore different pre-treatment requirements. There are water losses (as wastewater streams) associated with the potential pre-treatment processes. Potential wastewater treatment options, such a brine concentration, have been considered, which would produce high quality recycle water stream. Further discussion on water demand is presented in **Chapter 14**.

4.4.2 Water Supply

Sources

A number of potential water sources for the Dalton Power Project have been considered. The possible options may include one or a combination of:

- Utilising existing Upper Lachlan Council water supply;
- Lachlan River off take via the existing Upper Lachlan Council entitlement;
- Lachlan River off take via a new off-take;
- Local groundwater (via extraction bores);

- Delivering of water to site by truck;
- Rainwater harvesting (rooves and surface runoff); and
- Treated wastewater (including blowdown water and water from other on-site storages).

The overall water supply requirement to meet the water demands is a function of the pre-treatment requirements of the water supply. Different water sources would have different qualities and therefore different pre-treatment requirements. There are water losses (as wastewater streams) associated with the potential pre-treatment processes. The final water supply arrangement for the site may be a hybrid of different sources.

A summary of the water supply options is presented in **Table 4-4**. More detailed discussion of each option is provided in **Chapter 14.**

Table 4-4 Summary of Water Supply Options

Water Supply Options	Advantages	Disadvantages	Conclusion
Dalton potable water supply (groundwater)	Existing water supply in reasonable proximity to site. Water supply system is proposed to be upgraded.	Likely to be insufficient excess capacity to be the main water supply for the site, although this may change with proposed ULSC upgrades. Marginal water quality as a potable water supply without further treatment (though fine for further treatment to process water)	May be an option as a supplementary supply but unlikely to be sufficiently available excess capacity to be the main supply, although this may change with proposed ULSC upgrades.
Gunning potable water supply (Lachlan River offtake)	Council extraction entitlement held, which is well in excess of site needs. Water supply system is proposed to be upgraded.	Source is 15 km from the site (if piping). There is a suggestion that there is potential water supply constraints associated with the available water from the river.	Potential option as a primary water supply source but further investigation is required to determine feasibility, and to assess the implications of the proposed system upgrades.
Gunning treated sewage effluent (recycle water)	Initial indications are that there may of the order of 40ML of excess effluent, which is sufficient for all of or a reasonable proportion of site needs.	Source is 15 km from the site (if piping). Recycled water quality is not yet clear, but there is likely to be a higher pretreatment requirement. Microbiological quality risks would need to be managed.	Potential option as a supplementary water supply source but further investigation is required to determine feasibility.

Water Supply Options	Advantages	Disadvantages	Conclusion
Direct Lachlan River offtake	River in reasonable proximity to the site.	Suggestions that the supply may be seasonally constrained. Entitlement would need to be acquired. Diversion infrastructure required. Marginal water quality as a potable water supply without further treatment (though fine for further treatment to process water)	Not initially attractive relative to other options and would only be considered further if primary options prove unviable.
Groundwater extraction	Groundwater is available in the area. Although, relatively, local aquifers are not high yielding it is reasonably possible that the sufficient groundwater supply could be acquired from a number of bores on or nearby the site.	Entitlement would need to be acquired within the existing cap. Further investigations, including drilling, would be required to locate extraction bores, with no guarantee of success. Groundwater TDS may be higher than other potential supplies.	Potential option as a primary water supply source but further investigation is required to determine feasibility.
Tankered water (from sources identified above or another source beyond the immediate region)	Water can be sourced and is a guaranteed supply	Base domestic and utility water demands readily met by tankering. Relatively large overall water demand, including process water, to supply by tankering . Therefore large number of trips per year and potentially relatively expensive.	This is currently the only guaranteed water supply, and although other options would be considered and may be implemented, provision would be made for receiving tankered water.
Roof runoff harvesting	Reasonably good quality water.	Yield small relative to over water demand	This would be implemented as part of the design to provide supplementary water.
Stormwater runoff harvesting	Available onsite.	Could impact on downstream waterways, which has not been assessed. Objective to retain post development hydrology as close as possible to pre-development.	Not currently proposed.

For the purposes of this Environmental Assessment, it is currently proposed that the site water supply be through offsite tankering to meet the essential base domestic and utility water demands, and some or all of the process water demands (depending upon the development option adopted).

During the further design and development of the power station, further investigations will be conducted on the aforementioned supplementary water supplies, with on-site groundwater extraction and/or Upper Lachlan Shire Council water supplies the current preferred options, to meet the full nominated site water supply requirements. The final arrangements would be subject to further feasibility assessment. Further consideration, if necessary, may be given in the detailed design stage regarding piping from these sources, however, this Environmental Assessment does not address the broader environmental impacts associated with construction and operation of a water supply pipeline from these sources.

Demand

Assuming assume no significant implementation of the potential minimisation and recycling measures other than the recycling of brine concentrator distillate in the high fogging options, the overall water supply requirement then, depending upon the water source or combination of sources may be of the order of up to:

- **2 to 3 ML / annum** minimum water demand
- **10 to 20 ML / annum** overall for Stage 1 and **20 to 40 ML / annum** overall for Stage 2 for the F-Class case (evap cooling only)
- **50 to 70 ML / annum** overall for Stage 1 and **100 to 140 ML / annum** overall for Stage 2 for the E-Class case (evap cooling and high fogging).

Further discussion on water demand is presented in **Chapter 14**.

4.4.3 Wastewater Management

Wastewater from the Facility would be generated by the following operations:

- wastewater from evaporative cooler operation (referred to as blow down water);
- wastewater from water pre-treatment operation including:
  - pre-filtration backwash wastewater;
  - desalination system concentrate (high TDS reject steam); and
  - ion-exchange plant regeneration wastewater (and activated carbon pre-filter backwash, or EDI concentrate.
- wastewater from maintenance activities;
- dome stic wastewater;
- spills; and
- stormwater collected in bunded areas.

Brine Concentrator

In the water supply and demand scenario for a high fogging option, the potential wastewater volume would be such that evaporation ponds alone as the primary wastewater concentration method would become less attractive. In this context, based on preliminary assumptions of treatment technologies and wastewater volumes, a brine concentrator may be required to concentrate the wastewater and recover water for recycle. The concentrated brine would either be directly tankered offsite or discharged to an evaporation pond.

Process Wastewaters

The estimated wastewater generation quantities are:

- Stage 1: ranging from approximately **0.2 ML/annum** for a potable water supply case with a brine concentrator (fogging) compared to **5.4 ML/ annum** for a high TDS groundwater supply case for evaporative cooling; and
- Stage 2: ranging from approximately **0.4 ML/ annum** to **10.7 ML/ annum** respectively.

Process wastewaters, which are characterised by high TDS would be discharged directly to an evaporation pond for volume reduction and periodic offsite tanker disposal, or via a brine concentrator. In the case of the brine concentrator, the estimate volume is relatively small (~770 kL/a) and may be directly tankered off site for disposal at an appropriately licensed facility. Nevertheless, it has been assumed that it will be discharged to an evaporation pond for planning purposes.

Indicative sizing of the evaporation ponds for Stage 1 and Stage 2 is presented in **Table 4-5**.

Table 4-5 Evaporation Pond Indicative Sizing

Evaporation Pond	Evaporative surface area (m^2) (approx.)	Depth (m) (approx.) (excluding freeboard capacity)	Capacity (ML) (excluding freeboard capacity)
Stage 1	36,000	1.00	36
Stage 2	36,000	1.00	36

The pond sizing is very indicative and would be finalised when Project design is verified. The evaporation ponds are able to be accommodated within the Project footprint as shown in **Figure 14-3**.

A pond liner would be required to avoid contamination of surface water, soil and groundwater. A composite pond liner is proposed. The liner may consist of a High Density Polyethylene (HDPE) geomembrane placed over 1 m of compacted clay, to achieve a minimum combined permeability of $1x10^{-9}$. This is a preferred choice over a solitary clay liner, to minimise the potential for cracking of the clay liner and to define the boundary between sediment and liner, thus assisting cleaning of sediments. The final liner design would be considered in further design stages, understanding however that it would meet the regulatory permeability requirements.

Domestic Wastewater

A small amount of domestic wastewater would be generated by staff using the site. This is estimated to be less than 200 kL/annum. Wastewater generated may contain pathogens, oils and greases and small amounts of other chemicals such as detergents and soaps. Wastewater would be treated on-site to meet on-site disposal standards. The on-site disposal would utilise proprietary treatment system (examples of such systems include Advanced Wastewater Treatment System (AWTS) or Ecomax system) to ensure that there is zero discharge from the site. Appropriate investigations, if required, would be undertaken on the selection of the system to ensure that the manufacturer's installation requirements are met and that there is no discharge to the environment.

Alternatively a storage and pump system could be used to dispose of wastewater off-site at an appropriately licensed facility, or wastewater would be stored in a sewer tank and pumped out periodically.

Wastewater from Maintenance

It is expected that 1 to 2 ML/annum of wastewater could be generated from cleaning and maintenance at the plant. Liquid wastes generated through the washdown of the turbine blades is expected to contain only contaminates from the inlet air and the cleaning agents used. This waste water would be collected in washing bays in a bunded area and then disposed of off-site by a licensed contractor. Such a system would be used during construction works.

Fire Water

In the event of a fire, wastewater from fire fighting would be collected in the bunded facility area. The water may be of poor quality and would be assessed after any event and disposed of off site at licensed facilities if necessary. The facility bund would be sized in accordance with relevant guidelines.

Spills

It is possible that accidental spills would produce liquid wastes. This is most likely to occur in the bunded areas and the compound area. A spill management plan would be developed and implemented to minimise the likelihood of spills occurring and to minimise their impact. Spills within bunded areas would be contained within the bunds. Spills within the compound area would be contained within the compound area. Bunds would prevent potentially contaminated water from entering the stormwater system. Impacted bund water would be collected by an eductor truck for offsite disposal to an appropriately licensed facility.

Bund Water

Areas where there is a higher likelihood of spills or leaks occurring would be bunded. These areas include unroofed areas of plant.

As far as possible, rainwater would be prevented from collecting in bunds by ensuring that bunds are no larger than they need to be and by roofing bunded areas where practicable. It is, however, still possible that storm water would fall into bunds and become contaminated. Bunds would be sized to contain not only potential spills but also the maximum of potential firewater and/or rainfall (as per relevant government guidelines). Bunds would be designed so that they do not automatically empty into the compound's stormwater system. Any water contained within the bund would be assessed to determine if it was suitable for discharge into the stormwater system or requires off-site disposal.

Roofed areas of plant and the workshop would also be bunded to ensure that any spills or fire water would not escape into the compound area. Stormwater should not enter these areas. Any liquid contained in these bunds is likely to be contaminated and would be disposed of off-site.

4.4.4 Stormwater Management

The following stormwater management measures are proposed for the Project:

- Swale/Ta ble drains:
  - Divert catchment runoff around the site areas and into the sediment pond.
  - Divert and treat runoff from the power station hardstands into the sediment pond.
  - Treat runoff from the access road via swales.
- Sedimentatio n Pond:
  - Treat runoff from the disturbed site areas.

Sedimentation Pond

Sediment basins are used to retain coarse sediments from runoff and are important for protecting downstream elements from becoming overloaded or smothered with sediments. They operate by reducing flow velocities and encouraging sediments to settle out of the incoming water stormwater.

Initial assessment estimates the sediment pond volume as 800 kL, 20 m long x 20 m wide x 2 m deep. The permanent pool volume in the sediment pond is 200 kL, which would capture and store settled-out sediments. These sediments would be periodically removed during pond maintenance (normally once per 10 years). The average detention time for the pond would be 48 hours to achieve 85 % removal of suspended solids, some nutrients and metals. The proposed location of the pond is shown in **Figure 14-3**. This pond would discharge to the creek located to the south of the Site.

Bunded Transmission Pad

To contain any potential leaks or spillages the bunded area is proposed in accordance with *AS 1940-2004 The storage and handling of flammable and combustible liquids*. The transmission pad would retain 100 % of the oil volume on site, in the incident of a spill, and to have additional capacity to contain incident rainfall for a 100 year ARI event. Bund drainage (manual) would be confirmed clean and pass through an oil/sediment trap prior to discharge to the stormwater system.

Swales Drains

Vegetated swales are also proposed to convey stormwater in lieu of pipes and provide a desirable buffer between receiving waters (e.g. creek or wetland) and impervious areas of a catchment. They use overland flows and mild slopes to slowly convey water downstream. The interaction with vegetation promotes an even distribution and slowing of flows thus encouraging coarse sediments to be retained.

4.5 Facility Management

4.5.1 Chemicals and Oil Management

Only minor quantities of chemicals and / or dangerous goods would be stored at the Facility. A representative list of the type and quantities of chemicals to be used and stored at the proposed power plant is presented in **Table 4-6**.

Table 4-6 Chemical List

Product Name	Use	Quantity and Area Storage Location	Area of Facility where used
Diesel	Backup generator	Up to 10,000 L in fixed tank	Backup generator
Turbine Oils	Lubrication of turbines and pumps	1,000 L– bulk oil storage	Turbine building
Acetone	Cleaning Solvent	100 L– workshop, storage	Throughout the facility
Insulating Oil	Transformers	1,000 L	Bulk Oil Storage
Miscellaneous oils and lubricants	Lubrication of caustic and acid pumps, fire water pumps, transformer pumps	1,000 L – bulk oil storage	Fire water pump station and switchyard
Wash Water Liquid	Gas wash water additive	1,000 L– bulk chemical storage	Workshop / stores
Carbon dioxide and/or other proprietary fire protection gases such as Inergen and/or FM200	Fire protection and fuel line purging	As required	Throughout the facility
Scale inhibitor	Closed loop cooling system	100 L	Closed loop cooling system
Nitrogen	Gas line purging, in cylinders	As required, in cylinders	Chemicals for maintenance / repair work and clean-up

Note: Brand names are for example only

Chemicals would be stored on-site in designated chemicals storage facilities that would be constructed in compliance with relevant Australian Standards, including but not limited to:

- *Australian Standard AS 1940 (2004) The Storage and Handling of Flammable and Combustible Liquids;*
- *Australian Standard AS 4452 (1997) The Storage and Handling of Toxic Substances;*
- *Australian Standard AS 3780 (2008) The Storage and Handling of Corrosive Substances;*
- Australian Standard AS 4332 (2004) The Storage and Handling of Gases in Cylinders; and
- *Occupational Health and Safety Act 2000* and *Occupational Health and Safety Regulation 2001*.

Appropriate spill control would be provided around the gas turbine generators. Appropriate controls and alarms would indicate a lubricating oil leak including the low oil pressure alarm, low oil pressure trip and low oil level alarm.

Packaged chemicals would be stored within the storage room in the main on-site control building or workshop. Separate spillage control would be provided for each of these products, for example by the use of pallet bunds.

4.5.2 Waste Management

Solid Waste

The normal operation of the Facility would not be expected to generate significant quantities of solid waste. Most solid waste would be classified as “inert waste” and would be generated from spent filters – air, fuel and oil filters as well as:

- scrap metal – from packaging waste and plastic cabling;
- general maintenance – e.g. wood and cloth, office waste and chemical containers; and
- salts formed as a result of the evaporation process.

Solid waste would be segregated where possible into recyclable and non-recyclable waste products and disposed of appropriately by licensed contractors.

Liquid Waste

Liquid waste generated at the plant would include:

- potentially direct disposal of brine depending on design of Facility;
- waste oil; and
- used cleaning solvents.

All liquid wastes would be contained on-site and where possible separated into recyclable and non-recyclable materials. All waste would be classified and disposed of by a licensed contractor in accordance with the *EPA's Environmental Guidelines: Assessment, Classification & Management of Liquid and Non-Liquid Wastes* (1999).

4.5.3 Power

During construction and site preparation phases it would be necessary to have power to the Development Site. Power would be supplied from the existing distribution system by connecting to the existing 330 kV transmission line, other distribution supply or by use of temporary generators.

Ongoing local power supply is provided by the substation and local distribution connection.

4.5.4 Emergency Systems

A comprehensive fire alarm system would be installed throughout the plant and monitored from the control room. A gas leak detection system would be installed and monitored at the facility control room. A water tank for fire protection would be installed on-site.

Maintenance checks and training would be conducted to ensure operational preparedness of fire fighting equipment and the staff.

An Emergency Response Plan would be prepared for the Facility for the construction and operational phases of the proposed development.

4.6 Infrastructure

The proposed gas pipeline and access road has been split into two clear sections for the purposes of this assessment (**Figure 4-2**):

- Gas Pipeline (northern portion) and access road incorporates the gas pipeline route as well as a new road to allow access from the Facility to Walshs Road.
- Gas Pipeline (southern portion) would utilise Walshs Road and the gas pipeline would be located in the western side of the existing road easement until the connection point to the Moomba to Sydney Gas Pipeline. AGL proposes the construction of a valve station as the connection point from the Moomba to Sydney Gas Pipeline.

4.6.1 Gas Pipeline (northern portion) and access road

An access road would provide access to the Facility from the south from Walshs Road at the point where Walshs Road makes a 90 degree turn west. The northern portion of the gas pipeline would be collocated within this same easement. This infrastructure easement is approximately 1.9 km. The gas pipeline (northern portion) and access road easement presented in **Figure 4-2** is wider than the total area required, however is provided to encompass the worse case potential impact during construction.

The area of impact for the access road would be driven by the cut and fill areas required which would likely range from 10 to 45 m in width for the access road. Vegetation would need to be cleared to construct the access road, and the road easement would remain permanently cleared. The gas pipeline would be located within this footprint. Some vegetation around the gas pipeline may be allowed to regenerate following completion of construction. However, all vegetation clearing figures given in this report that relate to the Gas Pipeline (northern portion) and access road are maximum amounts of clearing required.

The gas pipeline and access road would also need to traverse up to four unnamed waterways or drainage lines with intermittent flow, or that flow only following rain events. To avoid adverse impacts on drainage catchments, local cross drain culverts would be provided at local gullies, depressions and other features. Water crossings would be designed in accordance with Department of Water and Energy's *Guidelines for controlled activities - Watercourse crossings* (February 2008).

The gas pipeline would be an underground line, except at the entry points to the Facility.

The road would be a sealed carriageway 6 m in width, with 1 m shoulder either side, total 8 m in width.

4.6.2 Gas Pipeline (southern portion) and valve station

The southern portion of the gas pipeline extends from the junction of Walshs Road to the Moomba – Sydney pipeline. In this portion the gas pipeline would be located in the western side of the existing road easement of Walshs Road until the connection point is reached at the new valve station. The width of the easement and construction areas would be between 5m and 6 m.

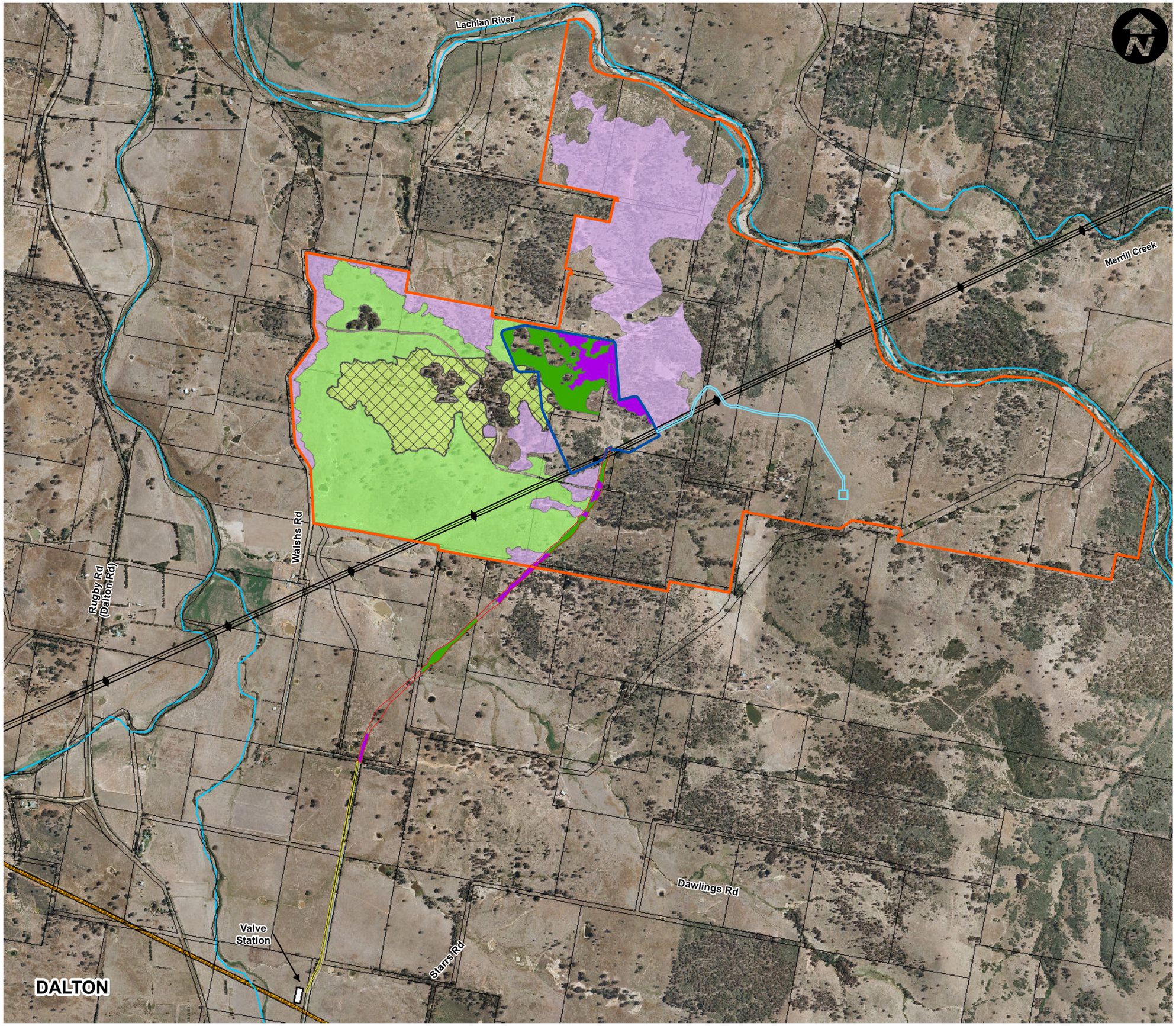
The gas pipeline would be an underground line (except at entry and exit points) extending from the end of the gas pipeline (northern section) and access road to the existing Moomba to Sydney Gas Pipeline at a valve station adjoining the road reserve directly adjacent to Walshs Road.

A new valve station would be constructed as the connection point from the Moomba to Sydney Gas Pipeline. The valve station would be set back 25 m from Walshs Road and would occupy an area of approximately 0.22 ha. The area would be fenced off from public access.

4.6.3 Offset Area

As a key component of the Dalton Power Project is of the proposal for a biodiversity offset area. The proposed offset area for the Dalton Power Project totals 183.26 ha and is sited adjoining the development area, shown in **Figure 4-5**. A decision on the conservation mechanism to be adopted to secure the site in perpetuity would be made in discussion with the OEH and following the determination of the Project.

The proposed offset area recognises the importance of the native biodiversity of the development footprint and encompasses some of the areas of highest relative biodiversity value within the Site. The offset area also includes areas that would otherwise not be conserved either naturally or through existing land management practices.



Legend

- AGL Site Boundary
- Plant Footprint
- Gas Pipeline (northern) and Access Road
- Gas Pipeline (southern)
- Communications Tower and Hut Footprint
- Communications Tower Services and Access Track
- Moomba-Sydney Pipeline
- Transmission Line

EEC's impacted by construction (URS):

- Natural Temperate Grassland^
- Box Gum Woodland*

EEC's for Offset (URS):

- Natural Temperate Grassland^
- Box Gum Woodland*
- Potential Natural Temperate Grassland

* TSC Listed Community
^ EBPC Listed Community

Note: Areas in hectares

0 1
Kilometres

Source: Aerial Image from AGL

Drawn: SB/AO	Approved: JW	Date: 04/03/2011
Job No.: 43177661	File No.: 43177661.068.mxd	

Client

AGL

Project

DALTON POWER PROJECT

Title

PROPOSED OFFSET AREA

Figure:4-5

URS

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The key features of the offset area include:

- 158.29 ha of native vegetation which comprises vegetation of high conservation significance, namely, endangered ecological communities:
  - Natural Temperate Grassland (80.71 ha); and
  - Box Gum Woodland (77.58 ha).
- 24.97 ha of Exotic Pasture that with appropriate management has the potential to become Natural Temperate Grassland.
- Protection of areas of native vegetation that have the potential to support a range of threatened fauna.
- Protection of habitat features such as hollow bearing trees, rocky outcrops and fallen timber that may be used by a range of threatened fauna species.

Table 4-7 summarises the offset area.

Table 4-7 Proposed Offset Area

Vegetation Community	EPBC Act Status	TSC Act Status	Total Area in Proposed Offset
Exotic Pasture (Potential Natural Temperate Grassland)	N/A N/A		**24.97**
Box Gum Woodland	N/A*	Endangered Ecological Community	**77.58**
Natural Temperate Grassland	Endangered Ecological Community	N/A	**80.71**
Total			**183.26**

*Community condition does not meet the condition required to be classified as Box Gum Woodland, under EPBC Act.

Full details of the proposed management regime for the offset area would be included in a management plan that would be prepared in consultation with OEH and SEWPAC.

4.7 Other site areas within the AGL property

The area of the AGL property not covered by the development footprint and offset area (i.e. the eastern portion of the AGL property beyond the communications tower footprint) is not proposed for any further future development by AGL.

This area would be managed in accordance with the management plans identified in **Chapter 13**.

4.8 Operating Hours and Staffing

The Dalton Power Project would be available to operate 24 hours a day, 7 days a week and could be operated remotely by AGL staff with contractors used for maintenance. In practice the Facility would only run during periods of high electrical demand. AGL's experience with its peaking power stations in Victoria and South Australia suggests that the Dalton Power Project is likely to operate between 2 to 15 % of the year.

The actual operating times of the power would be largely dependent on supply and demand conditions in the electricity market. Operation of the Facility is expected to occur mainly during morning and afternoon peak periods in summer and winter when demand rises due to weather conditions. However the Facility is required to be available to operate at any time should it be required to respond to high spot prices in the NEM, system emergency or security situations.

During the operational phase staff levels are expected to average around five personnel and generate around four to five vehicle movements in the peak.

Post construction maintenance of major items would occur once every three years at the most and require up to 100 personnel for a four to eight week period. This activity is likely to generate some cars, trucks and cranes during a weekday.

4.9 Project Construction

The construction and operational timetable for Dalton Power Project would be dependent on growth in electricity demand and economic factors. The Project would be constructed in time to meet projected demand, subject to economic factors such as the price of fuel, equipment, labour costs and the exchange rate. The estimated duration of construction would be around 24 months.

It is anticipated that construction would most likely take place on weekdays from 7.00 am to 6.00 pm during weekdays and 8.00 am to 1.00 pm on Saturdays or in accordance with any Environment Protection Licence conditions. Construction activities would not normally be undertaken on Sundays or public holidays unless inaudible at residential receivers. Where the Project requires construction work outside these hours, the regulatory authorities and affected stakeholders would be consulted and advised accordingly and approval sought where appropriate.

4.9.1 Facility Construction

The following summarises the construction program for the first stage:

- around 24 month duration per stage;
- typical workforce 50 persons;
- peak workforce 250 persons (duration up to two months);

- around 4,600 truck deliveries of construction equipment and materials (e.g. backhoes, cranes, materials, etc). Construction equipment would be sourced locally (where available) and once delivered, would stay on-site for the duration of construction;
- up to four (first stage) over-dimensional and / or over-mass escorted heavy transport convoys of pre-assembled gas turbine, generator and transformer units;
- between 2 and 20 truck deliveries per day of construction materials;
- the majority of the workforce is expected to be sourced from the local region where possible;
- typical peak hourly construction workforce traffic generation of 70 vehicle trips/hour; and
- peak workforce hourly construction workforce traffic generation of 140 vehicle trips/hour.

The construction program for the second stage would comprise Facility construction to achieve the residual generating capacity (an additional two to four turbines) for a completed maximum of six turbines on site. Although it is assumed that construction activities in stage 2 would be generally similar to the first stage, the intensity is likely to be lower as the majority of site preparation works and infrastructure would be established in the first stage.

The Facility construction contractor, prior to commencement on the Development Site, would prepare detailed construction programs and methods. These would be dependent on the detailed design and would need to demonstrate compliance with conditions of consent issued for the Dalton Power Project and other statutory requirements.

Construction activities would include the following:

- site establishment
  - mobilisation - establishing the site with equipment and facilities necessary to execute the construction phase;
  - clearing – managed in accordance with the mitigation measures identified in **Chapter 13**;
  - bulk earthworks – dust suppression and water containment would be employed during the bulk earthworks program to ensure that the effects on surrounding properties are minimised. Where excavation work extends into bedrock, suitable material would be reused as engineering fill on-site. During civil works to prepare the site, safeguards would be developed to protect the Lachlan River.
  - establishing and preparing foundations - foundations for major plant items and buildings would be established. The detailed design and construction of the foundations would take into account potential for geological activity;
- construction of buildings and plant – where possible, to minimise the construction time, prefabricated components would be imported to the site and erected during construction. Mobile cranes would be used to erect and complete the construction of heavy plant items; and
- demobilisation – removing all construction equipment and facilities and rehabilitating the development Footprint where impacted by construction activities.

The site establishment phase would have the following indicative timing post determination:

Month 1

- no physical works to be undertaken on site

Months 2 and 3

- GPS setting out of the Facility footprint- and heritage constraint mapping and staked out
- mobilisation - establishing the site with equipment and facilities necessary to execute the beginning stages of the construction work (huts and mess facilities)
- geotech investigations of plant footprint and road (boreholes)
- formation of laydown areas/ parking areas
- construction of the access road to the facility (4-8 weeks)
- grading works and formation of access track
- truck deliveries of construction equipment and materials (e.g. backhoes, cranes, materials, etc).
- stockpiling of materials

Month 4

- bulk earthworks (benching, cut and fill) (4 weeks)
- on site access road formed

Months 5 – 7

- Bored Piling
- Laying concrete slabs (establishing and preparing foundations)

All plant, equipment, buildings and services would be supplied, erected, operated and maintained in accordance with the relevant Australian Standards and the Building Code of Australia. Where an appropriate Australian Standard may not exist, the most suitable international standard would be used.

Construction Equipment

It is expected that construction would require heavy loads of plant and equipment to be delivered to the Development Footprint. The main components, being the gas turbine, generator and transformers, would be assembled overseas and delivered using special haulage vehicles known as Class 1 Restricted Access Vehicles. These vehicles require special permits and escorts, temporarily disrupting normal traffic flows at defined times approved by relevant authorities. The major plant components requiring special haulage conditions are listed in **Table 4-7**.

Table 4-7 Indicative Gas Turbine equipment transport for Stage 1 and Stage 2

Plant item	Number of items	Approximate weight (tonnes)	Maximum width (metres)	Maximum length (metres)	Maximum height (metres)
Turbine 6		343	5.4	11.2	5.2
Generator 6		230	3.8 10.7		4.2
Transformer	6	127	3.4 7.7 4.2		

The remaining plant and equipment would be erected on the Site. The Facility Footprint is sufficiently large to permit laydown areas and parking within the Site.

Major construction equipment types, estimated numbers and purpose are summarised in **Table 4-8.**

Table 4-8 Indicative Construction Equipment and Purpose

Equipment Type	Activity	Estimated Number
Bulldozers	Clearing of vegetation, removal of topsoil, development of internal roads and drainage swales	1
Scrapers	Removal of topsoil, development of internal roads and drainage swales and basins	2
Graders Site	levelling	2
Excavators Ex	cavation of soil, grading and levelling the site	5
Hydraulic Hammer	Rock excavation	2
Backhoe, Excavators	Trenching	3
Compactor, Rollers	Earth, road base, foundation and pad compaction	5
Cranes	Assembling fabricated building items and positioning plant equipment	2 (25 tonne) 1 (150 tonne) 1 (40 tonne) 5 (20 tonne)
Water Trucks	Moisture and dust control	2
Trucks	Haulage of excavated material, gravel, steel, and reinforcement, etc	5
Concrete Trucks	Delivery and pouring of concrete	8
Fuel and maintenance		2
Over dimensional vehicle	Transformer, gas turbine & generators (possible convoy of one multi-wheel transport unit with up to 3 tow vehicles & under private escort and police control)	6 convoys

4.9.2 Gas Pipeline Construction

The gas pipeline would be an underground line (except at entry and exit points) extending from the existing supply line. The majority of the gas pipeline route would be located beneath existing agricultural land or road reserves.

The pipeline would be approximately 3 km in length (northern and southern portions collectively). The estimated nominal pipeline size is 200 - 400 mm. The pipeline would be made of plastic coated steel.

The gas pipeline (northern portion) and access road would be approximately 1.9 km in length to the point where it enters the Facility footprint. The length of the gas pipeline (southern portion) would be approximately 1.1 km.

The gas pipeline would be constructed in accordance with the requirements of AS 2885 *Pipelines – Gas and Liquid Petroleum* and the APIA *Code of Environmental Practice*.

Construction activities would involve the following key steps:

- clearing of vegetation to prepare a safe construction area and to protect and preserve top soil;
- creating a trench in which to lay the pipeline undertaken by a trenching machine or excavator;
- installing cathodic protection systems;
- installing communications and control systems;
- rehabilitating all disturbed work areas maintaining cleared area;
- testing; and
- installing appropriate signage.

4.9.3 Gas Pipeline Operation

The pipeline and ancillaries operation, monitoring and control would be automated and/or performed remotely. The pipeline would require periodic inspection, maintenance and patrol activities by the pipeline operator. Occasional venting of limited gas volumes would be necessary for maintenance activities.

Statutory Planning – Summary of Key Outcomes

The Dalton Power Project is subject to the development and assessment processes and requirements of Part 3A of the EP&A Act. A Project Application was accepted by the Department of Planning (now Department of Planning and Infrastructure) on 25 March 2010 including a supporting Preliminary Environmental Assessment. On 19 April 2010 the Director-General issued Environmental Assessment Requirements.

The Project also triggers the Commonwealth EPBC Act. The potential impacts to Endangered Ecological Communities were the focus of an EPBC referral submitted for determination by the Commonwealth Minister for Sustainability, Environment, Water, Population and Communities. On 15 June 2010, the Project was determined to be a Controlled Action by the Minister for Sustainability, Environment, Water, Population and Communities. (EPBC 2010/5484). Supplementary Director-General Requirements for the Project were provided on 5 July 2010.

Other licences and approvals required for the Dalton Power Project include:

- Environment Protection Licence under the provisions of the *Protection of the Environment Operations Act 1997*;
- Notification to WorkCover to Keep Dangerous Goods under the *Occupational Health and Safety Regulation 2001* for the storage and handling of notifiable quantities of dangerous goods; and
- Pipeline licence under the *Pipelines Act 1967*.

The Development footprint encompasses and traverses land which is zoned RU2 Rural landscape and RU1 Primary Production under the Upper Lachlan Local Environment Plan 2010. The Dalton Power Project is permissible within these zones with development consent.

Chapter 5 Statutory Planning

5.1 Introduction

A number of statutory planning controls need to be addressed for the purposes of the Dalton Power Project. This chapter reviews Commonwealth, State and local planning legislation and policies that apply to the Dalton Power Project to determine approvals required to allow the proposed development to proceed.

5.2 State Legislation

5.2.1 Environmental Planning and Assessment Act 1979

The *Environmental Planning and Assessment 1979* (EP&A Act) and the *Environmental Planning and Assessment Regulation 2000* (EP&A Regulation), provide the framework for development and environmental assessment in NSW. Part 3A of the EP&A Act provides for a category of development known as Major Projects. *State Environmental Planning Policy 2005 (Major Development)* (SEPP Major Development) identifies categories of development which are considered to be Major Projects to which Part 3A of the EP&A Act applies.

The Dalton Power Project is considered to be a Major Project pursuant to clause 24 of Schedule 1 of the SEPP Major Projects entitled *'Electricity Generation'* as it is development for the purpose of electricity generation with a capital investment value of more than $30 million.

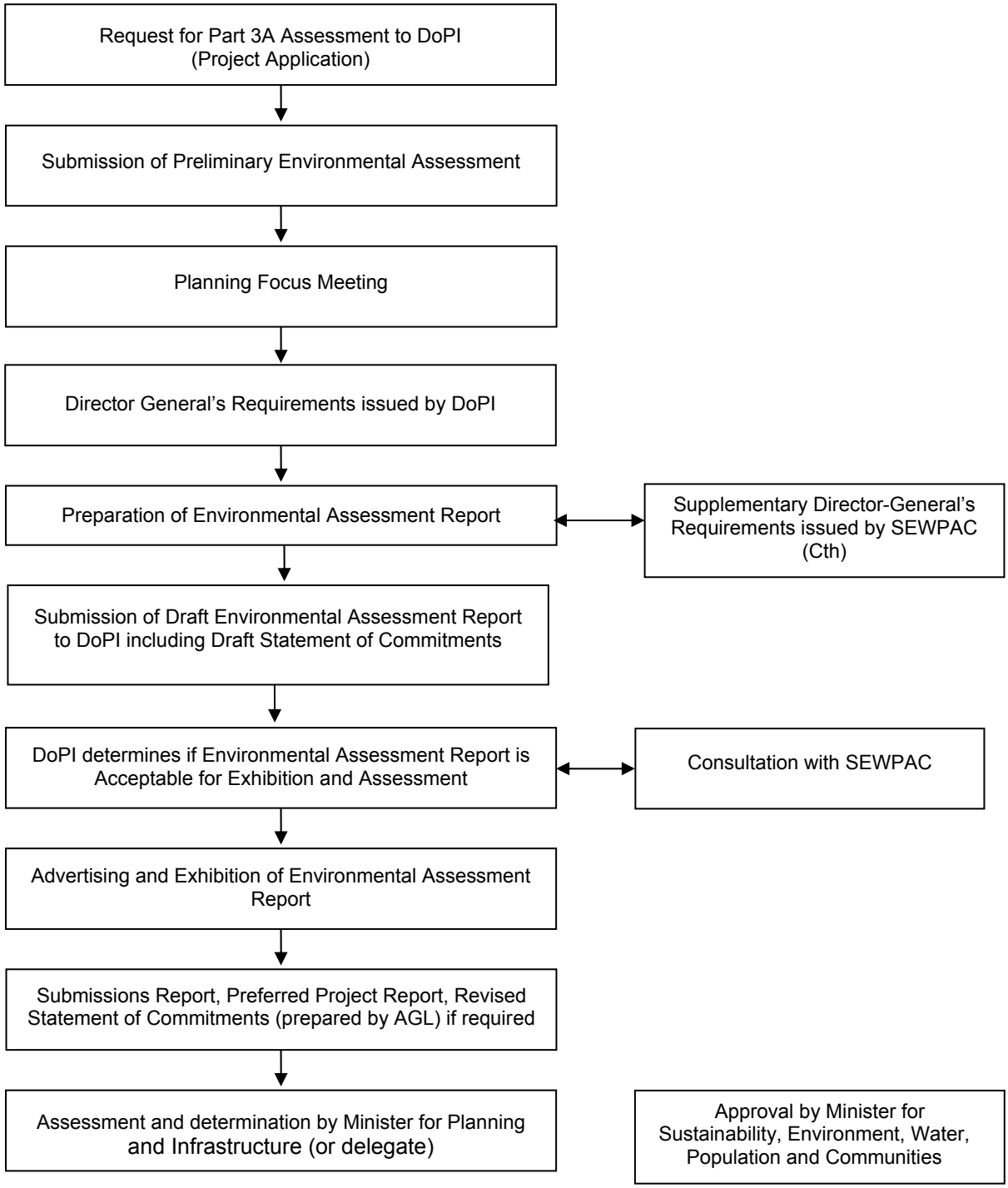
In February 2008, the Minister for Planning also declared development subject to Part 3A and also a power generation project over 250 MW to be a “critical infrastructure project”. The Dalton Power Project is therefore subject to the development and assessment processes and requirements of Part 3A of the EP&A Act. **Figure 5-1** illustrates the development and approvals process under Part 3A for the Dalton Power Project.

A Planning Focus Meeting (PFM) was held at Upper Lachlan Shire Council’s Gunning office on 25 March 2010 and included an inspection of the Development Site. The PFM was attended by representatives of Department of Planning and Infrastructure (DoPI), Office of Water (formerly Department of Environment, Climate Change & Water) and Upper Lachlan Shire Council.

The PFM provided a forum for discussion and consideration of issues to be addressed by AGL when considering planning approvals for the Dalton Power Project. The Project Application was accepted by the DoPI on 25 March 2010 with the supporting updated Preliminary Environmental Assessment (PEA), requesting that the Dalton Power Project be assessed under the provisions of Part 3A.

On 19 April 2010 the Director-General of DoPI issued to AGL Environmental Assessment Requirements pursuant to section 75F(2) of the EP&A Act (**Appendix A**).

Figure 5-1 Approvals Process for Dalton Power Project



Chapter 5 Statutory Planning

The *Environmental Planning and Assessment Amendment (Part 3A Repeal) Act 2011* (Part 3A Repeal Act) was given assent on 27 June 2011. Part 3A Repeal Act will commence on a date yet to be proclaimed.

Clause 2 of Schedule 6A of the Part 3A Repeal Act states that a Part 3A Project for which Environmental Assessment Requirements were notified or adopted before the repeal of Part 3A, is a transitional Part 3A Project. Schedule 6A sets out the transitional arrangements. Section 3 of Schedule 6A provides that Part 3A continues to apply to transitional Part 3A Projects.

As Environmental Assessment Requirements were notified for the Project on 19 April 2010, the Project is a transitional Part 3A Project for the purpose of the Part 3A Repeal Act and Part 3A will continue to apply.

5.3 Protection of the Environment Operations Act 1997

The *Protection of the Environment Operations Act 1997* (POEO Act) relates to the management of pollution and waste disposal in NSW and is administered by the NSW Office of Environment and Heritage (OEH) Under section 48 of the POEO Act, premises-based scheduled activities (as defined in Schedule 1 of the POEO Act) require an Environment Protection Licence (EPL). It is expected that the Dalton Power Project would require licensing under the provisions of Schedule 1 the POEO Act as it is a scheduled activity (No. 17) being “electricity generation” that supplies or is able to supply, more than 30 MW of electrical power. A licence would be required for operation.

5.3.1 Threatened Species Conservation Act 1995

The *Threatened Species Conservation Act 1995* (TSC Act) provides for the conservation of threatened species, populations and ecological communities of animals and plants. It provides a framework for the assessment of any action that may impact on threatened species.

Section 5A of the EP&A Act lists seven factors that must be taken into account in the determination of the significance of potential impacts of a proposed development on threatened species, populations or ecological communities (or their habitats) listed under the TSC Act. The so-called seven part test is used to determine whether a proposed development is likely to impose ‘a significant effect’ on threatened biota and thus whether a Species Impact Statement (SIS) is required to accompany a development application. Under Part 3A of the EP&A Act, however, there is no requirement for Section 5A of the EP&A Act to be addressed; hence there is no requirement for an SIS. Instead, the flora and fauna assessment must be prepared according to the Environmental Assessment Requirements, which refer to the draft *Guidelines for Threatened Species Assessment* (DECC 2005).

Notwithstanding the statutory requirements for Part 3A of the EP&A Act, the approach in this assessment has been to address Section 5A and complete the seven part test as a guide to assessing impacts on threatened biota that could be affected by the Project. This assessment is discussed further in **Chapter 13** *Flora and Fauna* and presented in **Appendix H**. The assessment addresses the principles stated in DECC (2005) guidelines for Part 3A biodiversity assessments. A number of mitigation measures have been incorporated into this Environmental Assessment to minimise the

potential impact of this project on the native biota within the AGL owned land. In addition, a biodiversity offset will be provided by AGL. This offset will ensure that any loss of EEC vegetation and threatened species habitat is appropriately managed and matched with the conservation of land containing similar vegetation and habitat resources that is acceptable to all parties.

Under Section 75U of the EP&A Act, the following Orders and Notices cannot be issued against the project, as it has been declared to be critical infrastructure project:

- an interim protection order (within the meaning of the TSC Act); and
- Division 1 (Stop work orders) of Part 7 of the TSC Act.

5.3.2 Water Management Act 2000

Currently, two different Acts administer access to water resources, the *Water Management Act 2000* and the *Water Act 1912,* and impose different access and licensing requirements.

The *Water Management Act 2000* (WM Act) provides for the protection of river and lakeside land in NSW, formerly held under the *Rivers and Foreshore Improvements Act 1948* for areas covered by a Water Sharing Plan. For water sources in NSW where Water Sharing Plans have not been gazetted and commenced, the *Water Act 1912* still governs the issue of new water licences and the trade of water licences and allocations.

The Lachlan River, to the north of the site, is subject to a Water Sharing Plan. Under the *Water Management Act 2000*, there are three types of approvals that, but for the operation of Section 75U(1) of the EP&A Act, would likely apply to the proposal. Under Section 75U(1) of the EP&A Act, projects approved under Part 3A do not require a water use approval under Section 89, a water management work approval under Section 90 or an activity approval under Section 91 of the *Water Management Act 2000*.

As the proposal does not impact on this river to the north of the site, the licence and approval provisions under the WM Act do not apply,

5.3.3 Water Act 1912

The *Water Management Act 2000* only applies to the extent that a water sharing plan under the *Water Management Act 2000* has commenced in relation to a water source.

Surface water is administered under Part 2 of the *Water Act 1912*. An embargo presently applies to the making of applications for new licences under Part 2. Groundwater is administered under Part 5 of the Water Act 1912. In contrast to the *Water Management Act 2000*, from which Section 75U of the EP&A Act provides exemptions for Part 3A projects, there are no exemptions under the *Water Act 1912* (either under Part 2 or Part 5).

5.3.4 National Parks and Wildlife Act 1974

The NSW *National Parks and Wildlife Act 1974* (NPW Act) is administered by the NSW Office of Environment and Heritage (OEH) and provides the basis for the legal protection of flora and fauna in NSW. Unless a licence is obtained under the NPW Act (or TSC Act) it is an offence to harm any animal that is protected or is a threatened species, population or ecological community. It is also an offence to pick any plant that is protected or is a threatened species, population or ecological community. In addition, a person must not, by act or omission, damage any critical habitat. However, under section 118A(3)(b)(iv) of the NPW Act, these provisions do not apply for a project approved under Part 3A of the EP&A Act. Impacts to endangered ecological communities are described in detail in **Chapter 13** *Flora and Fauna*.

The NPW Act also provides for the conservation of objects, places or features (including biological diversity) of cultural value within the landscape. A person who, without first obtaining the consent of the Director-General, knowingly destroys, defaces or damages, or knowingly causes or permits the destruction or defacement of or damage to, an Aboriginal object or Aboriginal place is guilty of an offence. However, under section 75U(d) of the EP&A Act, an Aboriginal Heritage Impact Permit (AHIP) under section 90 of the National Parks and Wildlife Act 1974 is not required. Impacts to Aboriginal heritage are detailed in **Chapter 15** *Heritage*.

5.3.5 Native Vegetation Act 2003

The NSW *Native Vegetation Act 2003* (NV Act) was established to prevent broad scale clearing, protect native vegetation of high conservation significance, improve the condition of existing native vegetation and encourage the regeneration of native vegetation in NSW. In assessing applications, consent authorities apply the 'maintain improve test', which means assessing how the proposal maintains or improves environmental values such as salinity, water, soils and biodiversity.

The NV Act requires approval from the relevant Council or Catchment Management Authorities (CMA) (in this case, the Lachlan CMA) for the clearing of native vegetation (with the exception of land listed in Schedule 1 of the Act). CMAs administer property vegetation plans under the NV Act.

According to section 75U(e) of the EP&A Act, an authorisation under section 12 of the NV Act to clear native vegetation or State protected land is not required for a project approved under Part 3A. Hence, the NV Act does not apply to this Project.

5.3.6 Heritage Act 1977

The aim of the Heritage Act 1977 is to conserve the environmental heritage of NSW. It details statutory responsibilities for (non-Aboriginal) historic buildings, places and objects and archaeological sites. 'Environmental heritage' refers to items or places of state and/or local significance, e.g., buildings, relics, etc. Under section 57 of the Heritage Act, it is an offence to damage, modify, etc, items without approval of the Heritage Council. However, the proposed works would not impact any items of heritage significance. Therefore the Heritage Act 1977 does not apply to this Project.

5.3.7 Waste Avoidance and Resource Recovery Act 2001

The objectives of the *Waste Avoidance and Resource Recovery Act 2001* are to encourage the most efficient use of resources, to reduce environmental harm, and to provide for the continual reduction in waste generation in line with the principles of ecologically sustainable development (ESD). To meet the objectives of the Act, a resource management hierarchy has been established, comprising:

- avoiding unnecessary resource consumption;
- recovering resources (including reuse, reprocessing, recycling and energy recovery); and
- disposal (as a last resort).

These measures would be incorporated into both the construction and operation of the proposed Dalton Power Project and are discussed further in **Chapter 4** and **14**.

5.3.8 Occupational Health & Safety Regulation 2001

Chapter 6A of the *Occupational Health & Safety Regulation 2001* (OHS Regulation) provides the requirements covering the premises where substances classified as Dangerous Goods are kept. These requirements include placarding of Dangerous Goods depots, annual notification requirements to NSW WorkCover Authority and requirements for a manifest.

AGL would be required to notify WorkCover NSW of Dangerous Goods stored and handled above "manifest quantities" as listed in Schedule 5 of the OHS Regulation.

5.3.9 Soil Conservation Act 1938

The *Soil Conservation Act 1938* (SC Act) administered by the Department of Lands is aimed at encouraging landholders to take soil conservation and erosion prevention measures and, where this fails, for the Department of Lands to order action to be taken. The SC Act is also important for the management of riparian vegetation. These matters are addressed in **Chapter 8** *Soils, Geology and Groundwater*. The construction and operation of the proposed development would be undertaken pursuant to an approved Environmental Management Plan (EMP) which would manage riparian vegetation and the potential for soil erosion.

5.3.10 Contaminated Land Management Act 1997

The *Contaminated Land Management Act 1997*(CLM Act) has been established to control the risk of harm to human health and the environment, and sets out criteria to determine whether these risks exist. It provides the Office of Environment and Heritage with the authority to declare sites for investigation and remediation or voluntary management agreements. The potential for contamination of the site is discussed in **Chapter 8** *Soils, Geology and Groundwater*. The proposed development would operate in accordance with the relevant requirements established in the CLM Act.

5.3.11 Noxious Weeds Act 1993

The *Noxious Weeds Act 1993* (NW Act) defines the roles of government, departments and private landholders in the management of noxious weeds. The NW Act establishes categorisation and controls actions for the various listed noxious weeds according to their potential to cause harm to the local environment. Weeds are categorised in Control Classes 1 through 4 and managed accordingly.

The environmental assessment considers these management measures in **Chapter 13** *Flora and Fauna* and any mitigation measures would be included in the EMP for the construction and operation phases of the development.

5.3.12 Pipelines Act 1967

The *Pipelines Act 1967* sets out the approvals system for the construction and operation of cross-country transmission pipelines in NSW. Under the *Pipelines Act 1967* any person who wishes to construct and operate a pipeline for the purposes of any substance requires an authorisation or licence. A Licence would be required for the gas pipeline.

5.4 Environmental Planning Instruments

Under section 75J(3) of the EP&A Act, approval for a project may (but is not required to) take into account the provisions of any environmental planning instrument for projects subject to Part 3A of the Act.

This section considers the provisions of such environmental planning instruments in relation to the Project.

5.4.1 State Environmental Planning Policies

Below is a discussion of the State Environmental Planning Policies with respect to the Project.

SEPP No. 33 – Hazardous and Offensive Development (SEPP 33)

SEPP 33 applies to development for the purpose of potentially hazardous industries and potentially offensive industries. The proposed gas-fired power station constitutes a potentially hazardous and offensive industry as defined under Clauses 3 and 4 of SEPP 33 on the basis that if no measures were to be employed, the development would pose a significant risk to property and would emit polluting discharges. A Preliminary Hazard Analysis has been prepared which found that with the proposed mitigation measures the risk associated with this development would be very low. This is discussed in **Chapter 18** *Preliminary Hazard Analysis* and presented in **Appendix J**. As such the Dalton Power Project would not be considered potentially hazardous or offensive under the provision of SEPP 33.

SEPP No. 44 – Koala Habitat Protection (SEPP 44)

SEPP 44 applies to the Dalton Power Project because the Development Site is located within the Upper Lachlan Shire Local Government Area (listed in Schedule 1 of SEPP 44 as land to which SEPP 44 applies).

A flora and fauna assessment has been prepared (refer **Chapter 13** *Flora and Fauna* and presented in full in **Appendix H**) for the site, however no evidence of koalas or koala habitat were recorded within the Development Site.

Where potential habitat is identified, the area must be investigated for core koala habitat, defined as an area of land with a resident breeding population of koalas, evidenced by attributes such as breeding females and recent sightings and historical records of a population. Where core koala habitat is found to occur, SEPP 44 requires that a site-specific Koala Plan of Management is prepared. The potential koala habitat is reviewed in **Chapter 13** *Flora and Fauna* and as core koala habitat was not identified within the Development Site, a Koala Management Plan is not required under SEPP 44.

SEPP (Major Development) 2005

According to the SEPP Major Development, development categorised as a 'major project' requires assessment and approval of the Minister for Planning in accordance with Part 3A of the EP&A Act. The SEPP Major Development defines certain types of development as comprising major projects. The Dalton Power Project comprises a major project under the requirements of the SEPP Major Development, namely Schedule 1, Clause 24 *"Development for the purpose of a facility for the generation of electricity or heat or their co-generation (using any energy source, including gas, coal, bio-fuel, distillate and waste and hydro, wave, solar or wind power), being development that (a) has a capital investment value of more than $30 million…".*

Accordingly, the proposed development will be subject to assessment by the Director-General of the DoPI and determination by the Minister for Planning (or delegate) in accordance with Part 3A of the EP&A Act.

It is noted that, in deciding whether or not to approve the carrying out of a project, the legislation states (Section 75J(3)(b) of the EP&A Act) that the Minister may (but is not required to) take into account the provisions of any environmental planning instrument that would not (because of section 75R) apply to the project if approved. The development footprint of the proposed development traverses land zoned as RU2 Rural Landscape and RU1 Primary Production, where the proposed development is permissible with consent under the provisions of the Upper Lachlan LEP. Hence, the proposed development is not prohibited under the LEP.

It is noted that although there have been recent amendments to the SEPP Major Development regarding Part 3A Projects, as Director-General's Requirements had already been issued for the Project prior to 8 April 2011, from the Project remains under the Part 3A regime, and will continue to be assessed under Part 3A of the EP&A Act.

SEPP (Infrastructure) 2007

State Environmental Planning Policy (Infrastructure) 2007 (Infrastructure SEPP) provides a consistent planning regime for infrastructure and the provision of services across NSW, along with providing for consultation with relevant public authorities during the assessment process. The SEPP supports greater flexibility in the location of infrastructure and service facilities along with improved regulatory certainty and efficiency.

Section 34(1) of SEPP Infrastructure provides that development for the purpose of electricity generating works may be carried out by any person with consent on any land in a prescribed rural, industrial or special use zone.

Critical Infrastructure Projects

On 26 February 2008 the Minister for Planning declared certain power generating facilities to be 'critical infrastructure projects' being development that:

- has capacity to generate at least 250 MW; and
- is the subject of an appli cation lodged pursuant to section 75E or section 75M of the EP&A Act prior to 1 January 2013.

The Project has the capacity to generate in excess of 250 MW and as noted above, an application has been lodged for the Project pursuant to section 75M prior to 1 January 2013.

Therefore the Project is considered to fall within the definition of a critical infrastructure project.

5.4.2 Local Environmental Planning Instruments

Upper Lachlan Local Environmental Plan 2010

The Project is subject to the provisions of the Upper Lachlan Local Environmental Plan 2010. The aims of the Upper Lachlan Local Environmental Plan 2010 and the assessment of how the Project demonstrates consistency with these aims is detailed in **Table 5-1** below.

Table 5-1 Assessment of Project against Upper Lachlan Shire LEP 2010 aims

LEP objective	Project Consistency	Location within EA
a) to provide planning controls for Upper Lachlan and to update and consolidate into one instrument the various planning controls that currently apply to Upper Lachlan	N/A N/A	
b) to encourage the sustainable management, development and conservation of natural resources	Natural gas is a clean burning fuel and has comparatively low greenhouse gas emissions. In terms of alternate power generation technologies, open cycle gas turbines present the best balance of outcomes between the imperatives of climate change mitigation and meeting peak electricity demand while managing the price of electricity for end use consumers.	**Chapter 3** Alternatives
c) to promote the use of rural resources for agriculture and primary production including fishing, forestry, mining and related processing, service and value adding industries	The Project benefits broader community services through the supply of electricity to the state of NSW and the National Electricity Market, and is expected to have positive economic and social impacts during both construction and operation phases with potential for a positive effect on the regional economy.	**Chapter 3** Alternatives **Chapter 16** Land Use and Property Impacts **Chapter 17** Socio Economic Assessment
d) to protect and conserve the environmental and cultural heritage of Upper Lachlan	Having regard to the Environmental Assessment findings and the principles of ESD, environmental issues associated with the proposed development of the Project have been fully considered. Potential impacts identified are capable of being mitigated and the proposed development does not represent a threat of serious or irreversible environmental damage.	**Chapters 7 - 18**
e) to encourage new residents to Upper Lachlan by providing a range of housing opportunities in the main towns and villages	The Project is expected to have positive economic and social impacts during both construction and operation phases with potential for a positive effect on the regional economy through contribution to GDP, income and employment, which may indirectly stimulate growth within the LGA	**Chapter 17** Socio Economic Assessment
f) to allow development only if it occurs in a manner that minimises risks due to environmental hazards, and minimises risks to important elements of the physical environment, including water quality	A Preliminary Hazard Analysis was undertaken for the Project as part of the Environmental Assessment. Despite the fact that many of the assumptions in the PHA are highly conservative, the results show that the risk associated with this development is very low. Chapter 14 Water Management includes mitigation measures to reduce the potential impacts of the Project on water quality.	**Chapter 18** Preliminary hazard Analysis **Chapter 14** Water management

LEP objective	Project Consistency	Location within EA
g) to promote and coordinate the orderly and economic use and development of land in Upper Lachlan	The use of natural gas for the Project results in efficient use of resources for electricity generation. The Project benefits broader community services through the supply of electricity to the state of NSW and the National Electricity Market, and is not considered to represent an incompatible land use within the surrounding landscape. The Site has been chosen because of the significant buffer which exists around it, and the Project would also include a significant environmental offset to be managed for conservation purposes.	**Chapter 17** Socio Economic Assessment **Chapter 16** Land Use and Property Impacts
h) to protect and enhance watercourses, riparian habitats, wetlands and water quality within Upper Lachlan's drinking water catchments so as to enable the achievement of the water quality objectives	Having regard to the Environmental Assessment findings, environmental issues associated with the proposed development have been fully considered. Potential impacts identified are capable of being mitigated. Given the significant buffer which exists around the area of the Site as well as the design considerations and mitigation measures proposed for the construction and operation stages, the proposed development does not represent a threat of serious or irreversible environmental damage.	**Chapters 7 - 18**

All land within the AGL Site Boundary is zoned RU2 Rural Landscape, with parts of the proposed Gas Pipeline (northern section) and Access Road, as well as the Gas Pipeline (southern section) zoned RU1 Primary Production. Zoning RU1 Primary Production and RU2 Rural Landscape, provide that "power generation" facilities are permissible with Council consent.

The Dalton Power Project falls within the definition of *"electricity generating works"* contained in the Upper Lachlan LEP. Accordingly, the Dalton Power Project falls within the list of permissible uses of the zoning in the Upper Lachlan LEP. The Project is consistent with the aims and objectives of the LEP.

5.5 Commonwealth Legislation

Environment Protection and Biodiversity Conservation Act 1999

Under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), approval from the Commonwealth Minister for the Environment, Water, Heritage and the Arts is required for an action that is:

- likely to have a significant impact on a "matter of national environmental significance";
- carried out on Commonwealth land and is likely to have a significant impact on the environment;
- carried out outside of the Commonwealth land and is likely to have a significant impact on the environment on Commonwealth land; or

- carried out by the Commonwealth government.

A Flora and Fauna assessment was undertaken as part of the Environmental Assessment for the Project, and is presented in **Appendix H**. The Flora and Fauna assessment found that there are important ecological values on the site. One Endangered Ecological Community (EEC) 'Natural Temperate Grassland of the southern Tablelands of NSW and the ACT' (referred to as Natural Temperate Grasslands) was found to occur within the development footprint. This community is listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act (EPBC) 1999*.

The potential impacts to this EEC were the focus of an EPBC referral submitted for determination by the Commonwealth Minister for Sustainability, Environment, Water, Population and Communities. On 15 June 2010, the Project was determined as a Controlled Action by the Minister for Sustainability, Environment, Water, Population and Communities (EPBC 2010/5484). Supplementary DGRs for the Project were provided on 5 July 2010 (refer to **Appendix A**).

Department of Planning and Infrastructure confirmed (refer to **Appendix A**) that the interim procedures in relation to an accredited assessment process will apply to the assessment of this project under the EPBC Act so that the Department of Planning and Infrastructure can undertake an environmental impact assessment of the project to satisfy the requirements of both NSW and Commonwealth legislation.

Assessment required under the EPBC Act is addressed throughout this Environmental Assessment and specifically within **Chapter 13** *Flora and Fauna* and **Appendix H. Chapter 1** *Introduction* presents a table cross-referencing the supplementary DGRs addressing the EPBC Act noting where each issue is addressed.

Native Title Act 1993

Native title is concerned with the rights and interests of Aboriginal and Torres Strait Islander peoples in relation to land and water in Australia and its territories. The Act is administered by the Commonwealth Department of Sustainability, Environment, Water, Populations and Communities. The *Native Title Act 1993* administers processes relating to the recognition, protection and determination of native title and dealings with native title land.

The Dalton gas pipeline study area is located within a broad area included in an active Native Title Claim by the Gundungurra Tribal Council Aboriginal Corporation *(reference NC97/7).* As noted within the Heritage Assessment (refer to **Chapter 15** and **Appendix I**), the claim does not apply to freehold estate and accordingly does not directly apply to the Dalton Power Project. It is noted that consultation with the Gundungurra Tribal Council Aboriginal Corporation has been progressed during the Environmental Assessment process.

Consultation - Summary of Key Outcomes

AGL has worked in collaboration with relevant government agencies, Upper Lachlan Council, local landowners and the community since late 2008.

In accordance with the Environmental Assessment Requirements, consultation for the Project has targeted the following groups:

- State government agencies;
- Upper Lachlan Shire Council;
- Local Aboriginal Land Council
- Affected land owners; and
- Other community stakeholders.

AGL is committed to maintaining regular contact with the regulatory authorities, neighbouring land owners, the Dalton community and other interested parties during the exhibition and assessment of the Project.

Stakeholder and community engagement has informed AGL's identification of risk throughout project inception and the environmental assessment and approvals stages. Consideration of stakeholder and community feedback has informed the draft statement of commitments that AGL has proposed within this Environmental Assessment in order to manage the impact of works during construction and operation stages, should approval be granted. AGL would maintain ongoing dialogue with affected stakeholders to monitor and manage the social and environmental impacts of the development over time.

Chapter 6 Consultation

6.1 Introduction

AGL has been committed to community and stakeholder engagement throughout the development of the Dalton Power Project and has worked in collaboration with relevant government agencies, and the local community, since late 2008 to identify issues that impact local environmental amenity.

AGL has a commitment to working collaboratively with all interested stakeholders for the Project. With the typical life of a gas power project being at least 25 years, and as a long-tem owner operator, AGL is committed to being a valued member of the local community, as well as developing constructive working relationships and communication channels with the community in line with AGL's Community Charter.

The principles of the AGL Community Charter are:

- to deliver on promises made to the community;
- to endeavour to respond to all queries within 5 working days;
- to work to solve all perceived problems put to AGL where possible, and to investigate and aim to find practicable solutions, and to communicate any outcomes;
- being committed as a valuable member of the community by using AGL's resources to build a stronger local community; and
- to leave a positive legacy in the community that extends beyond the life of the Project.

Additionally, AGL offers face to face briefings with interested stakeholders should they be requested, throughout the life of the Project.

6.1.1 Stakeholder Identification

In line with the Environmental Assessment Requirements (**Appendix A**), consultation for the project has included the following groups:

- Office of Environment and Heritage (formerly DECCW);
- Upper Lachlan Shire Council;
- NSW Department of Industry and Investment;
- TransGrid;
- Air Services Australia;
- Lachlan Catchment Management Authority;
- Local land owners;
- APA Group – the gas pipeline owner.

Additionally, there has been consultation with the Commonwealth Department of Sustainability, Environment, Water, Population and Communities regarding the referral under the EPBC Act, issues arising out of this referral and subsequent assessment requirements for the Project.

6.1.2 Purpose of Consultation

In order to undertake a comprehensive Environmental Assessment of the Project, appropriate emphasis needs to be placed on those issues that are likely to be of greatest significance which may impact the local environment, neighbouring landowners and the wider community. To ensure this has occurred, a program of community and Government consultation, preliminary environmental studies and review of previous technical reports was undertaken to identify relevant environment issues and potential impacts.

6.2 Consultation Activities to Date

Consultation for the Project has been led by AGL, and has consisted of direct consultation with local authorities and government agencies. Consultation with the wider community has taken a variety of forms to date. The consultation strategy is outlined below.

6.2.1 Agency Stakeholder Consultation

Planning Focus Meeting

A Planning Focus Meeting (PFM) was held on the site 25 March 2010, and included stakeholders from DECCW, DoPI, Upper Lachlan Shire Council and AGL. The key issues raised were reflected in the Director General's Requirements (DGR's) issued by the DoPI. These issues have informed the Environmental Assessment and have been addressed throughout the EA as outlined in detail in **Chapter 1**.

Ongoing Government Agency Consultation

AGL has sustained consultation with a number of agency stakeholders throughout the preparation of the environmental assessment. The flora and fauna investigation, in particular, has been guided by agency input, with various meetings and correspondence between AGL, URS, and both the Office of Environment and Heritage (formally (DECCW) and SEWPAC (Commonwealth) between 2010 and 2011.

The Environmental Assessment has also been updated to respond to comments from various government agencies consulted by AGL prior to adequacy review, and by the DoPI during the adequacy review period (April 2011).

Table 6-1 offers a summary of Government Agency Consultation undertaken to date.

Local Government Consultation

Consultation between AGL and the Upper Lachlan Shire Council has included formal involvement in the PFM, as well as a number of face to face meetings. **Table 6-1** below details that the most recent meeting between the Council and AGL was on the 29th April 2011 to discuss water sourcing options for the Project.

AGL also provided the State and Federal Members of Parliament with information and extended the offer of a Project Briefing to them, as outlined in **Table 6-1**.

Chapter 6 Consultation

Table 6-1 Summary of agency and local government consultation

Stakeholder	Form of Consultation	Date	Key issues raised	Where issues are addressed in the EA
State Government				
Department of Environment, Climate Change and Water (DECCW), [now Office of Environment and Heritage]	Various meetings and correspondence. Draft Flora and Fauna Assessment provided to DECCW for comment prior to adequacy review submission.	Between 2010 and 2011	Outcomes of additional survey effort. Comment provided on Flora and Fauna Assessment and comments have been incorporated.	Throughout Chapter 13 and Appendix H
NSW Office of Water	In addition to AGL seeking input directly, DoPI sought feedback from the NSW Office of Water during the adequacy review period.	10 March 2011 April 2011	Issues related predominately to reducing the level of uncertainty around potential water sourcing options discussed within the EA.	AGL have addressed these requirements throughout Chapter 14
NSW Department of Industry and Investment	DoPI sought feedback from Department of Industry and Investment during the adequacy review period.	April 2011	No response received to date	N/A
Air Services Australia	AGL sought feedback on the project and provided the PEA for review	10 March 2011, April , May 2011	Will provide comment following provision of the plume rise study to CASA	Plume rise assessment Chapter 9 and Appendix D
Civil Aviation Safety Authority	AGL sought feedback on the project and provided the PEA for review	10 March 2011	CASA outlined the plume rise study requirement	Plume rise assessment Chapter 9 and Appendix D
Lachlan Catchment Management Authority	AGL sought feedback on the project and provided the PEA for review	10 March 2011	Vegetation Offsets Water sourcing	Chapter 13 Flora and Fauna and Appendix H Chapter 14
Rural Fire Service	AGL sought feedback on the project and provided the PEA for review	10 March 2011	Asset protection zones Location of adequate water supply for bush fire suppression Future management regimes for the AGL site	Fire protection provisions will be incorporated into facility design. Water for bush fire suppression discussed in Chapter 14. Commitment towards further assessment of bushfire hazard (Chapter 19)
TransGrid	Commercial negotiation of Connection and Negotiation Agreement, Connection Application and Offer to Connect	Various Connection Investigations and network studies.	Upgrade plans by TransGrid in the immediate vicinity of the Dalton Power Project	Chapter 3 Alternatives to the Proposal
Department of Defence	AGL sought feedback on the project and provided the PEA for review	10 March 2011	Dept. responded with no comment to provide as no Defence assets are located within the area.	N/A

Stakeholder	Form of Consultation	Date	Key issues raised	Where issues are addressed in the EA
Commonwealth Government				
SEWPaC	Referral under EPBC Act. Various meetings (on site (URS, AGL, SEWPaC, June 2010), face-to-face and teleconference (Feb 2011) to discuss management of EPBC issues for the Project and the Flora and Fauna Assessment. Draft Flora and Fauna Assessment provided to SEWPaC prior to submission for Adequacy Review (Jan 2011). Feedback provided by SEWPaC prior to and during the adequacy review period. Additional face to face meeting (URS,AGL, SEWPaC, June 2011) held to discuss outstanding issues.	Various	Reflected in the Supplementary Director General's Requirements (DGR's). Amendments to Flora and Fauna Assessment following comment in response to adequacy review and face to face meeting have been incorporated.	Throughout the EA (refer to Chapter 1). Chapter 13 and Appendix H.
Local Government				
Upper Lachlan Council	AGL gave a Project briefing to Senior Staff at Council offices on 16 March 2010. Council attended the PFM on 25 March 2010, and a further information and question session with Senior Staff and all Councillors (with the exception of one) was held on 19 May 2010. AGL provided Council with a face to face project update briefing on the 29th April 2011.	Various	No specific issues raised Potential water sourcing options for the project.	N/A Discussions have informed the refinement of discussion around water sourcing options (see Chapter 14)
State and Federal Members of Parliament				
Alby Schulz, Federal Member for the seat of Hume, and Katrina Hodgkinson, State Member for the seat of Burrunjuck.	On 4 May 2010, AGL forwarded an information pack to both the local State and Federal members of parliament, offering a briefing session. Alby Shulz requested a briefing, and this was undertaken by AGL on 3 June 2010.	Various	No specific issues raised	N/A

6.2.2 Community Consultation

Consultation with the wider community has taken a variety of forms to date including direct face to face meetings with landholders during the initial project stage in late 2008, issuing newsletters, and facilitating community comment through establishing a public website (www.agl.com.au/dalton) in March 2010 when the PEA was submitted for the Project. AGL has endeavoured to keep the

community informed at various stages of the project via letters to neighbouring lot holders, the wider Dalton community and to residents within Gunning and Biala. A copy of one such letter is included in **Appendix B**. In addition, the first of a number of planned open day community meetings was held in Dalton on the 16 April 2011 to coincide with the submission of the draft Environmental Assessment to the Department of Planning and Infrastructure (DoPI).

Newsletter

Australia Post mail drops were organised in April 2011 to provide a newsletter to residents in proximity *to* the AGL Site, as well as within the wider areas of Dalton, Gunning and Biala. The newsletter provided an outline of the proposal and an update on progress, as well as extending an invite to the planned Community Open Day. A copy of this newsletter is included within **Appendix B**.

Community Open Day

AGL held a Community Open Day in Dalton on Saturday morning, 16 April 2011. The event was held in the Dalton Church Hall, and was widely advertised through the newsletter distribution, as well as through adverts placed within the Yass Tribune and the Lions Club of Gunning Noticeboard **(Appendix B)**.

The open format of the day provided the community with direct access to AGL representatives who were able to engage on a one-on-one basis with residents to provide project information and address specific concerns. AGL ensured that representatives across the business were available, from personnel involved at the feasibility and design stage of power projects, through to construction manager representatives. Two URS personnel also attended specifically to address technical environmental queries. Materials to assist in information dissemination included the following:

- Copies of the newsletter;
- Poster displays of various project aspects and environmental assessment findings; and
- Acoustic monitoring equipment to demonstrate sound pressure levels and explain how attended monitoring for noise is carried out.

The Open Day was attended by at least 41 people who signed the attendance sheet, with 20 of those people indicating their interest in receiving future communication from AGL about the proposal. It is estimated that between 50 and 60 people dropped in during the course of the morning.

AGL was made aware that some interested residents could not attend the community open day. AGL representatives have endeavoured to accommodate requests for alternative meeting times and have subsequently met with residents within Dalton as well as the Upper Lachlan Shire Council during the period 28 – 29 April 2011.

6.2.3 Feedback tools

Website Enquiries

AGL has maintained a public website (www.agl.com.au/dalton) since March 2010 to facilitate public comment and requests for project information. The general issues of importance to the community as expressed through enquiries received via the website have included;

- Noise concerns;

- Flora and Fauna impacts;
- Air Quality impacts;
- More general requests for information from AGL;
- Visual Impacts;
- Project justification queries (particularly about renewable energy alternatives);
- Enquiries regarding design safety; and
- Property rental and other local business opportunities.

AGL has responded to each website enquiry in a timely matter. Where AGL could provide responses prior to the completion of environmental studies, AGL has done so.

Community Open Day Feedback

The following project issues were raised by community members and discussed with AGL representatives on the 16 April 2011 and on the 28 – 29 April 2011:

- Generation of dust and other construction phase impacts;
- Traffic impacts;
- Potential impacts of noise and vibration;
- Visual impacts;
- Air Quality and emissions and odour impacts;
- Water sourcing and availability;
- Enquiries regarding design safety and hazard;
- Flora and Fauna impacts including impacts to threatened species known to occur within the CMA;
- Land use change and future use of the AGL site;
- Weed management;
- Fire hazard and hazard reduction burning;
- Local employment generation and opportunities;
- Accommodation provision for the workforce; and
- AGL contribution to the community.

Only a small number of feedback forms were filled out by community members during the course of the Community Open Day held on the 16 April 2011. A much greater proportion of the visitors to the hall signed the attendance sheet upon entry to the hall, and about half of these people had already indicated their interest in receiving further project updates from AGL in due course.

AGL representatives particularly encouraged people to utilise the feedback forms if their questions could not be addressed immediately, or if they required AGL to respond to their query prior to the release of the full Environmental Assessment during the Public Exhibition Period.

Chapter 6 Consultation

Table 6-2 below cross references the sections in the Environmental Assessment where these community concerns and interests have been considered and assessed.

Table 6-2 Summary of community concerns raised during consultation

Issue	Comments	Location within EA
Generation of dust and other construction phase impacts	The distance to the nearest residential dwelling is approximately 2 km which is considered to provide a sufficient buffer zone between the main work area to prevent nuisance dust impacts. The minimisation and control of dust emissions during the construction period would be implemented through the Construction Environmental Management Plan (CEMP) to be developed for the Project.	**Chapter 9** Air Quality **Section 9.5.1** Emissions During Construction **Appendix C** Air Quality Impact Assessment **Section 16.5.1** Construction Phase Impacts and Mitigation Measures
Traffic impacts	The traffic and transport assessment found that the arterial road network can satisfactorily and safely accept the additional traffic generated by the development during the construction, operational and maintenance phases. Temporary works may be required along approved routes for these over-mass and over-dimensional loads and would be defined in further consultation with the RTA and relevant Councils.	**Chapter 11** Traffic and Transport **Appendix F** Traffic Impact Assessment
Potential impacts of noise and vibration	On the basis of the noise and vibration assessment carried out for the Project, it is concluded that noise impacts of the proposed construction and operation of the plant and proposed gas pipeline and access road are not expected to degrade the existing acoustic environment nor create annoyance to the residential receptor locations surrounding the Facility.	**Chapter 12** Noise and Vibration **Appendix G** Noise Impact Assessment
Visual impacts	The visual assessment concluded that overall the Dalton Power Project would have a low visual impact on people in areas surrounding the Site.	**Chapter 10** Landscape and Visual **Appendix K** Landscape and Visual
Air Quality and emissions and odour impacts	The results of the dispersion modelling showed that the predicted impacts on ground level concentrations of NO_2, PM_{10}, CO and SO_2, when added to peak background concentrations, were within the OEH regulatory criteria. In addition, the predicted incremental concentrations of formaldehyde were found to be within OEH criteria. Given the undeveloped nature of the site, there is considered to be no significant potential for any dust emissions from construction activities to contain contaminants, or for the works to give rise to odorous emissions	**Chapter 9** Air Quality **Appendix C** Air Quality Impact Assessment **Appendix E** Greenhouse Gas Assessment
Water sourcing and availability	The Facility has a small essential water demand, comprising domestic water, utility water and firewater water. Water for the Project can be sourced through a number of options that are outlined in the assessment.	**Chapter 3** Alternatives to the Proposal **Chapter 14** Water Management

Issue	Comments	Location within EA
Design safety and hazard	The preliminary hazard analysis (PHA) assessment has been carried out for the Project. The main hazard associated with the proposed Project is associated with the handling of natural gas (predominantly composed of methane gas), which is a flammable gas held under pressure.	**Chapter 18** Preliminary hazard Analysis **Appendix J** PHA
Flora and fauna impacts including impacts to threatened species known to occur within the CMA	A Flora and Fauna Assessment of the proposed development footprint has been undertaken. The results of the assessment indicate that there are a number of ecological values associated with the Site. The design of the project was prepared so as to avoid impacts wherever possible. A range of mitigation are proposed to minimise impacts to native species within the locality. Further, a Biodiversity Offset Strategy (developed in consultation with OEH and SEWPaC) is proposed to offset potential impacts. The offset area falls within the AGL Site and is proposed to be set aside for protection of biodiversity values in perpetuity.	**Chapter 13** Flora and Fauna **Appendix H** Flora and Fauna
Land use change and future use of the AGL site	AGL would implement the proposed Biodiversity Offset Strategy (prepared in consultation with OEH and SEWPAC) to compensate for clearing impacts associated with the Project and in line with the requirements of the offsetting policies of those bodies to provide management the offset area for environmental purposes in perpetuity . While a number of potential impacts have been identified as part of this Environmental Assessment, none of them will negatively impact surrounding land uses, nor will they have an effect on those land owners being able to continue using their land for rural purposes.	**Chapter 16** land Use and Property Impacts **Chapter 13** Flora and Fauna **Appendix H** Flora and Fauna
Weed management	A Weed and Pest Management plan would be developed and implemented. AGL have also taken on board community concerns regarding the current condition of the AGL Site and have implemented further weed management strategies involving strategic weed spraying.	**Chapter 13** Flora and Fauna **Appendix H** Flora and Fauna **Chapter 16** Land Use and Property impacts (**Section 16.4**)
Fire hazard and hazard reduction burning	AGL have committed to further assessment of the impact of bushfires on the power station and bushfire ignition threats from the power station during the design stage.	**Chapter 18** Preliminary Hazard Analysis
Local employment generation and opportunities	The Project will require up to approximately 250 construction workers. AGL would endeavour to source as much of this construction labour from the local region, in particular from Goulbourn, the largest major town within close proximity to the Project site. Once operational, the facility would require approximately 5-10 full time employees, and AGL would seek local workers to operate the Dalton facility wherever possible.	**Chapter 17** Socio Economic Impacts

Chapter 6 Consultation

Issue	Comments	Location within EA
Accommodation provision for the workforce	AGL would endeavour to source as much of this construction labour from the local region, in particular from Goulbourn, the largest major town within close proximity to the Project site. AGL is currently investigating existing accommodation options in and around Dalton.	**Chapter 17** Socio Economic Impacts
AGL contribution to the community.	AGL has an active community engagement philosophy that involves support of particular community initiatives. AGL commits to examining potential involvement in community engagement initiatives within the local communities in which it would operate the Dalton Power Project.	**Chapter 17** Socio Economic Impacts

6.3 Aboriginal Consultation

In accordance with the DGRs, specific consultation targeting Aboriginal communities has been undertaken by Navin Officer Heritage Consultants as outlined in the NSW DECCW *Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010*.

An advertisement was placed in the Yass Tribune on 19 May 2010 to identify, notify and register Aboriginal people who hold cultural knowledge relevant to determining the cultural significance of Aboriginal objects and or places in the area of the proposed project.

Three responses were received. Responses were received from:

- Upper Lachlan Council;
- DECCW - advising potential Aboriginal Land Councils that may be interested in the Project;
- Office of the Registrar of the Land Right Act NSW - advising that the Project site does not have any registered Aboriginal land owners.

The Onerwal Land Council is the Local Aboriginal Land Council (OLALC) for the Dalton Project. Representatives of the OLALC were invited to accompany the heritage consultants on their field surveys. Although arrangements were made for attendance of OLALC representatives for the field surveys, they did not attend the survey. The heritage assessments will be forwarded to the OLALC for their consideration and comment. Further detail of Aboriginal consultation is provided in **Appendix I**.

No other registrations of interest were recorded.

6.4 AGL's Consideration of Consultation Inputs

Throughout the environmental assessment stage, stakeholder and community engagement has informed the development of the project, the identification and siting of a preferred option, as well as AGL's identification of risk. It has subsequently been a driving factor in the environmental studies commissioned, and the preparation of the Environmental Assessment. Consideration of stakeholder and community feedback has informed the draft statement of commitments that AGL has proposed to manage project impacts during the construction and operation stages, should approval be granted.

6.5 Commitment to Ongoing Consultation

AGL is committed to maintaining regular contact with the regulatory authorities, neighbouring land owners, the Dalton community and other interested parties during the assessment of the Dalton Power Project.

In accordance with the provisions of the EP&A Act, the Environmental Assessment will be on exhibition for a minimum period of 30 days. This period enables stakeholders to comment on the proposal through the exhibition phase of the Project. All submissions received will be considered as part of the assessment process.

AGL will foster full community engagement in the exhibition process – including support for the community to make submissions – by organising additional consultative measures such as additional meetings on request, and correspondence / literature distribution to the local area as required.

Following exhibition of the Environmental Assessment, copies of all submissions, or a report of all issues raised will be provided to AGL and relevant Government authorities. AGL will review the submissions and respond to issues raised.

The Director General of DoPI will prepare an assessment report on the Project, which will take into account the comments from relevant Government authorities as well as other interested stakeholders. The assessment report will be provided to the Minister for Planning and Infrastructure who will determine whether to grant approval for the Project and any conditions under which the Facility will operate in accordance with the EP&A Act.

While this initial phase of consultation completes the planned consultation activities for inclusion in the Environmental Assessment, AGL would continue to respond to concerns raised by the community. AGL would maintain ongoing dialogue with affected stakeholders to effectively monitor and manage the social and environmental impacts of the development over time. This may include initiatives such as:

- Notifying adjoining landowners and the Dalton community of when construction is likely to be initiated;
- Reporting progress via the local community newspaper, and
- Maintaining project information on the AGL's dedicated project website.

7.1 Introduction

The likelihood of an environmental impact occurring can be described in terms of its probability. Overlaying this probability is the need to recognise that a degree of uncertainty may be associated with possible environmental impacts, particularly during the initial risk assessment process. Where there is scientific uncertainty, a cautious approach will identify a higher level of risk providing a conservative assessment.

Each identifiable impact can be assigned an occurrence rating, between being 'rare' through to 'almost certain'. In simplifying the possible impacts for the purpose of an environmental risk assessment, an element of subjectivity must also be introduced.

An environmental risk assessment of the Project was undertaken to inform the Environmental Assessment process. This chapter outlines the key findings from this assessment as they relate to environmental risk, and details the wider methodology utilised to carry out the environmental risk assessment for the proposed Project as presented in this Environmental Assessment.

7.2 Methodology

The issues raised by stakeholders and local residents informed AGL's consideration of risk and the technical investigations carried out as part of the assessment process. A number of additional sources were used by the AGL Project team to ascertain the level of environmental risk associated with the Project, including the planning and legislative requirements affecting the site, the environmental context of the Project area and the region, and the findings of the specialist environmental studies undertaken for the preparation of this Environmental Assessment. Additionally, the assessment was based on existing hazard management plans and other operational documents that are used by AGL in the day to day management of similar facilities.

A Preliminary Hazard Analysis (refer to **Chapter 17**) was also undertaken as part of the Environmental Assessment for the proposal.

7.2.1 Issues raised by Stakeholders

Issues that were raised by key agency stakeholders were considered to be crucial in assisting to define the level of environmental risk associated with the Project. The issues raised by key agency stakeholders are reflected in the Director-General's Requirements (**Chapter 1** *Introduction*). The issues include:

- air quality related issues;
- greenhouse gas impacts;
- traffic and transport related impacts;
- surface and groundwater impacts;
- visual impacts;
- noise related impacts;

Chapter 7 Environmental Risk

- ecol ogical impacts;
- impacts associated with hazards arising from the operation and expansion of the facility, such as fire, hazardous materials, etc; and
- impacts on neighbouring agricultural land uses.

Issues of concern to the wider community as communicated to AGL through the website, face to face meetings and the first of a number of planned Community Open Day events included the following (refer **Chapter 6** *Consultation*):

- Noise and vibration concerns;
- Air Quality and emissions and odour impacts;
- Flora and Fauna impacts;
- Visual Impacts;
- Traf fic impacts;
- Water sourcing and availability;
- W eed management;
- Generation of dust and other construction phase impacts;
- More general requests for information from AGL;
- Project justification queries (particularly about renewable energy alternatives);
- Enquiries regarding design safety;
- Land use change and future use of the AGL site;
- Fire hazard and hazard reduction burning;
- Property rental and other local business opportunities.
- Local employment generation and opportunities;
- Accommodation provision for the workforce; and
- AGL contribution to the community.

7.3 Summary of Potential Environmental Risks

The identification and prioritisation of environmental issues associated with the Project has been based on the consideration of:

- the planning and legislative requirements affecting the site;
- the environmental context of the Project area and the region;
- the outcomes of the community and stakeholder consultation undertaken thus far;

- a review of previous investigations of the Project site; and
- the findings of the specialist environmental studies undertaken for the preparation of this Environmental Assessment.

Based on these considerations, a summary of the environmental risk analysis for the Project has been prepared and is presented in **Table 7-1** below. Further to this, **Table 6-2** within **Chapter 6 *Consultation*** outlines the issues identified to date during community consultation, and where and how these concerns have been considered within the Environmental Assessment.

Table 7-1 Summary of Environmental Risk

Issue	Environmental Risk	Likelihood of Occurrence	Where issue is addressed in EA
Agriculture related impacts	Risk of impacts on existing and neighbouring agricultural land uses resulting from the Project.	Low. AGL has purchased the Project site, with less than 5 % (approximately) of the total Site required for the Project. Agricultural land uses (such as grazing) can continue on most areas of the Site, and the Project would not hinder the ongoing agricultural land uses of neighbouring properties.	Refer **Chapter 16**
Surface Water	Contamination of surface water.	Possible without control measures, but unlikely due to proposed mitigation measures.	Refer **Chapter 14**
Groundwater	Contamination of ground water.	Unlikely without control measures, less so due to proposed mitigation measures.	Refer **Chapter 8**
Noise and Vibration	Increased noise impacts above the OEH guidelines. Impacts on local residents.	Unlikely due to the large buffer distance between both the Project site and sensitive receivers.	Refer **Chapter 12** and **Appendix G**
Air quality	Emission of air pollutants and odour above the OEH guidelines.	Unlikely based on air assessments undertaken.	Refer **Chapter 9** and **Appendix C**
Greenhouse gas emissions and energy use	Excessive energy consumption and related GHG emissions compared to similar facilities.	Unlikely, due to standardised plant design. Further total emissions are low when compared to coal fired power stations of similar generating capacity. Furthermore, as a peaking power station, the site will only be used for a relatively low proportion of the year.	Refer **Chapter 9** and **Appendix E**
Traffic and transport	Significant impacts on local Dalton community, impacting levels of service and traffic flow.	Low, due to the relatively low level of truck movements, and the fact that most traffic impacts will be short term in nature, and overall levels of service will not be adversely impacted. Most traffic movements will avoid the Dalton township.	Refer **Chapter 11 and Appendix F**
Visual	Significant visual impacts resulting from the Project on sensitive receptors.	Low. Site section study that was carried out selected location of least visual impact. Few sensitive receivers given relatively isolated location. Significant buffer between Project site and visual receptors.	Refer **Chapter 10** and **Appendix K**

Chapter 7 Environmental Risk

Issue	Environmental Risk	Likelihood of Occurrence	Where issue is addressed in EA
Flora and Fauna	Negative impact on biodiversity.	Possible, although Project site and infrastructure routes have been selected to reduce impacts on biodiversity. Ecological assessment has been undertaken identifying impacts on flora and fauna. Project includes avoidance, mitigation measures, and a proposed offset area within the Site. Consequently, it is considered that the overall biodiversity of the local area will be 'maintained or improved'.	Refer **Chapter 13** and **Appendix H**
Water management	Definition of water source. Impacts on receiving waters.	Possible as a range of water sources have been identified. Further studies to be undertaken relating to groundwater use and potential for supply by water pipeline. Management measures to be implemented to minimise potential impact on receiving waters.	Refer **Chapter 14**
Socio economic	Negative impact on existing social conditions and on economic vitality of the Dalton area.	Rare as the Project will generate additional employment demand, while amenity impacts are low.	Refer **Chapter 17**
Hazard and risk	Increased risk to surrounding land uses from leak of natural gas.	Rare. Preliminary Hazard Analysis indicates that risk to surrounding land use is low as there are no significant land uses or population within close proximity to areas that may be impacted by explosion or fire and the underlying risk of an event is low.	**Chapter 18** and **Appendix J**
Bushfire risk	Increased bushfire risk to surrounding land uses from the Project.	Possible, although Preliminary Hazard Analysis has considered that further assessment is not required to address fire as there are adequate design controls. Notwithstanding this, AGL have committed to further assessment of the impact of bushfires on the power station and bushfire ignition threats from the power station.	Refer to **Chapter 18**.
Cumulative impacts	Possible cumulative impacts include noise, air quality and odour, surface water, groundwater, and traffic.	Possible without adequate control measures and management techniques.	Each respective Environmental Assessment chapter considers various impacts arising from the Project.

7.4 Conclusion

This chapter has outlined the most significant potential environmental risks associated with the Project. The potential risks were assessed for likelihood of occurrence and reference included for where further assessment is presented for each issue within this Environmental Assessment.

The hazard and risk assessment carried out and summarised in **Chapter 18** concluded that the Project would not introduce any significant risks on surrounding land uses.

Soils, Geology and Groundwater – Summary of Key Outcomes

The Site lies within the Lachlan Fold Belt geological unit and the Lachlan Fold Belt Groundwater Management Unit. Previous studies have indicated that the water table would be at some depth and below the proposed depth of excavation.

At present the Site is unmined. Historically, the area around Gunning has been mined for gold, however the last recorded mining activity was in 1956. Therefore it is considered unlikely that mine subsidence would affect the site. However, Commissioners Gold hold an exploration permit over the area. No issues were raised by Commissioners Gold during consultation with them.

The mitigation measures and safeguards would ensure that soils and groundwater are satisfactorily managed using suitable design, construction and management. With these measures, any impacts on soils and groundwater resulting from the construction and operation of the Project are likely to be negligible.

Chapter 8 Soils, Geology and Groundwater

8.1 Existing Environment

8.1.1 Topography

The northern and eastern boundaries of the Site are formed by the Lachlan River with the most western and eastern sections having areas of land that slope gently towards the River. Some sections of the Site, adjacent to the River, are relatively steep. The south-western corner of the property is characterised by a large hill which is clearly visible from the surrounding areas.

8.1.2 Regional Geology

The geology of the Dalton area is illustrated on the Gunning 1:100,000 Geology Map. The 1:100,000 Gunning Geology Map shows the Site lies within the Lachlan Fold Belt and is underlain by a series of metamorphosed Ordovician Age sediments and Silurian Age intrusives. The major rock unit in the area is the Adaminaby Group, which in this area comprises mostly phyllite and metamorphosed quartz arenite with some chert. These beds are folded and generally steeply dipping. This rock type mostly forms rounded hills with varying degrees of outcrop and soil depth.

To the south of the Site, the Adaminaby Group is intruded by the Silurian Age Wyangala Batholith, which comprises a typical granitic material, known locally as the Oolong Granite. The granite area is characterised by steep sided hills with numerous rounded boulder (Tors) outcrops.

The Tertiary age Wheeo Basalt forms a capping on the ridge tops to the east of the project area, but is also indicated to be present on only one hill top on the south-western side of the Development Footprint. The Wheeo Basalt comprises black alkali basalt to basanite flows, containing porphyritic olivine and titanium augite, with flow banding, vesicles and doleritic textures. The basalt is more resistant than the phyllites but like the phyllite can be closely jointed.

The weathering process has resulted in the formation of broad flat alluvial soil deposits in the valleys of the creek that forms the southern boundary of the Site and in the valley of the Lachlan River along the northern side of the Site.

8.1.3 Geological Structure

The Ordovician sequence has been extensively faulted and folded, with several major north–south trending thrust faults recognised to the east of the project area. A major north-south trending fault zone is also located to the west of the Site but there are no known regional faults shown on the mapping within the area under consideration.

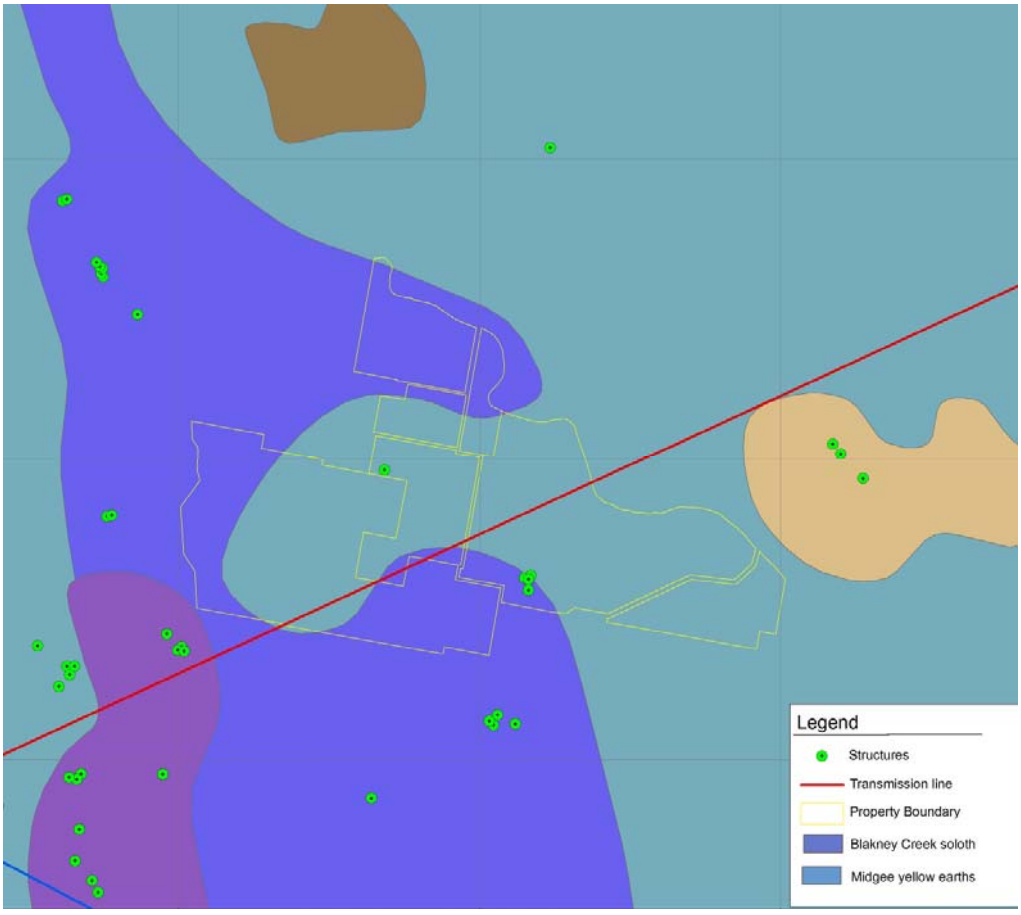
8.1.4 Soils

The Soil Conservation Service of New South Wales 1:250,000 Goulburn Soil Landscape Map indicates the two predominant soil types in the project area are Blakney Creek soloth and Midgee yellow earths (Aurecon, 2009), illustrated in **Figure 8-1**.

The Blakney Creek unit is located on the footslopes and valley floors and comprises undifferentiated Ordivician and early Silurian metasediments. It is an acid to neutral yellow duplex soil with minor stony yellow earths and red podzolic soils. Erosion hazard for this soil type is high (topsoil) and low to high (sub-soil). This unit dominates the footprint of the gas pipeline (northern portion) and access road and a small portion of the southern area of the Plant footprint.

The Midgee unit occurs on the rolling hills at higher elevations and comprises Ordivician and some Devonian and Silurian metasediments. It is commonly acid stony yellow earths and yellow podzolic soils in association with lithosols and red earths. Erosion hazard for this soil type is high to very high. This unit dominates the Plant footprint.

Figure 8-1 Soil landscapes of the Project area



Source: Siting Study Report, Aurecon (2009)

While detailed mapping of soils has not been undertaken, there is some evident variation in soil depth and characteristics across the site. Variations relate to the underlying geology, slope, position on the slope and ground water level and variations in ground water levels. It is considered that soils should be regarded as erodible and managed to limit erosion and off site sedimentation (Aurecon, 2009).

8.1.5 Groundwater

In December 2008, two orders were made which embargo new applications for groundwater licences for all groundwater not covered by water sharing plans in the inland part of NSW. The order was made under Section 113(a) of *The Water Act 1912* and applies to all land within the Upper Lachlan Alluvium, in which the Project site is located.

Extractions (5000 ML/year) are currently operating well below the sustainable yield of 1,057 599 ML/year (Aurecon, 2009). However as studies between 2004 and 2008 have shown a consistent seasonally adjust drop in water level, a continuing trend since 1991, entitlements for groundwater use must be obtained.

AGL is currently investigating options for obtaining the relevant permits and licensing arrangements for the transfer of existing groundwater entitlements for the Project. AGL has located numerous water licences for sale and therefore has a high level of certainty that sufficient water licensing requirements could be met for the project.

Water source options are discussed further in **Chapter 14**.

8.1.6 Geotechnical aspects

Based a field inspection of the site, it was considered that there appear to be no geotechnical aspects that would preclude the use of the site for a gas turbine power station (Aurecon, 2009). The site preparation would involve a typical cut/fill operation with cuts of the order of 10 m required to establish a level bench for the power station. In steeper areas, the site could be established on split benches to reduce the volume of strong rock to be excavated in the site preparation.

A geotechnical investigation would be required to establish whether the rock can be excavated by mechanical means or whether blasting would be required. The weathered rock and fill material should accommodate the likely loads imposed by the foundations. If alluvial material occurs at the preferred site, a geotechnical investigation would be required to establish its suitability as a foundation material.

A data review was undertaken on the earthquake potential of the area (Aurecon, 2009). On average one earthquake a month was reported heard or felt in the Dalton area during the period June 1993 – December 1995. These events had magnitudes as low as ML 0.6. In the Dalton-Gunning zone, the average time interval between large, potentially damaging magnitude ML 6.0 earthquakes is of the order of 120 years (Aurecon, 2009). The review concluded that the potential for heightened earthquake activity at the Site could be accommodated in the design of the foundations for the proposed plant (Aurecon, 2009).

Apart from the earthquake hazard, the assessment concluded that are no other known geological hazards in the area. In particular:

- there is no evidence on any large scale landslides; and
- there are no known major active volcanic or surface tectonic structures in the project area.

8.2 Assessment of Potential Impacts

8.2.1 Construction Phase Impacts

Excavation

A nominal platform level of RL 575m has been adopted at the location of the exhaust stacks in order to minimise the top level of the stacks and resulting visual impact. A geotechnical investigation would be undertaken to establish whether the rock can be excavated by mechanical means or whether blasting would be required. The weathered rock and fill material should accommodate the likely loads imposed by the foundations. If alluvial material occurs at the preferred site, a geotechnical investigation would be required to establish its suitability as a foundation material.

Erosion of Disturbed Areas

During the construction period, a small proportion of the total Site would be disturbed in order to construct the compound, access roads, gas and water pipelines, and electricity supply. Rainfall on these disturbed sites may cause soil erosion and runoff may contain high levels of sediments which could then enter the natural drainage system. It is considered that soils should be regarded as erodible and therefore managed to limit erosion and off site sedimentation.

Groundwater

It is considered that the water table under the area would be at some depth and below the proposed depth of excavation. This would be confirmed during detailed design through a groundwater assessment.

Soil Contamination

Given the undeveloped nature of the Site, it is unlikely that soil has been significantly impacted by site based activities. As a result, it is unlikely that any soil contamination is present on the Site.

8.2.2 Operational Phase Impacts

There is potential for contamination at the site during operation from spills of fuel, oil or chemicals. Surface water from the site that may be potentially contaminated by spills or leaks include:

- rainfall runoff from operational areas of the site; and
- accumulated water within bunds.

In addition, where flows are concentrated, soil erosion may occur. The impact of surface water flows is addressed in **Chapter 14** *Water Management*.

8.3 Mitigation Measures

8.3.1 Design

Further assessment of the geotechnical and groundwater conditions would be undertaken during detailed design.

8.3.2 Construction

A Construction Soil and Water Management Plan would be developed and implemented as part of the CEMP for the construction works to ensure effective management of potential soil erosion issues. Construction would be planned to minimise the time that disturbed land is exposed. Disturbed areas would be quickly revegetated or covered with a non-erodable surface following construction. During the construction period water may be required for dust suppression.

8.3.3 Operation

Management of surface water flows from the plant footprint are described in detail in **Chapter 14**. The outlet of the compound's stormwater system would be designed to maximize the dispersion of these high flows and thereby minimize their potential to cause soil erosion downstream.

Appropriately bunded areas would be included for storage of fuels, oils and chemicals.

Areas within the plant area would be appropriately drained so that surface runoff would be prevented from infiltrating directly onto the ground and from reaching the groundwater.

8.3.4 Summary

The mitigation measures and safeguards would ensure that soils and groundwater are satisfactorily managed using suitable design, construction and management. Accordingly any impacts on soils resulting from the construction and operation of the Project are likely to be negligible.

Table 8-1 presents the mitigation measures to address the soil and geological issues for the Dalton Power Project.

Table 8-1 Summary of Mitigation Measures

Mitigation Measures	Implementation of mitigation measures		
	Design	Construction	Operation
Further geotechnical and groundwater assessments would undertaken to inform the detailed design.	✓		
A Construction Soil and Water Management Plan would be developed and implemented for the construction works to ensure effective management of potential soil erosion issues.		✓	
At a minimum the measures outlined in the *Managing Urban Stormwater – Vol 1 Soils and Construction* would be implemented. Measures may include: • limiting slope length, • installation of sediment filters and the construction of a sedimentation basin downstream of the plant area.		✓	
Construction would be planned to minimise the time that disturbed land is exposed.		✓	
Disturbed areas would be quickly revegetated or covered with a non-erodable surface following construction.		✓	
During the construction period water may be required for dust suppression.		✓	
Discharge from the sedimentation pond would be through an appropriately designed dissipating structure to minimise soil erosion potential.			✓
Appropriately bunded areas would be included for storage of fuels, oils and chemicals.		✓	✓
Areas within the operational plant area would be appropriately drained so that surface runoff would be prevented from infilitrating directly onto the ground and from reaching the groundwater.			✓

Air Quality and Greenhouse Gas Emissions – Summary of Key Outcomes

Impacts During Construction

The distance to the nearest residential dwelling is more than 2 km which is considered to provide a sufficient buffer zone between the main work area to prevent nuisance dust impacts. The minimisation and control of dust emissions during the construction period would be implemented using procedures contained in the Construction Environmental Management Plan (CEMP) for the Project.

Impacts During Operation - Air Quality Assessment

The potential air quality impact of the Dalton Power Project has been assessed using the Calpuff dispersion modelling package. The pollutants assessed included nitrogen dioxide (NO_2), carbon monoxide (CO), sulphur dioxide (SO_2), particulate matter (PM_{10}) and formaldehyde. The dispersion modelling has used a largely conservative approach, in accordance with the DECCW (2005) *Approved Methods and Guidance for the Modelling and Assessment of Air Pollutants in NSW*. In order to assess the cumulative impact of the plant emissions on the local air quality, background concentrations of the criteria pollutants were obtained from the relevant OEH and TMS monitoring stations.

Given the quantity, velocity and temperature of the exhaust gases emitted from the exhaust stacks, open cycle gas turbine plumes can travel at high velocities through the atmosphere. The assessment found that the plant has potential issues for aviation safety, where the high velocity of the exhaust gases can potentially affect the handling characteristics of aircraft, with the risk of airframe damage in extreme cases.

The results of the dispersion modelling showed that the predicted impacts on ground level concentrations of NO_2, PM_{10}, CO and SO_2, when added to peak background concentrations, were within the OEH regulatory criteria. In addition, the predicted incremental concentrations of formaldehyde were found to be within OEH criteria. This analysis has also assumed that all oxides of nitrogen (NO_x) exist as nitrogen dioxide.

Impacts During Operation - Greenhouse Gas Assessment

A greenhouse gas assessment has been performed for the Facility, and has included scope 1, scope 2 and scope 3 emissions associated with natural gas combustion in the open cycle gas turbine generators, and the consumption of electricity from the electricity grid. The principal greenhouse gas emission from the Facility is carbon dioxide (CO_2), which is a product of natural gas combustion. Minor quantities of other greenhouse gases may be emitted and have been represented in this assessment, as carbon dioxide equivalent (CO_2-e). The assessment has considered four potential plant configurations, each with an average of operational time of 15 % of the year.

Chapter 9 Air Quality and Greenhouse Gas Emissions

Total annual emissions were estimated to be in the range of 0.66 to 1.47 Million tonnes of carbon dioxide equivalent (Mt CO_2-e). The associated emissions intensity of generation was calculated to be approximately 800 kilograms of carbon dioxide equivalent per megawatt hour of electricity generated (kg CO_2-e/MWh).

Based on a project life of 30 years, the total lifetime emissions were estimated to be between 20.1 and 44.0 Mt CO_2-e.

A comparison of emissions from the Facility to state and national greenhouse gas inventories was also made. Emissions from the project were estimated to be in the range of 0.41-0.90% and 0.11-0.25% of the state and national inventories, respectively. In addition, emissions from the project were estimated to be in the range of 0.85-1.85% and 0.23-0.49% of stationary energy emissions from the state and national inventories, respectively.

Impacts during Operation - Plume Rise Assessment

A plume rise assessment was performed which showed that the peaking power plant would produce exhaust plumes with vertical velocities that exceed 4.3m/s above the Obstacle Limitation Surface. Due to the plume rise from the stack emissions, an aviation hazard analysis based on the predicted impacts of the proposed facility has been performed. The aviation hazard analysis was compiled in accordance with the Civil Aviation Safety Authority's (CASA) Advisory Circular *"Guidelines for Conducting Plume Rise Assessments"* (June, 2004). A search of CASA registered aerodromes and unregistered landing strips indicated that there are no known landing strips within a 15 km radius of the Project site.

Whilst this assessment is considered conservative with respect to the modelled operating times and operating conditions, the Civil Aviation Safety Authority (CASA) may choose to designate this to be a potential hazard to aircraft operators in the area.

Further consultation with CASA would be undertaken to ensure the Project is appropriately recognised as a potential aviation hazard.

Air Quality and Greenhouse Gas Emissions | Chapter 9

9.1 Introduction

In order to assess the likely impact of the operation of the proposed Dalton Power Project on local and regional air quality, the study included:

1. An assessment of local air quality.
2. Dispersion modelling of pollutants such as nitrogen dioxide (NO_2), carbon monoxide (CO), sulphur dioxide (SO_2), particulate matter (PM_{10}) and formaldehyde.
3. An assessment of plume rise.

The impact on ambient air quality with respect to regulatory emission limits and ground level concentration criteria of the primarily gaseous emissions has been assessed by URS. The local air quality assessment involved dispersion modelling and has been conducted in accordance with OEH's *Approved Methods and Guidance for the Modelling and Assessment of Air Pollutants in NSW* (DEC, 2005) (referred to herein as the *Approved Methods)*. The assessment of the impact on local air quality used a largely conservative approach, in accordance with the *Approved Methods*. This chapter provides summary of this assessment and the full assessment is presented in **Appendix C**.

An aviation safety assessment has also been conducted for the Project to determine compliance with the Civil Aviation Safety Authority's (CASA) Advisory Circular *"Guidelines for Conducting Plume Rise Assessments"* (June, 2004). This assessment is summarised in this chapter and presented in full in **Appendix D**.

The impact from construction on air quality has been qualitatively assessed.

9.2 Existing Environment

9.2.1 Climate and Meteorology

A summary of climatological data collected at Yass by the Bureau of Meteorology (BoM) is provided in **Appendix C**. The weather station at Yass is considered to be representative of the region, including the proposed development site. The Yass Meteorological Station is located approximately 25 km to the south-west of the site. These data indicate that the region experiences hot summers and cold winters. The mean daily maximum temperature is approximately 29^0C during summer and 12^0C during winter. Sub-zero temperatures have been recorded between April and November and are regularly recorded during winter with temperatures lower than -8^0C having been measured. The area receives moderate rainfall having a mean annual rainfall of 648.5 mm over an average of 93.5 rain days per year.

The meteorological data used in the assessment was generated using CSIRO's The Air Pollution Model (TAPM) and further discussed in **Appendix C.** The TAPM derived meteorological data indicates that the region experiences moderate to high wind speeds, primarily from the north to north west, with an average wind speed of 4.38 m/s, and 1.4 % calms (wind speeds less than 0.5 m/s) recorded for the year 2006.

9.2.2 Background Air Quality

No site-specific background monitoring data was available for this assessment. Therefore, background concentrations of NO_2, CO, SO_2 and PM_{10} have been adopted from areas which have a greater pollution potential as a function of population, industrial emissions, meteorology and topography. Whilst this is unsuitable for predicting the actual scale of cumulative air quality impacts of the proposed Project, it is conservative, and appropriate for the purposes of this assessment in demonstrating compliance with regulatory criteria. The background data for this assessment were sourced from two government monitoring stations which undertake monitoring as part of the National Environment Protection Measure for Ambient Air Quality (AAQ NEPM); Monash (ACT) and Chullora (NSW).

The ACT Government Territory & Municipal Services Performance Monitoring Station (PMS), located at Monash in the Australian Capital Territory, is approximately 82 km south of the proposed site. The population in the area of the PMS is 324,000 and the station is located at a site that is considered "generally representative of the upper bound" of pollutant concentrations for the region. The monitoring data collected here is considered to provide a conservative representation of the background concentrations required for this assessment due to the size of the surrounding population and the siting of the PMS within valley topography where wood fired heaters are commonly used.

Background levels of CO and SO_2 are not measured at Monash. The background data for these pollutants were taken from the OEH monitoring station at Chullora, located in Sydney's south west. It should be noted that the Chullora monitoring station is located in within Sydney's south west and is surrounded by industry, residential areas and heavily trafficked roads, consequently the background SO_2 and CO concentrations used in this assessment are considered conservative as the proposed development site is situated away from such sources. Whilst the incorporation of these data is unsuitable for predicting the actual scale of cumulative air quality impacts of the proposed Facility, it is conservative, and appropriate for the purposes of this assessment in demonstrating compliance with regulatory criteria.

The concentrations listed in **Table 9-1** have been incorporated into this assessment for the purpose of estimating cumulative concentrations.

Table 9-1 Summary of Background Pollutant Concentrations

Substance	Averaging Period	Monitoring Source	Background Concentration (µg/m^3)	OEH Criteria (µg/m^3)
NO_2	1 hour	Monash, ACT	90[A] 246	
	Annual Monas	h, ACT	37[A] 62	
CO	15 minutes	Chullora, NSW	6270[B] 100,0	00
	1 hour	Chullora, NSW	4752	30,000
	8 hours	Chullora, NSW	2876	10,000
SO_2	10 minutes	Chullora, NSW	61[B] 712	
	1 hour	Chullora, NSW	43	570
	24 hours	Chullora, NSW	11	228
	Annual Chul	lora, NSW	3	60
PM_{10}	24 hour	Monash, ACT	45.3	50
	Annual Monas	h, ACT	16.9	30
Formaldehyde 1	hour	NA[C] NA	[C] 20	

Notes:
A: Values reported in TMS (2007) as ppm have been converted assuming 273K and 1 atm.
B: Sub hourly concentration estimated from peak hourly concentration based on power law discussed in **Appendix C**.
C: Not Applicable: The *Approved Methods* stipulate that only the incremental impact be evaluated.

- Monash data sourced from: TMS(2007), The Australian Capital Territory 2006 Ambient Air Quality Report against the Ambient Air Quality National Environment Protection Measure
- Chullora data sourced from: DECCW (2007), National Environmental Protection (Ambient Air Quality) Measure Compliance *Report New South Wales.*

9.3 Impacts During Construction

The Stage 1 construction phase is anticipated to take around 24 months and will involve the construction of concrete footings for the generator units, the formation of unsealed site roads, installation of turbine units, construction of a switchyard and transmission connection, installation of the gas pipeline and gas receiving station, fencing, commissioning and other minor works.

The construction program for the second stage would comprise construction activities to achieve the residual generating capacity for a completed maximum of six turbines on site. Although it is assumed that the construction would be generally similar to the first stage, the intensity is likely to be lower as the majority of site preparation works and infrastructure would be established in the first stage.

During both the Stage 1 and Stage 2 construction phases, there is the potential for dust to be generated due to the excavation and handling of soils, site grading activities and vehicles movements. Given the undeveloped nature of the site, there is considered to be no significant potential for any dust emissions from construction activities to contain contaminants, or for the works to give rise to odorous emissions, consequently emissions during construction have not been quantified.

The distance to the nearest residential dwelling is more than 2 km which is considered to provide a sufficient buffer zone between the main work area to prevent nuisance dust impacts. The minimisation and control of dust emissions during the construction period will be implemented using procedures contained in the Construction Environmental Management Plan (CEMP) for the Project.

9.4 Impacts During Operation

9.4.1 Air Quality Modelling

Methodology

The potential air quality impact of the Dalton Power Project has been assessed using the Calpuff dispersion modelling package. The pollutants assessed included nitrogen dioxide (NO_2), carbon monoxide (CO), sulphur dioxide (SO_2), particulate matter (PM_{10}) and formaldehyde. The assessment of the impact on local air quality used a largely conservative approach, in accordance with the *Approved Methods*. Modelling was performed of a 40 x 40 km modelling domain. From previous modelling assessments of open cycle gas turbine facilities, peak impacts have occurred at a distance of up to 10 km from the emission source. The modelling domain has been selected to include the region where the peak impact might be predicted to occur.

This assessment has considered a total of eight scenarios. These are:

- Stage 1, E Class Plant, Startup;
- Stage 1, E Class Plant, Operation;
- Stage 1, F Class Plant, Startup;
- Stage 1, F Class Plant, Operation;
- Stage 2, E Class Plant, Startup;
- Stage 2, E Class Plant, Operation;
- Stage 2, F Class Plant, Startup; and
- Stage 2, F Class Plant, Operation.

For modelling purposes it has been assumed that all turbines would operate continuously for all hours of the year, under all meteorological conditions. Given the use of a Lagrangian puff model, where emissions from sequential hours are tracked and have the potential to co-contribute to ground level concentrations within a single hour, the assumption of continuous operation is considered conservative, particularly for startup scenarios where, in reality, the Facility would not startup in sequential hours.

The emission parameters for the Dalton Power Project are contained in **Table 9-2**, while the assumptions used for the detailed air modelling are detailed in **Appendix C**.

Table 9-2 Gas turbine emission parameters

Parameter	E Class		F Class	
	Startup	Operation	Startup	Operation
Stack Height (m)	35	35	46	46
Stack Diameter (m)	6.0	6.0	6.7	6.7
Exit Temperature (ºC)	365	532	435	610
Exit Velocity (m/s)	20	40	13	45
Duration (min)	15	-	20*	-
Emission Rates (g/s)	**Startup**	**Operation**	**Startup**	**Operation**
NO_x 48.1		19.3	26.3	30.6
CO 730.7		4.6	179.6	9.1
SO_2 1.3		1.3	2.0	2.0
PM_{10} 3.0		3.0	3.8	3.8
Formaldehyde 1.79		0.15	2.88	0.24

Note: The stack parameters for the F Class startup are the average over a 16 minute startup, however emission rates have been weighted with an additional 4 minutes of operating emissions, such that the net emissions flux is representative of that which would occur over the 20 minutes after ignition.

Results

Table 9-3 provides the results of the dispersion modelling. All predictions were below regulatory criteria. Although one result is shown to be approaching criteria, Stage 2 F Class operation scenario NO_2 prediction, this result has been calculated in a conservative manner.

Contour isopleths for nitrogen dioxide across the modelling domain have been provided in **Appendix C**. Isopleths for other compounds have not been presented due to the low levels predicted.

Table 9-3 Summary of maximum dispersion modelling results with comparison against regulatory criteria (Il results in µg/m^3)

Substance	Averaging Period	Stage 1				Stage 2				Background	Maximum Cumulative*	OEH Criteria
		E Class		F Class		E Class		F Class				
		Startup	Operation	Startup	Operation	Startup	Operation	Startup	Operation			
NO_2	1 hour	71.8	87.3 46.5 64.6			96.9 92.0 100.8			150.7	90	240.7	246
	Annual	0.3	0.1 0.2 0.1			0.4 0.2 0.3 0.2 37					37.4	62
CO	15 minute	1439	27 282		25	1717	29 798		59 6270		7987	100,000
	1 hour	1091	21 214		19	1301	22 605		45 4750		6051	30,000
	8 hour	320	5 29		3	420	7 64		8 2880		3300	10,000
SO_2	10 Minute	6.3	8.4 4.4 6.0			6.8 8.9 9.9 14.1				61	75.1	712
	1 hour	4.4	5.9 3.1 4.2			4.8 6.2 6.9 9.8 43					52.8	570
	24 hour	0.4	0.5 0.4 0.2			0.6 0.7 0.7 0.6 11					11.7	228
	Annual	0.01	0.01 0.01 0.01			0.02 0.01 0.02 0.01 3					3.0	60
PM_{10}	24 hour	1.0	1.2 0.8 0.5			1.3 1.6 1.4 1.1 45.3					46.9	50
	Annual	0.03	0.02 0.03 0.01			0.04 0.03 0.05 0.02 16.9					16.9	30
Formaldehyde	1 hour	0.9	0.2 1.5 0.		1	1.3 0.20		3.2 0.1 NA			3.2	20

*Cumulative results presented for all compounds except formaldehyde, which has been assessed on an incremental basis in accordance with the *Approved Methods.*

Comparison Against Emission Limits

The turbines proposed for the Facility would comply with the relevant emission limits specified in the *Protection of the Environment Operations (Clean Air) Regulation 2002*. The proposed use of DLN emission controls guarantees that the turbine emissions would be less than 25 ppmvd (parts per million volumetric dry) at the 15 % oxygen reference condition. **Table 9-4** presents the proposed in-stack emission limit for oxides of nitrogen.

Table 9-4 Proposed in-stack emission limit for oxides of nitrogen

Air Impurity	In-Stack Concentration (mg/m^3 dry, 273K,15%O_2)	Regulatory Limit (Group 6) (mg/m^3 dry, 273K,15%O_2)
Nitrogen dioxide (NO_2) or nitric oxide (NO) or both as NO_2 equivalent	51 70	

Discussion of Results

The predicted impact of nitrogen dioxide, carbon monoxide, sulphur dioxide, particulate matter and formaldehyde emissions from the Facility were shown to be below OEH criteria. Consequently, on the basis of these predictions, no adverse impacts on local air quality are expected as a result of the intermittent discharge of these pollutants from the proposed Facility.

The intent of the assessment was to investigate the compliance of the proposal with air quality criteria. As required by the *Approved Methods,* the assessment has included, in some instances, an overestimation of actual impacts. This is appropriate for the purpose of investigating compliance with regulatory criteria.

Nitrogen Dioxide

As there is uncertainty as to how NO_x from the Facility would be manifested, the modelling conservatively considered all NO_x as NO_2. The peak prediction for NO_x, when added to the peak NO_2 background concentrations, was found to be below regulatory criteria. Of the eight scenarios, the Stage 2, F Class Operation scenario was shown to be approaching criteria. The peak impact area was predicted to occur at a point some 10 km south south-west of the Facility, as shown in the Figures section of **Appendix C.** This result has been calculated in accordance with the *Approved Methods* using conservative assumptions.

Carbon Monoxide, Sulphur Dioxide, Particulate Matter (PM_{10}) and Formaldehyde

The predicted impact of carbon monoxide, sulphur dioxide, particulate matter (PM_{10}) and formaldehyde from the Facility were shown to be below criteria. Consequently, no adverse impacts on local air quality are expected as a result of the intermittent discharge of these pollutants from the proposed peaking power plant.

9.4.2 Greenhouses Gas Assessment

A greenhouse gas assessment for the Project was also undertaken, the results of which are attached as **Appendix E**. The assessment discusses the current regulatory context of greenhouse gas emissions from the Project and includes a quantitative model of the tonnages of greenhouse gas produced by the Facility. This is compared to state and national greenhouse gas inventories for both the energy sector, and the sum of all sectors. The results of that assessment are discussed below.

Greenhouse Gas Assessment Methodology

The greenhouse gas inventory for the Facility has been based on the accounting and reporting principles detailed within the Greenhouse Gas Protocol (the Protocol) (WBCSD/WRI, 2004). The greenhouse gas emission inventory for the Project is based on the methodology detailed in the Protocol, and the relevant emission factors in the *National Greenhouse Accounts (NGA) Factors* (the NGA factors) (DCC, 2009a), and the relevant *Intergovernmental Panel on Climate Change (IPCC) Good Practice Guidance* (IPCC, 2000).

A spreadsheet model has been specifically developed for the Project and uses the data sources and emission factors detailed below in order to calculate project emissions for every year of operation according to the Protocol. This model uses the methodology detailed in the NGA Factors.

The main greenhouse gases emitted during operation of the Dalton Power Project activities will be carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O). To report these emissions, they are converted to carbon dioxide equivalents (CO_2-e) as specified under the Kyoto Protocol.

The Protocol further defines direct and indirect emissions through the concept of emission “scopes”.

- **Scope 1: Direct greenhouse gas emissions**

Direct greenhouse gas emissions occur from sources that are owned or controlled by a company. For example:

– Emissions from combustion in owned or controlled boilers, furnaces, vehicles, etc.;

– Fugitive emissions of greenhouse gases; and

– Emissions from on-site power generators.

- **Scope 2: Electricity indirect greenhouse gas emissions**

This accounts for greenhouse gas emissions from the generation of purchased electricity consumed by the company. Purchased electricity is defined as electricity that is purchased or otherwise brought into the organisational boundary of the company. Scope 2 emissions physically occur at the facility where electricity is generated but they are allocated to the organisation that owns or controls the facility or equipment where the electricity is consumed. Scope 2 emissions also capture the importing of energy (such as chilled water or steam) into a site.

- **Scope 3: Other indirect greenhouse gas emissions**

This is an optional reporting class that accounts for all other indirect greenhouse gas emissions resulting from a company's activities, but occurring from sources not owned or controlled by the company. Examples include extraction and production of purchased materials; extraction and distribution of purchased fuels; and use of sold products and services.

Greenhouse Gas Inventory

The quantitative component of this assessment encompasses the operational stage of the Facility. The operational boundary has been defined as the boundary of the power station site. Power generated has been quantified as gross power sent out, whilst electricity required to power auxiliary plant equipment has been quantified as electricity imported from the grid. The estimated fuel consumption and power generated per year (electricity sent out) are presented in **Table 9-5**.

Table 9-5 Estimated Gas Consumption and Electricity Sent Out and Consumed

Project Stage	Amount Gas Combusted (PJ/yr)	Electricity Sent Out (GWh/yr Gross)	Electricity Consumed (GWh/yr)
Stage 1, E Class	9.8	838	12
Stage 1, F Class	10.7	927	14
Stage 2, E Class	14.7	1257	18
Stage 2, F Class	21.4	1854	27

Table 9-6 presents estimated greenhouse gas emissions from the Facility on an annual basis. These estimates have included Scope 1, Scope 2, and Scope 3 emissions. These account for emissions from combustion, (indirect) emissions associated with the extraction, production and transport of the natural gas to the site, as well as emissions associated with electricity imported from the grid for use in the production of electricity

Table 9-6 Estimated Greenhouse Gas Emissions on an Annual Basis

		Emissions (Mt CO_2-e)				Full Fuel Cycle Emissions Intensity
Scenario	Activity	Scope 1	Scope 2	Scope 3	Total	kg CO_2-e/MWh
Stage 1, E Class	9.8 PJ Consumed 838 GWh Generated	0.50	0.01	0.16	0.67	801
Stage 1, F Class	10.7 PJ Consumed 927 GWh Generated	0.55	0.01	0.17	0.73	791
Stage 2, E Class	14.7 PJ Consumed 1257 GWh Generated	0.76	0.02	0.23	1.01	801
Stage 2, F Class	21.4 PJ Consumed 1854 GWh Generated	1.10	0.02	0.34	1.47	791

Chapter 9 Air Quality and Greenhouse Gas Emissions

Based on the fuel consumption and power sent out, for the four plant configurations, with operating duty of 15%, the plant was estimated to emit between 0.66 and 1.44 Mt CO_2-e at an emissions intensity of approximately 800 kg CO_2-e/MWh.

Table 9-7 shows greenhouse gas emissions for the proposed plant on a project lifetime of 30 years. assuming 15% operation per year. AGL's current peaking experience indicates that on a long term average, the plant would be in operation for approximately 3% of the year. Consequently, the use of the upper limit of proposed operation is considered highly conservative. Long term market trends define the operating duty, and ultimately the commercial life, of the Facility. Consequently, large uncertainties are associated with potential emissions over the project lifetime.

Table 9-7 Estimated Greenhouse Gas Emissions on a Project Lifetime Basis

	Project Lifetime Emissions (Mt CO_2-e)			
Scenario	**Scope 1**	**Scope 2**	**Scope 3**	**Total**
Stage 1, E Class	15.1 0.3		4.7	20.1
Stage 1, F Class	16.5 0.4		5.1	22.0
Stage 2, E Class	22.7 0.5		7.0	30.2
Stage 2, F Class	33.0 0.7		10.2	44.0

Generator Performance

The proposed use of natural gas fired open cycle gas turbine technology at Dalton results in electricity production at a lower greenhouse intensity than the existing NSW average. Whilst detailed plant selection for the proposed Facility is yet to be made, **Table 9-8** shows the emissions intensities for the proposed open cycle gas turbine technology, as well as a range of other generator technology types. The data in **Table 9-8** are primarily sourced from the Technical Guidelines: Generator Efficiency Standards (AGO, 2006) and the Energy Directions Green Paper (NSW Government, 2004).

The emissions intensities contained in AGO(2006) were generated for the purpose of identifying standards of performance for new plant types under the recently defunct "Greenhouse Challenge Plus" program. Within the document, the presented emissions intensities are defined as representing Best Available Technology (BAT) on the basis of reviews conducted during 2004-2005. The technologies included in AGO(2006) represent mature technologies for which efficiency improvements are gradual, and have been limited in recent years. It is considered that these technologies are representative of current BAT.

Table 9-8 Emissions intensity of various generator technology types

Technology Type	Emissions Intensity (kg CO_2-e/MWh)
Open Cycle Gas-Fired Turbine	~600 – 700[1]
Open Cycle Gas-Fired Turbine (BAT)	710[2]
Combined Cycle Gas Turbine	~400 – 500[1]
Combined Cycle Gas-Fired Turbine (BAT)	454[2]
Coal-Fired – Best Existing Australian Plant	830[1]
Coal-Fired – World's Best Practice	~800 – 810[1]
Coal-Fired with Water Cooling (BAT)	855[2]
Coal-Fired with Air Cooling (BAT)	893[2]
Current NSW Average (NGA Scope 2 + Modified Scope 3)*	960[3]
2009 NSW GGAS Pool Coefficient* 967	[4]

Notes:

[1]NSW Government (2004) *Energy Directions Green Paper*.

[2]AGO (2006) *Technical Guidelines: Generator Efficiency Standards* - These intensities have been scaled with emission factors from DCC(2008) to incorporate the full fuel cycle (Scope 1+3) emissions and thus allow comparison with NSW Government (2004)[1] and DCC (2009a)[3]. Note that DCC(2008) factors have been used in this analysis, as DCC(2009a) does not include a Scope 3 emission factor for NSW black coal in electricity generation.

[3]DCC (2009a) *National Greenhouse Accounts (NGA) Factors*, June 2009. *Includes standard NSW Scope 2 emission factor of 890 CO_2-e/MWh, as well as transmission network operators specific scope 3 factor from footnotes of Table 3 9 of DCC (2009a) of 70 kg CO_2-e/MWh. This particular Scope 3 emission factor has been used in order to avoid the inclusion emissions due to transmission and distribution losses, and thus provide a factor suitable for comparison against full fuel cycle emissions intensities.

[4]NSW Government (2008) *Fact Sheet – The NSW Pool Coefficient* November 2008. **Pool Coefficient does not include full suite of Scope 3 emissions, and is also calculated from a subset of NSW based national electricity market generators.

As can be seen in **Table 9-8**, the proposed technology has a lower intensity than the grid average, which is largely defined by the balance of coal and hydroelectric generation. It should also be acknowledged that of the technology types presented in **Table 9-8**, open cycle gas turbine technology is the only technology that is designed to proceed from standby to generation at full load in a timeframe consistent with the peaking regime in which AGL proposes to operate.

Comparison to National and NSW Greenhouse Gas Inventories

Quantitative greenhouse gas emissions from the Facility and comparison with greenhouse gases generated from the electricity sector in NSW and Australia are provided in **Table 9-9**. For the four plant configurations considered in this assessment, at an operating duty of 15%, the total annual emissions were predicted to be in the range of 0.67 to 1.46 Mt CO_2-e. For the sectors considered, these emissions constitute a small percentage of the inventory totals.

Table 9-9 Comparison of Proposal to State and National Greenhouse Gas Inventories

2007 Greenhouse Gas Inventory Sector	Greenhouse Gas Emissions (Mt CO_2-e)	% Contribution represented by the Dalton Power Project			
		Stage 1		Stage 2	
		E Class	F Class	E Class	F Class
NSW Stationary Energy sector	79.4	0.85%	0.92%	1.27%	1.85%
Total NSW GHG emissions	162.7	0.41%	0.45%	0.62%	0.90%
Australian Stationary Energy sector	297.7	0.23%	0.25%	0.34%	0.49%
Total Australian GHG emissions	597.2	0.11%	0.12%	0.17%	0.25%

Australia's future greenhouse gas inventory data are not possible to forecast with certainty. The 2007 inventory data shows that national emissions across all sectors rose by 9.3 % from 1990 to 2007. The largest sector increase was the stationary energy sector, followed by transport, showing a rise due to population growth and electricity demand for resources. Since future trends are unknown, the greenhouse gas emissions from the Facility cannot be meaningfully compared to future emissions from other sources of greenhouse gases in Australia over the operational life of the plant.

Greenhouse Gas Abatement

AGL is the largest producer of renewable energy in Australia, with installed capacity of 1,170 MW, and an additional 928 MW currently under construction. AGL is, and has been for many years, committed to investing in low emission (including natural gas) technology or renewables projects.

AGL proposes to implement technology that is consistent with current BAT. Hence the Project design has incorporated a range of greenhouse gas mitigation measures. In addition, greenhouse gas mitigation measures have been identified for the detailed design, and operational phases of the Project. These measures are detailed in **Table 9-10**.

Table 9-10 Greenhouse Gas Mitigation Measures Available to the Project

Mitigation Measure	Greenhouse Gas Reduction
Incorporated at Project Design Phase	
Technology Selection: Adoption of OCGT – Plant is able to be started and stopped quickly thus minimising fuel consumption outside of periods when the generator is on line. Alternatives to OCGT include CCGT or coal-fired generation, which would have to run on standby for large proportions of the year in order to be available to the peaking market (and would have significantly higher emissions). OCGT also has lower operational emissions than alternative peaking technologies.	Not Quantified[1]

Fuel Selection: Use of Natural Gas – Natural Gas has lower emissions per GJ of heat energy than alternative fuels such as oil or coal.	~20-40%[2]
Plant Selection: Implementation of OCGT with high thermal efficiency - AGL proposed plant for this Project that achieves a thermal efficiency that is consistent with Best Available Technology (BAT) as defined in the Generator Efficiency Standards (AGO,2006).	~10% (60 kg CO_2-e/MWh)
Plant Selection: Implementation of Evaporative Cooling - AGL propose evaporative cooling which will offer efficiency benefits reducing greenhouse gas emissions when operating during hot conditions.	~1.5% (10 kg CO_2-e/MWh)
Available to Project at Detailed Design, Commissioning and Operational Phases	
Efficiency Auditing – In a manner consistent with both AGL's internal directives, and regulatory requirements under the *Energy Efficiency Opportunities Act 2006* (as amended), conducting audits to ensure that plant is being operated efficiently, and to identify opportunities to improve efficiency and reduce emissions intensity e.g.: • restoring the plant to design condition – e.g. replacing filters and removing fouling; • changing operational settings – e.g. ensuring control systems are operating correctly; • investigating and implementing retrofit improvements, and other mitigation options – e.g. turbine blades capable of withstanding higher combustion temperatures, CCS and waste heat brine concentration. EEO obligations involve assessment and implementation of efficiency improvements with a payback period of four years or less on a 5 year assessment cycle.	Varied: Operational efficiency improvements would typically result in reductions in the vicinity of 1-2% (6-12 kg CO_2-e/MWh), whilst CCS may achieve reductions in the range of 90% (500 kg CO_2-e/MWh[2])
Carbon Capture and Sequestration - separation of carbon dioxide from the generator exhaust stream, with subsequent transportation and underground storage.	AGL do not anticipate CCS will prove commercially effective on the proposed OCGT technology under the proposed peaking operational regime. Further discussion provided in **Appendix E** Section 4.2.3.

Notes: [1] Due to the need to maintain boilers in ready state, emissions intensity from applying CCGT or coal-fired generation to a peaking regime (as proposed by AGL) would likely be in excess of an order of magnitude higher. [2] Based on scope 1 emissions: Natural Gas: 51.3 kg CO_2-e/GJ (58% of Coal), Diesel Oil: 69.5 kg CO_2-e/GJ (79% of Coal) Coal: 88.4 kg CO_2-e/GJ.

As noted above, AGL proposes to implement technology that is consistent with current BAT for peaking operation. This largely precludes the application of greenhouse gas mitigation measures beyond those that are an inherent part of the Project.

An evaluation of the implementation of CCS for the Project indicates that CCS is unlikely to represent a technically or commercially feasible greenhouse mitigation measure for the Project (See ***Greenhouse Gas Assessment*** **(Appendix E)** for further detail).

AGL anticipates that additional, and currently unfeasible, greenhouse gas mitigation strategies may become more feasible during the future operation of the Facility. These are likely to be based around efficiency improvements associated with the adoption of improved technologies and componentry that are developed.

Such improvements could be implemented during routine maintenance and refurbishment of the Facility and would be in line with current Commonwealth Government policy on the introduction of a carbon priceto the Australian market, AGL proposes to investigate the feasibility of such measures as and when they become commercially feasible within the context of the development of a carbon price and market.

9.4.3 Plume Rise Assessment

Methodology

A Plume Rise Assessment was undertaken for the Project, and was conducted using The Air Pollution Model (TAPM), Version 3.07 for the purposes of assessing the potential for the Facility to create an aviation hazard. TAPM was used in conjunction with meteorological data for 2006 collected from Bureau of Meteorology Automatic Weather Station (AWS) at Goulburn Airport. These meteorological data were incorporated into TAPM to assist in generating site-specific meteorology at the location of the Facility. The model considered the plume rise from a range of exhaust stack configurations. For details, see **Appendix D**.

In this assessment, the 'Buoyancy Enhancement Factor' parameter in TAPM has been used to account for the additional plume rise due to the merging of the plumes. The approach taken is considered conservative under the majority of meteorological conditions, and appropriate for the conditions under which the greatest plume rise is predicted to occur.

The modelling considered six scenarios which are outlined in **Appendix D**. They include single turbine scenarios and plant type scenarios which are considered to represent the upper bound of the plume impact from multiple stacks, where the merging assumptions are conservative for the majority of meteorological conditions, and appropriate for conditions conducive to plume rise, when worst case impacts are predicted to occur.

Results

The modelling results show that, as expected for an open cycle gas turbine facility, the plant will produce exhaust plumes with vertical velocities that exceed 4.3m/s above the Obstacle Limitation Surface (OLS). **Table 9-11** displays the maximum, minimum and average critical plume extents. The critical vertical plume extent is the height (for a given hour modelled) at and below which, the vertical velocity (w) of the plume exceeds 4.3m/s. The critical horizontal plume extent is the total downwind translation of the plume boundary at the point at which the vertical velocity decreases to 4.3m/s. The maximum critical horizontal plume extent of 959 m was predicted to occur at a height of approximately 1860 m. This is further illustrated in **Figure 4-11** of **Appendix D**.

Table 9-11 Maximum, minimum and average critical plume extents

Scenario	Critical Plume Extent (m agl)					
	Maximum		Minimum		Average	
	Vertical	Horizontal	Vertical	Horizontal	Vertical	Horizontal
E Class Single Turbine	688	203 50		22 105 63		
E Class Stage 1	1695	530 77		77 252		220
E Class Stage 2	1821	668 99 113			326	308
F Class Single Turbine	1120	280 67		33 153 98		
F Class Stage 1	1740	601 98		91 294		257
F Class Stage 2	2119	959	148 172	451 455		

Table 9-12 shows the critical vertical plume extent by percentage of time, for the year 2006. For example, the result of 839 m for 0.05% for the F Class single turbine scenario indicates that for 1 in every 2000 hours, the plume velocity exceeds 4.3m/s at a height greater than or equal to 839 m.

Table 9-12 Heights below which the vertical velocity exceeds 4.3m/s by percentage of 2006

Percentage of time	Height below which vertical plume averaged velocity >4.3 m/s (m agl)					
	E Class			F Class		
	Single Turbine	Stage 1	Stage 2	Single Turbine	Stage 1	Stage 2
100%	50	77 99 67			98	148
90%	59	121 161 83			148	237
80%	63	142 189 93			172	273
70%	68	162 216 101			195	309
60%	75	185 245 111			220	342
50%	84	212 276 126			249	378
40%	95	244 312 145			281	416
30%	113	281 352 171			319	467
20%	140	324 404 204			366	561
10%	185	409 532 254			473	757
9%	190	427 550 260			493	791
8%	197	444 578 268			511	826
7%	203	462 605 276			532	877
6%	210	488 645 288			567	930

Percentage of time	Height below which vertical plume averaged velocity >4.3 m/s (m agl)					
	E Class			F Class		
	Single Turbine	Stage 1	Stage 2	Single Turbine	Stage 1	Stage 2
5%	218	529 703 305			612	993
4%	227	569 773 324			676	1071
3%	242	642 857 345			762	1184
2%	269 746		1008	385 883		1316
1%	319 928		1194	454 107	4	1484
0.5%	377	1067 132	7 537		1216	1673
0.3%	421	1156 140	4 626		1282	1760
0.2%	463	1213 148	6 674		1345	1796
0.1%	539	1437 167	5 747		1592	1863
0.05%	606	1547 172	0 839		1647	1976

The assessment has considered six scenarios, which have indicated that thermal plumes from the Facility would penetrate the Obstacle Limitation Surface (OLS) of 110 m above ground level (agl) at velocities greater than the CASA-specified critical velocity of 4.3 m/s.

Assessment scenarios were based upon two approaches:

- **Single Turbine Scenarios** - In the single turbine scenarios, the impact of a single turbine unit was assessed independently of neighbouring plumes. This is considered representative of a single turbine in operation. This scenario is also representative of the lower bound of plume impact multiple turbines.
- **Plant (Merged Emissions) Scenarios** - For the plant type scenarios, a buoyancy enhancement factor was applied in order to account for interactions between neighbouring plumes. The selected buoyancy enhancement factors assumed that buoyancy was completely conserved until the complete merging of adjacent plumes under all meteorological conditions. Hence the plant type scenarios are considered to represent the upper bound of the plume impact from multiple stacks.

Given the greater degree of buoyancy enhancement that occurs under meteorological conditions conducive to plume rise, the merged emissions scenarios are considered most appropriate for maximum vertical extents, and conservative for the remainder of meteorological conditions.

Consideration should be given for the plant to be designated a potential hazard to aircraft operators in the area. The implementation of such designation is at the discretion of the Civil Aviation Safety Authority (CASA). Further consultation with CASA would be undertaken following the detailed design stage. It is understood that CASA would require confirmation of any changes to the design that may affect the plume rise assessment. Prior to operation of the facilities, AGL would provide CASA with the following information:

- "As constructed" coordinates in latitude and longitude of the Facility;
- Final height (in AHD) of the buoyant sources; and
- Ground elevation of the site (in AHD).

Aviation Safety

Due to the plume rise from the stack emissions, an aviation hazard analysis based on the predicted impacts of the proposed facility has been performed, and is shown in **Appendix D**. The statistics have been compiled in accordance with the Civil Aviation Safety Authority's (CASA) Advisory Circular *"Guidelines for Conducting Plume Rise Assessments"* (June, 2004). Where there is potential for an exhaust plume with a vertical velocity greater than 4.3 m/s at the Obstacle Limitation Surface (OLS) of 110 m, a hazard analysis is required. As part of this analysis, a search of CASA registered aerodromes within a 15 km radius was undertaken. Furthermore, a desktop search of other unregistered landing strips was also undertaken. The results of these surveys indicated that there are no known landing strips within a 15 km radius of the Project site.

This assessment involved use of the TAPM model which was used to create site-specific meteorological data, including meteorology for the upper atmosphere. TAPM was also used to calculate plume rise trajectories for the turbine emissions.

The modelling results show that as typically found with an open cycle gas turbine facility, the plant would produce exhaust plumes with vertical velocities (*w*) that exceed 4.3m/s above the OLS for a significant proportion of the year (base upon the plant running at full load all hours of the year). The maximum, minimum and average heights at which the plume velocity is greater than 4.3 m/s are provided in **Table 9-13** and **Table 9-14** for Stage 1 and Stage 2 respectively.

Table 9-13 Stage 1 - Maximum, Minimum and Average Critical Plume Extents

Statistic	Critical Vertical Plume Extent (m agl)	Critical Horizontal Plume Extent (m)
Maximum 174	0	601
Minimum 98		91
Average 294		257

Table 9-14 Stage 2 - Maximum, Minimum and Average Critical Plume Extents

Statistic	Critical Vertical Plume Extent (m agl)	Critical Horizontal Plume Extent (m)
Maximum 211	9	959
Minimum 148		172
Average 451		455

A plume rise assessment was performed which showed that the peaking power plant would produce exhaust plumes with vertical velocities that exceed 4.3m/s above the Obstacle Limitation Surface.

Whilst this assessment is considered conservative with respect to the modelled operating times and operating conditions, the Civil Aviation Safety Authority (CASA) may choose to designate this to be a potential hazard to aircraft operators in the area.

9.5 Conclusion

9.5.1 Emissions during Construction

The distance to the nearest residential dwelling is approximately 2 km which is considered to provide a sufficient buffer zone between the main work area to prevent nuisance dust impacts. The minimisation and control of dust emissions during the construction period would be implemented using procedures contained in the Construction Environmental Management Plan (CEMP) for the Project.

9.5.2 Emissions during Operation

Air Quality

The potential air quality impact of the Dalton Power Project has been assessed using the Calpuff dispersion modelling package. The pollutants assessed included nitrogen dioxide (NO_2), carbon monoxide (CO), sulphur dioxide (SO_2), particulate matter (PM_{10}) and formaldehyde. The dispersion modelling has used a largely conservative approach, in accordance with the DECCW (2005) *Approved Methods and Guidance for the Modelling and Assessment of Air Pollutants in NSW*. In order to assess the cumulative impact of the plant emissions on the local air quality, background concentrations of the criteria pollutants were obtained from the relevant OEH and TMS monitoring stations.

The results of the dispersion modelling showed that the predicted impacts on ground level concentrations of NO_2, PM_{10}, CO and SO_2, when added to peak background concentrations, were within the OEH regulatory criteria. In addition, the predicted incremental concentrations of formaldehyde were found to be within OEH criteria. This analysis has also assumed that all oxides of nitrogen (NO_x) exist as nitrogen dioxide.

Greenhouse Gases

The greenhouse gas inventory has focused on scope 1 and scope 3 emissions associated with natural gas combustion in the open cycle gas turbine generators. The principal greenhouse gas emission from the Facility is carbon dioxide (CO_2), which is a product of natural gas combustion. Minor quantities of other greenhouse gases may be emitted and have been represented in this assessment, as carbon dioxide equivalent (CO_2-e).

The assessment has considered four potential plant configurations, each with an operating duty of 15% of the year.

Total annual emissions were estimated to be in the range of 0.67 to 1.47 Million tonnes of carbon dioxide equivalent (Mt CO_2-e). The associated emissions intensity of generation was calculated to be approximately 800 kilograms of carbon dioxide equivalent per megawatt hour of electricity generated (kg CO_2-e/MWh).

Based on a project life of 30 years, the total lifetime emissions for the four plant configurations considered were estimated to be between 20.0 and 44.0 Mt CO_2-e.

A comparison of emissions from the Facility to state and national greenhouse gas inventories was also made. Emissions from the project were estimated to be in the range of 0.41-0.90% and 0.11-0.25% of the state and national inventories, respectively. In addition, emissions from the project were estimated to be in the range of 0.85-1.85% and 0.23-0.49% of stationary energy emissions from the state and national inventories, respectively.

AGL anticipates that the implementation of the Carbon Pollution Reduction Scheme (CPRS) in 2011 would be a significant consideration in the selection of plant size and type and ultimately the greenhouse efficiency of the Facility.

Plume Rise Assessment

A plume rise assessment was performed which showed that the peaking power plant would produce exhaust plumes with vertical velocities that exceed 4.3m/s above the Obstacle Limitation Surface.

Whilst this assessment is considered conservative with respect to the modelled operating times and operating conditions, the Civil Aviation Safety Authority (CASA) may choose to designate this to be a potential hazard to aircraft operators in the area. Further consultation between AGL and CASA is currently proceeding. Should CASA determine that the Facility represents a risk to aircraft operations in the area, the risk would be mitigated. Typical mitigation measures include the notification of aircraft in the region of the emission source, through the routine distribution of NOTAM (Notice to Airmen) notices.

9.6 Summary of Mitigation Measures

Table 9-15 presents a summary of the air quality mitigation measures.

Table 9-15 Summary of Mitigation Measures

Mitigation Measures	Implementation of mitigation measures		
	Design	Construction	Operation
Air Quality			
As part of the detailed design of the development, the assumptions and emission estimates used in this assessment would be reviewed and should the expected emission rates or stack details increase over the values used here, the modelling would be revised to ensure that OEH air quality standards and goals would be met.	✓		
Liaise with CASA to address the issue of potential aviation hazard of the plant.	✓		
Any emissions of dust particulates during construction would be specifically controlled through the implementation of mitigation measures, which would be incorporated into a Construction Environment Management Plan (CEMP).	✓	✓	
The CEMP would consider the most appropriate dust mitigation method suited to the activity and circumstances. This may include: – watering, spraying or covering earthworks during excavation and handling and on exposed surfaces and stockpiles; – scheduling activities for more favourable meteorological conditions; – ceasing earthmoving activities when wind speeds exceed 30 km/hr; – covering or limiting truck soil loads; – reducing speed limits on unsealed surfaces; – cleaning soil off the undercarriage and wheels of trucks; – any long-term soil stockpiles would be stabilised using measures such as fast seeding grass or synthetic cover spray.		✓	
Monitoring of air emissions during operation would be undertaken in accordance with the Environment Protection Licence.			✓
Greenhouse Gas			
Install plant that achieves a thermal efficiency that is consistent with Best Available Technology (BAT) as defined in the Generator Efficiency Standards (AGO,2006).	✓	✓	
Conduct efficiency audits in accordance with both AGL's internal directives, and regulatory requirements under the *Energy Efficiency Opportunities Act 2006* (EEO - as amended), conducting environmental audits to ensure that plant is being operated efficiently, and to identify		✓	✓

Mitigation Measures	Implementation of mitigation measures		
	Design	Construction	Operation
Air Quality			
opportunities to improve efficiency and reduce emissions intensity e.g.: • restoring the plant to design condition – e.g. replacing filters and removing fouling; • changing operational settings – e.g. ensuring control systems are operating correctly; • investigating and implementing retrofit improvements, and other mitigation options – e.g. turbine blades capable of withstanding higher combustion temperatures, CCS and waste heat brine concentration.			

Landscape and Visual - Summary of Key Outcomes

A total of 34 potential view locations were identified as part of the visual assessment process.

For the proposed Power Station layout, an assessment of the visibility rating for each potential view location indicated the following:

- a **NIL** visibility rating for 16 of the 34 view locations has been determined, while a **LOW** visibility rating has been determined for 18 view locations;

For the proposed Communication Tower infrastructure, an assessment of the visibility rating for each potential view location indicated the following:

- a **NIL** visibility rating for 15 of the 34 view locations has been determined, while a **LOW** visibility rating has been determined for 19 view locations; and

For the proposed Valve Station:

- a **NIL** visibility rating for 22 of the 34 view locations has been determined, while a **LOW** visibility rating has been determined for 12 view locations.

There are unlikely to be any significant and direct views toward the power station and communication tower and valve station from the majority of local roads or access tracks. Views toward the power station are likely to be restricted to portions of the exhaust stacks and will be generally for a short duration where visible.

The low visual impact would be due to a combination of the following factors:

- Existing trees and more dense timbered areas combine with natural undulating landform to screen the majority of views toward the power station site from surrounding areas including views from rural residential dwellings.
- There are no significant views toward the power station site from surrounding local roads or property access tracks.
- The majority of ancillary structures associated with the power station (including control buildings, workshop and electrical infrastructure) would be largely screened by existing trees and timbered areas within the AGL site boundary as well as the undulating topography surrounding the site.
- The exhaust stacks, which are the tallest structures associated with the power station, would be visible from a number of surrounding rural residential properties as well as some surrounding local roads and private access tracks. The exhaust stacks may also be visible above the skyline from some view locations surrounding the power station site. Given the generally narrow profile of the exhaust stacks and taking into account the proposed mitigation measures, it is unlikely that the exhaust stacks would result in a significant visual impact on people at surrounding view locations. Visible emissions plumes above the power station exhaust stacks would be unlikely during operation.
- Views toward the exhaust stacks from the majority of rural residential properties would generally be restricted to mid or upper portions of the exhaust stacks, with views to the lower sections and associated power station infrastructure blocked by existing trees and undulating landform.

Chapter 10 Landscape and Visual

- There are no known existing developments of a similar nature within the local or surrounding area. Therefore it is considered that no cumulative visual impacts are likely to occur.
- The valve station is unlikely to result in significant visual impacts due to its location within an area of low density population as well as the small number of motorists travelling along Walshs Road on a daily basis.
- Distant views toward the communications tower are likely to be influenced by atmospheric conditions which will tend to reduce the visibility of the tower.
- The use of dark colours and non-reflective materials would help to minimise the potential for visual contrast between the power station and tree canopy background when viewed from some view locations beyond the AGL site boundary or valve station location.
- The used of appropriate colours and finishes to elements within the valve station would help to minimise the visibility of the valve station from surrounding view locations.

10.1 Introduction

The visual assessment involved a comprehensive evaluation of the visual character of the landscape in which the Project would be located and an assessment of the potential visual impacts that could result from the construction and operation of the Facility.

The primary objective of the visual assessment was to determine the likely visual impact of the power station and associated infrastructure on people living and working in, or travelling through the landscape surrounding the Project.

10.2 Methodology

The visual assessment adopted a methodology that has been applied to a number of visual assessments for similar power station projects, and by other professionals undertaking visual studies for similar developments.

A desktop study was undertaken by reference to 1:25,000 topographic maps as well as aerial photographs of the site and surrounding area. The topographic maps and aerial photographs were also used to identify potential view locations that could be verified during the fieldwork component of the visual assessment.

The field inspection involved:

- a detailed inspection to determine the potential extent of visibility of the Project;
- determination of the view locations from which the Project could potentially be visible;
- assessment of visual impact using:
  - potential visibility of the Project site;
  - identification and mapping of potential view locations;
  - analysis of visibility; and
- identification of mitigation measures to minimise potential visual impacts.

10.2.1 Assessment of Visual Impact

The potential visual impact of the Project at individual view locations would result primarily from a combination of the potential visibility of the power station structures and the visual character of the landscape between, and surrounding, the viewer and the Project. The potential degree of visibility and potential visual impact may be partly determined by a combination of factors including:

- the category of situation from which people may view the Project (examples of viewer categories include residents and motorists);
- the visual sensitivity of view categories surrounding the Project;
- the potential number of people with a view toward the Project from any one view location;
- the distance between the view location and the Project; and
- the duration of time a person may view the Project from any static or dynamic view location.

10.2.2 Panoramic Photographs

A series of photographs were taken during the course of the fieldwork to illustrate views from a number of potential view locations, which were inspected and assessed as part of the visual assessment process.

Individual photographs were digitally stitched together to form a segmented panoramic image to provide a visual illustration of the existing view from each photographic location.

10.2.3 Visual Assessment Criteria

A visibility rating for each view location has been assessed and determined against the criteria outlined in **Table 10-1** below:

Table 10-1 View Location Assessment Criteria

Criteria	Definition
Number of Viewers	
High	>200 people per day
Moderate	150 - 199 people per day
Low	50 - 149 people per day
Very Low	<50 people per day
View Distance	
Distant	>6km
Long	3km – 6km
Medium	2km – 3km
Short	1km – 2km
Very short	<1km
Period of View	
Long term	> 2 hours
Moderate term	30 - 120 minutes
Short term	10 – 30 minutes
Very Short Term	< 10 minutes

An indicative visibility rating resulting from various combinations of the above criteria is listed in **Table 10-2**.

Table 10-2 Visibility Criteria Matrix

	Distance and Long Distance			Medium Distance			Short Distance			Very Short Distance		
Period of View	**L/M**	**S**	**VS**	**L/M**	**S**	**VS**	**L/M**	**S**	**VS**	**L/M**	**S**	**VS**
High No. of Viewers	M	L	L	H	M	M	H	H	M	H	H	H
Moderate No. of Viewers	L	L	L	M	M	L	H	M	M	H	H	M
Low No. of Viewers	L	L	L	M	L	L	M	M	L	H	M	L
Very Low No. of Viewers	L	L	L	L	L	L	M	L	L	M	M	L

- **Period of View** L/M=Long to Moderate term, S=Short term , VS=Very Short term
- **Levels of visibility** L=low, M=medium and H=high

The visibility criteria matrix is used as a guide to determine a visibility rating. The visibility rating for each view location is also considered against other factors, which include the sensitivity of the viewer. For example, residential properties are highly sensitive whereas industries have lower sensitivity.

10.3 Elements of Dalton Power Project

Details of the various components of the Project are described in detail in **Chapter 4**. The key visual elements associated with the Project include:

- proposed access road;
- up to six gas turbines;
- up to six exhaust stacks up to 46 m high but likely between 28 – 30 m high;
- control building;
- workshop and store;
- switchyard and transformer;
- one or two additional transmission line structures to be constructed within the existing TransGrid 330 kV easement to connect the Facility to the transmission network;
- proposed valve station to be located adjacent to the Moomba to Sydney Gas Pipeline in proximity to Walshs Road; and
- A 60m high lattice steel communications tower supporting antenna dishes.

The transmission line connection would be generally screened from surrounding view locations by topography and existing trees within and surrounding the site.

The access road, control building, ancillary infrastructure and constructed gas pipeline would generally not be visible from most view locations.

The proposed valve station adjacent to the Moomba to Sydney Gas Pipeline would occupy an area of approximately 0.22 ha and would be set back approximately 25 m to the west of Walshs Road. This would be the only element of the proposed gas pipeline outside of the Facility which would be located above ground. The area, which would be approximately 30 m x 70 m in size would be fenced off from public access and AGL proposes a number of mitigation measures to minimise the visual impact of this infrastructure from the road.

Chapter 10 Landscape and Visual

10.4 Existing Environment

10.4.1 Visual Character of the Surrounding Landscape

Site Context

The proposed power station site is located approximately 4 km north of the rural village of Dalton.

The power station footprint is located on gently sloping land that falls north and east. The site would be subject to some cut and fill earthworks to provide a suitably level construction platform.

The landscape immediately surrounding the site is predominantly rural in nature. The landscape has been generally cleared for arable and livestock production, although timbered areas have been retained along a number of gullies that flow to the Lachlan River, and on surrounding hill tops and ridgelines.

The landscape surrounding the site is divided by a number of drainage lines that flow to the Lachlan River, and give rise to an undulating landform either side of the river corridor.

The Site has a small number of clumped and individual trees scattered across it, some of which would be removed to accommodate the Facility and associated infrastructure.

The existing landscape surrounding the Project site contains a number of constructed elements that contribute to the local visual character that includes:

- a 330 kV transmission line;
- local roads and access tracks; and
- agricultural structures.

A small number of rural residential and farm properties are located in the landscape around the Project. Some of the residential properties are not visually prominent due to screening by surrounding undulating landform or the presence of trees around them. Visibility from residential properties was determined during the site analysis and fieldwork carried out as part of the visual assessment process.

Landform and Elevation

Topography

Topography is a key influence on the extent to which the proposed power station may be visible from surrounding areas. The key aspects are summarised below:

- The power station would be located on a saddle between a north south ridgeline extending to the west of the Lachlan River, and a small hill rising to around 600 m AHD to the south west of the site.
- The ground level at the base of the exhaust stacks would be around 575 m AHD. The top of the exhaust stacks would be up to around 621 m AHD but is likely to be around 605 m AHD.
- Land immediately to the north and east of the site falls gently to the Lachlan River corridor, and rises moderately steeply to the west across and over a small hill.

- The Lachlan River follows a meandering course in a general north west to south east alignment. A small number of gullies extend from land surrounding the site to the river corridor.

Vegetation

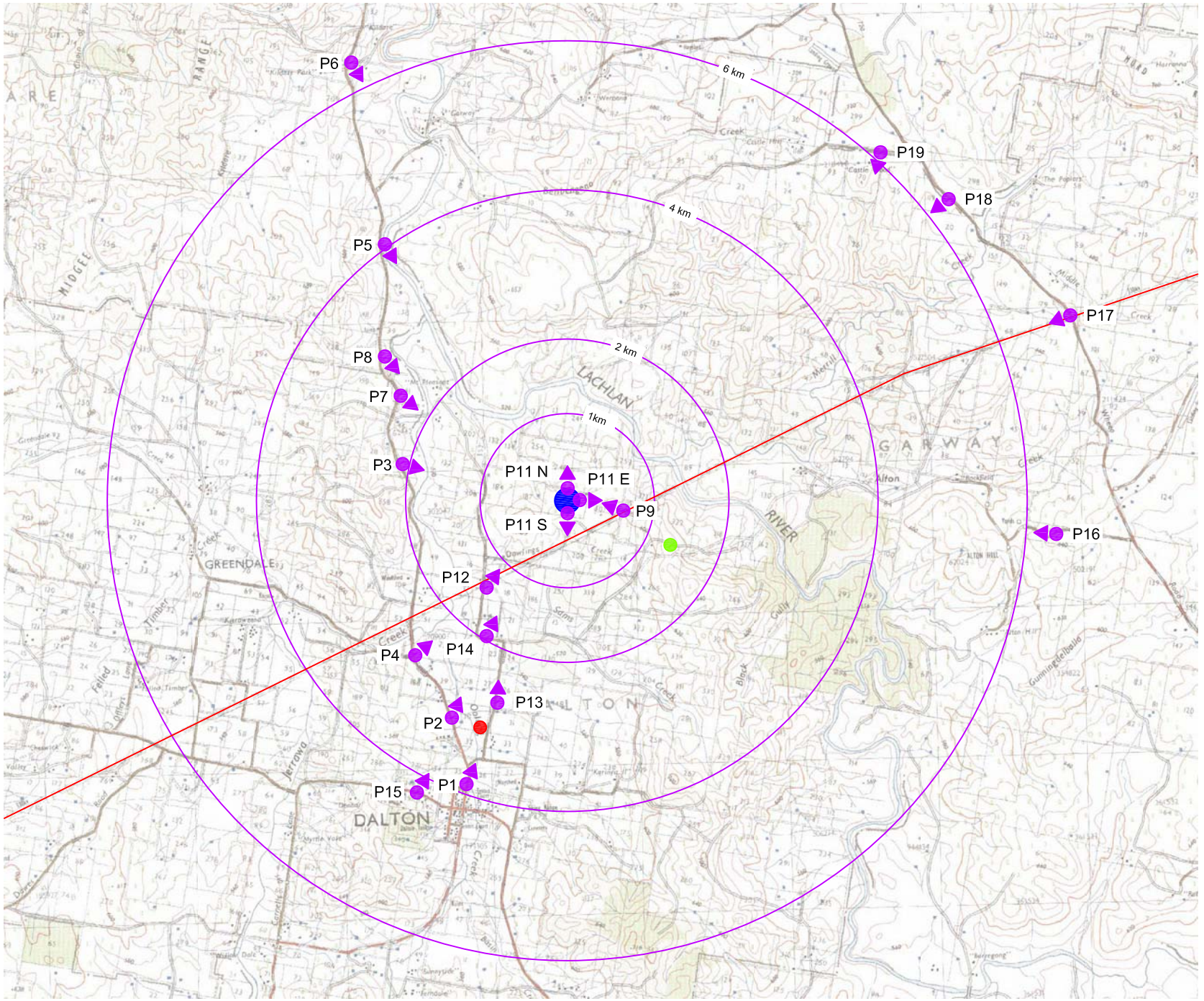
The Site and immediate surrounding area is generally characterised by grass pasture with stands of scattered and individual trees. Denser timbered areas occur in several locations around the Development Footprint, across slopes as well as within gullies and drainage lines.

Overall the characteristics of the landscape surrounding the Development Footprint are generally robust, and would tend to be less affected by the development.

10.4.2 View Locations

The panoramic images presented in this report have been annotated to identify key existing features located within the field of view.

The location of photographs taken from potential view locations are illustrated in **Figure 10-1**, and panoramic photographs illustrated in **Figures 10-2** to **10-6.**



LEGEND

- INDICATIVE SITE LOCATION
- INDICATIVE COMMUNICATION TOWER LOCATION
- INDICATIVE VALVE STATION SITE LOCATION
- DISTANCE OFFSET
- PHOTO LOCATION
- EXISTING 330kV TRANSMISSION LINE

N

0m 2km

Source: Copyright Department of Lands Panorama Avenue Bathurst 2795 (www.lands.nsw.gov.au)

Drawn: AO	Approved: LO	Date: 24/02/2011
Job No.: 43177661	File No.: 43177661.10-1.dwg	

Client: AGL

Project: DALTON POWER PROJECT

Title: PHOTO LOCATIONS

Figure: 10-1

URS

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Photo Location 1 View north from Chappel Street, Dalton

Photo Location 2 View north from road

Photo Location 3 View east to south east from road

Photo Location 4 View north east from road at creek crossing

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Job No.: 43177661	File No.: 43177661.10-3.dwg	

Client: AGL

Project: DALTON POWER PROJECT

Title: PHOTOSHEET 1

Figure: 10-2

URS

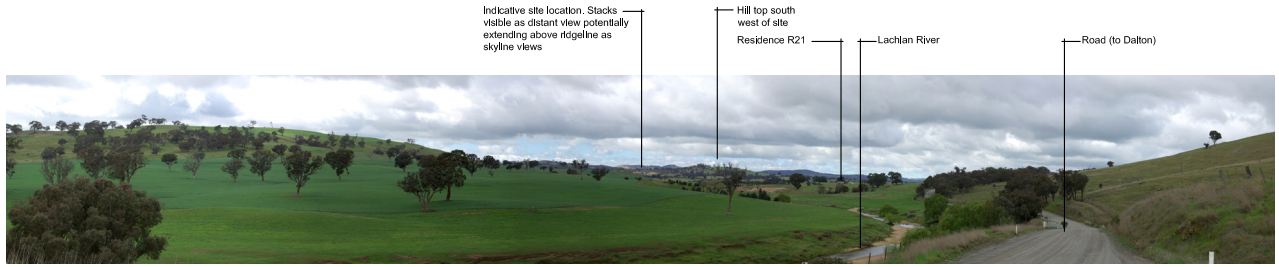

Photo Location 5 View south to south east from road

Photo Location 6 View south to south east from road cutting

Photo Location 7 View south east from road

Photo Location 8 View south east from road

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Client: AGL

Project: DALTON POWER PROJECT

Title: PHOTOSHEET 2

Figure: 10-3

URS

Photo Location 9 View west from within AGL site boundary

Photo Location 11N - View north from proposed power station site

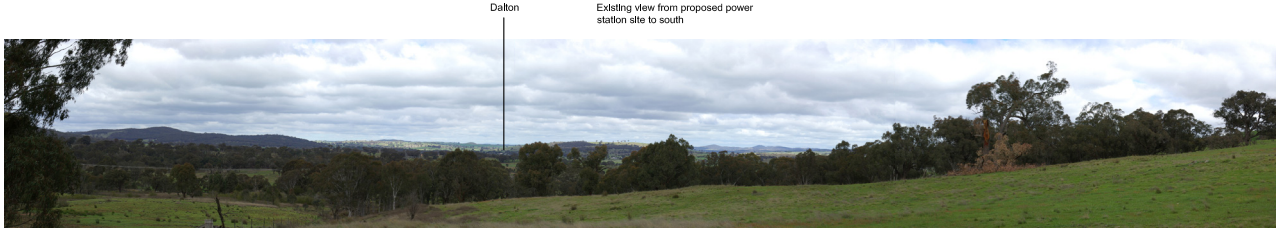

Photo Location 11S - View south from proposed power station site

Photo Location 11E - View east from proposed power station site

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Client: AGL

Project: DALTON POWER PROJECT

Title: PHOTOSHEET 3

Figure: 10-4

URS

Photo Location 12 View north east from Cowper Street

Photo Location 13 View north from Cowper Street

Photo Location 14 View north from Cowper Street

Photo Location 15 View north from Boorowa Road

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Client: AGL

Project: DALTON POWER PROJECT

Title: PHOTOSHEET 4

Figure: 10-5

URS

Photo Location 16 View west from Alton Lane

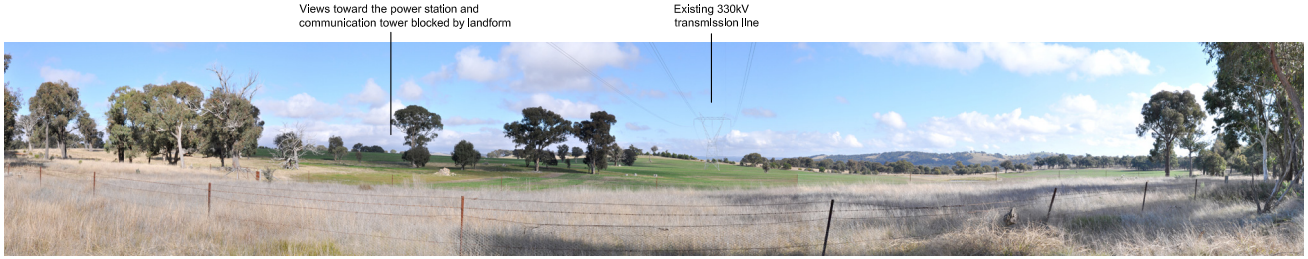

Photo Location 17 View west from Wheeo Road (along existing transmission line easement)

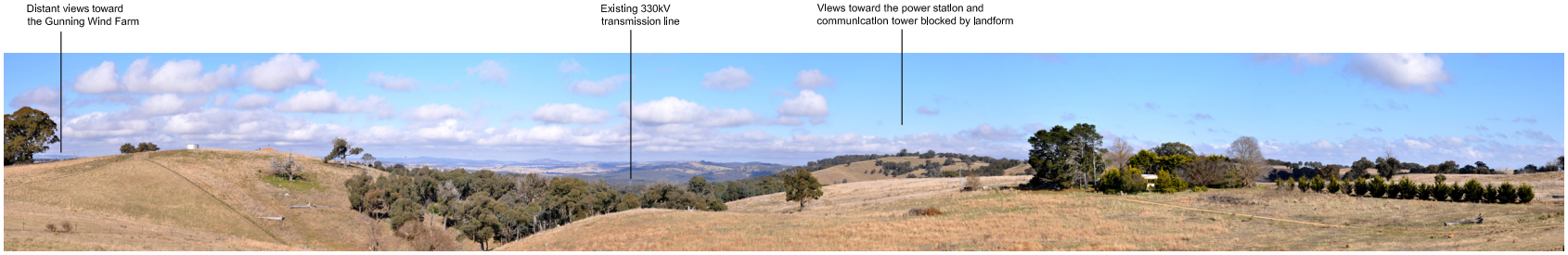

Photo Location 18 View west to south from Wheeo Road

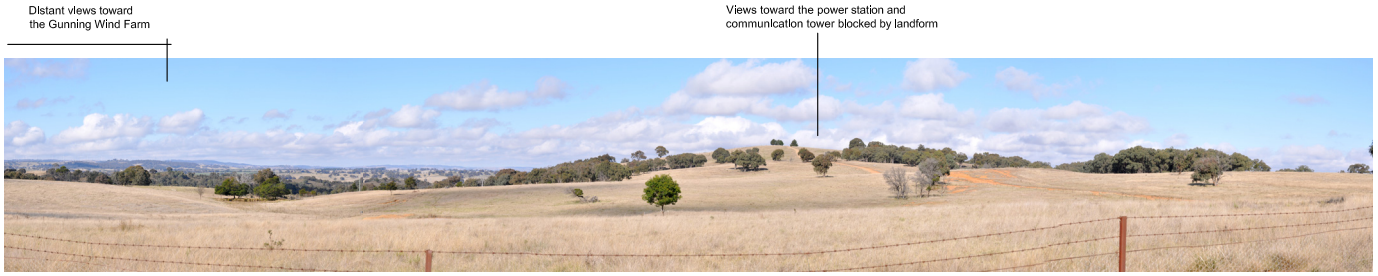

Photo Location 19 View south from residential access road

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Job No.: 43177661	File No.: 43177661.10-6.dwg	

Client: AGL

Project: DALTON POWER PROJECT

Title: PHOTOSHEET 5

Figure: 10-6

URS

Chapter 10 Landscape and Visual

10.5 Assessment of Visual Impact

10.5.1 Introduction

The potential visual impact of the Facility would result primarily from the combination of two factors:

- The level of visibility or extent to which the Facility structures would be visible from surrounding areas.
- The degree of visual contrast between the Facility structures and the capability of the surrounding landscape to visually accommodate them.

The potential visual impact from particular view locations is strongly dependant on the level of visibility from that location, which in turn is dependant on a number of criteria which are defined in **Table 10-1**.

10.5.2 Visibility

Visibility is a measure of the extent to which particular structures of the Facility would be visible from surrounding areas and considers the relative number and type of viewers, the period of the view, view distance and context of the view.

The underlying rationale for this component of the visual assessment is that, if a part of the Facility is not visible from a particular area then the potential visual impact would be nil. Similarly, if the number of people who would potentially see portions of the Facility is low, then the visual impact would be low compared to a situation in which a large number of people have the same view.

The distance between the Facility and the potential viewers has been illustrated as a series of concentric band widths extending out from the proposed site across the landscape. Individual view locations can be identified and assessed in relation to their distance and the degree of potential visual impact.

The influence of distance on visibility results primarily from two factors:

- With increasing distance the proportion of the horizontal and vertical view cone occupied by the Facility would decline.
- As the view distance increases so does the atmospheric effects resulting from dust and moisture in the atmosphere, which tends to make elements of the Facility appear grey, thus reducing the contrast between the Facility and the background against which they are viewed.

Visual simulations have been developed for P1, P2, P4, P7 and P16 (refer **Figure 10-2**) to present the possible visibility of the Project from potential view locations. These are shown in **Figures 10-7** to **10-11**.

Photo Location 1 Existing view north to north east from Chapel Street, Dalton

Indicative extent of Dalton Power Station including views toward mid and upper portions of exhaust stacks (at approximately 4km)

Existing transmission line supporting structure

Proposed communication tower (at approximately 4.2km)

Photo Location 1 Proposed view north to north east from Chapel Street, Dalton

Figure: 10-7

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Photo Location 2 Existing view north east from Bevendale Street, Dalton

Indicative extent of Dalton Power Station including views toward mid and upper portions of exhaust stacks (at approximately 3.3km)

Existing transmission line supporting structure

Proposed communication tower (at approximately 3.7km)

Photo Location 2 Proposed view north east from Bevendale Street, Dalton

Figure: 10-8

URS

Photo Location 4 Existing view north east from Bevendale Street, Dalton

Photo Location 4 Proposed view north east from Bevendale Street, Dalton

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Photo Location 7 Existing view east to south east from Bevendale Street, Dalton

Photo Location 7 Proposed view east to south east from Bevendale Street, Dalton

Figure: 10-10

URS

Photo Location 16 Existing view west to north west from Alton Lane

Photo Location 16 Proposed view west to north west from Alton Lane

Figure: 10-11

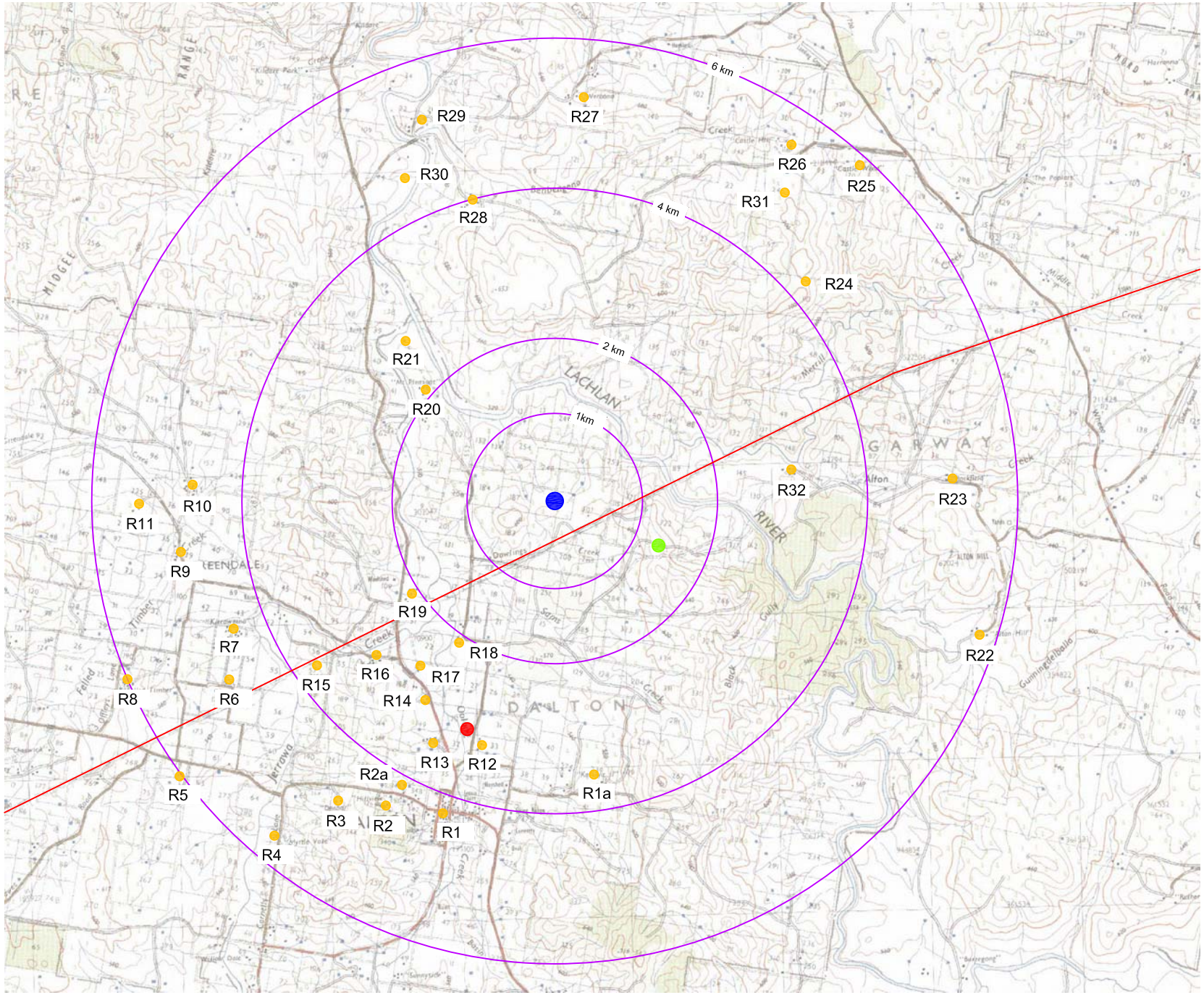
URS

10.5.3 Visibility Matrix

Potential view locations from residential locations are illustrated in **Figure 10-10**. **Table 10-3** presents the Visibility Matrix for the potential view locations together with the:

- category of viewer;
- context of view;
- approximate distance between the view location and the Facility;
- relative numbers of people; and
- period of view.

The visibility rating has been assessed in accordance with the visibility criteria outlined in **Section 10.2.3.** This methodology considers the visibility rating to be a result of the distance to the proposed power station; the period of view (ranging from short term <10 minutes to long term >2 hrs), and the number of viewers likely to be impacted. As outlined in **Table 10-3** below, all residential locations are considered with 'high viewer sensitivity'.



LEGEND

- INDICATIVE POWER STATION SITE LOCATION
- INDICATIVE COMMUNICATION TOWER LOCATION
- INDICATIVE VALVE STATION SITE LOCATION
- DISTANCE OFFSET
- R18 — RECEPTOR LOCATION
- EXISTING 330kV TRANSMISSION LINE

N

0m 2km

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Drawn: AO	Approved: LO	Date: 4/05/2011
Job No.: 43177661	File No.: 43177661.10-12.dwg	

Client: AGL

Project: DALTON POWER PROJECT

Title: POTENTIAL VIEW LOCATIONS

Figure: 10-12

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Table 10-3 Visibility Matrix - View Locations

View Location	Category of Viewer	View Context	Approx. distance from Project elements	Relative number of viewers	Estimated period of view	Viewer sensitivity	Potential Visual Impact
R1	Resident	Long distance views north toward the proposed power station from Dalton rural township are partially screened by buildings and vegetation within the Dalton built area. Potential views may extend toward the upper portions of the exhaust stacks from residences on the north fringe of the village which, at a long distance, are unlikely to create a significant visual impact. Long distance views toward the communication tower will be largely screened by tree cover within and surrounding residences within the village, although a small number of residences will experience direct and indirect views toward the tower, including views from garden areas or land immediately surrounding dwellings. Short to very short distance views toward the valve station will be largely screened by tree cover, as well as built structures within the village.	Power Station: 4.1km Communication Tower: 4.3km Valve Station: 870m	Low	Potentially Long Term	High	**Power Station** Low (and generally Nil) for the majority of dwellings within the Dalton village area. **Communication Tower** Low (and generally Nil) for the majority of dwellings within the Dalton village area. **Valve Station** Low (and generally Nil) for the majority of dwellings within the Dalton village area.

View Location	Category of Viewer	View Context	Approx. distance from Project elements	Relative number of viewers	Estimated period of view	Viewer sensitivity	Potential Visual Impact
R1a	Resident	Long distance views north toward the proposed power station from rural residential dwelling are generally screened by the influence of topography and vegetation. Potential views may extend toward the upper portions of the exhaust stacks which, at a medium distance, are unlikely to create a significant visual impact. Long distance views toward the communication tower will be partially screened by low undulating landform and scattered tree cover to the north of the residence. Short distance views toward the valve station will be largely screened by tree planting to the west of the residence.	Power Station: 3.7km Communication Tower: 3.2km Valve Station: 1.8km	Low	Potentially Long Term	High	**Power Station** Low **Communication Tower** Low **Valve Station** Nil
R2	Resident	Long distance views north to north east toward the proposed power station from residential dwellings are partially screened by vegetation and the influence of topography. Potential views may extend toward the upper portions of the exhaust stacks which, at a long distance, are unlikely to create a significant visual impact. Long distance views will extend toward the communication tower, which would not be expected to be visually prominent at this long distance view. Short distance views will extend toward the valve station which would not tend to be visually prominent.	Power Station: 4.6km Communication Tower: 5km Valve Station: 1.5km	Low	Potentially Long Term	High	**Power Station** Low **Communication Tower** Low **Valve Station** Low

Chapter 10 Landscape and Visual

View Location	Category of Viewer	View Context	Approx. distance from Project elements	Relative number of viewers	Estimated period of view	Viewer sensitivity	Potential Visual Impact
R2a	Residents	Long distance views north to north east toward the proposed power station from residential dwellings are partially screened by vegetation and the influence of topography. Potential views may extend toward the upper portions of the exhaust stacks which, at a long distance, are unlikely to create a significant visual impact. Long distance views will extend toward the communication tower, which would not be expected to be visually prominent at this long distance view. Short distance views will extend toward the valve station which would not tend to be visually prominent.	Power Station: 4.3km Communication Tower: 4.7km Valve Station: 1.1km	Low	Potentially Long Term	High	**Power Station** Low **Communication Tower** Low **Valve Station** Low
R3	Resident	Long distance views north to north east toward the proposed power station, communication tower and valve station from residential dwelling are partially screened by vegetation and the influence of topography. Potential views may extend toward the upper portions of the exhaust stacks which, at a long distance, are unlikely to create a significant visual impact.	Power Station: 4.9km Communication Tower: 5.5km Valve Station: 1.9km	Low	Potentially Long Term	High	**Power Station** Low **Communication Tower** Low **Valve Station** Low

View Location	Category of Viewer	View Context	Approx. distance from Project elements	Relative number of viewers	Estimated period of view	Viewer sensitivity	Potential Visual Impact
R4	Residents	Long distance views north to north east toward the proposed power station, communication tower and valve station from residential dwelling are partially screened by vegetation surrounding the residence and the influence of topography. Potential views may extend toward the upper portions of the exhaust stacks which, at a long distance, are unlikely to create a significant visual impact.	Power Station: 5.8km Communication Tower: 6.4km Valve Station: 2.9km	Low	Potentially Long Term	High	**Power Station** Low **Communication Tower** Low **Valve Station** Low
R5	Residents	Long distance views north to north east toward the proposed power station, communication tower and valve station from residential dwelling are partially screened by vegetation surrounding and beyond the residence and the influence of topography. Potential views may extend toward the upper portions of the exhaust stacks which, at a long distance, are unlikely to create a significant visual impact.	Power Station: 6.2km Communication Tower: 7km Valve Station: 3.9km	Low	Potentially Long Term	High	**Power Station** Low **Communication Tower** Low **Valve Station** Low
R6	Resident	Long distance views north east to east toward the proposed power station, communication tower and valve station from residential dwelling are generally screened by agricultural buildings to the east of the residence.	Power Station: 4.9km Communication Tower: 6km Valve Station: 3.2km	Low	Potentially Long Term	High	**Power Station** Nil **Communication Tower** Nil **Valve Station** Nil

Chapter 10 Landscape and Visual

View Location	Category of Viewer	View Context	Approx. distance from Project elements	Relative number of viewers	Estimated period of view	Viewer sensitivity	Potential Visual Impact
R7	Resident	Long distance views north east to east toward the proposed power station, communication tower and valve station from residential dwelling are largely screened by influence of local topography.	Power Station: 4.8km Communication Tower: 6km Valve Station: 3.4km	Low	Potentially Long Term	High	**Power Station** Nil **Communication Tower** Low **Valve Station** Nil
R8	Resident	Long distance views north east to east toward the proposed power station, communication tower and valve station from residential dwelling are largely screened by influence of local topography.	Power Station: 6.2km Communication Tower: 7.3km Valve Station: 4.6km	Low	Potentially Long Term	High	**Power Station** Nil **Communication Tower** Nil **Valve Station** Nil
R9	Resident	Long distance views north east to east toward the proposed power station, communication tower and valve station from residential dwelling are screened by influence of local topography	Power Station: 5km Communication Tower: 6.4km Valve Station: 4.5km	Low	Potentially Long Term	High	**Power Station** Nil **Communication Tower** Nil **Valve Station** Nil

View Location	Category of Viewer	View Context	Approx. distance from Project elements	Relative number of viewers	Estimated period of view	Viewer sensitivity	Potential Visual Impact
R10	Resident	Long distance views north east to east toward the proposed power station, communication tower and valve station from residential dwelling are screened by influence of local topography.	Power Station: 4.8km Communication Tower: 6.2km Valve Station: 4.9km	Low	Potentially Long Term	High	**Power Station** Nil **Communication Tower** Nil **Valve Station** Nil
R11	Resident	Long distance views north east to east toward the proposed power station, communication tower and valve station from residential dwelling are screened by influence of local topography.	Power Station: 5.5km Communication Tower: 6.9km Valve Station: 5.3km	Low	Potentially Long Term	High	**Power Station** Nil **Communication Tower** Nil **Valve Station** Nil
R12	Resident	Long distance views north toward the proposed power station and communication tower from residential dwelling are generally screened by influence of topography and vegetation. Very short distance views toward the valve station will occur from areas surrounding the residence, with some partial screening provided by tree planting within the property.	Power Station: 3.4km Communication Tower: 3.5km Valve Station: 290m	Low	Potentially Long Term	High	**Power Station** Nil **Communication Tower** Nil **Valve Station** Low

Chapter 10 Landscape and Visual

View Location	Category of Viewer	View Context	Approx. distance from Project elements	Relative number of viewers	Estimated period of view	Viewer sensitivity	Potential Visual Impact
R13	Resident	Long distance views north east to east toward the proposed power station, communication tower from the residential dwelling are generally screened by influence of topography and vegetation. Potential views may extend toward the upper portions of the exhaust stacks which, at a medium to long distance, are unlikely to create a significant visual impact. Very short distance views toward the valve station will occur from areas surrounding the residence, with some partial screening provided by tree planting within the property.	Power Station: 4km Communication Tower: 3.5km Valve Station: 490m	Low	Potentially Long Term	High	**Power Station** Low **Communication Tower** Low **Valve Station** Low
R14	Resident	Long distance views north east to east toward the proposed power station, communication tower from the residential dwelling are partially screened by influence of topography and vegetation. Potential views may extend toward the upper portions of the exhaust stacks which, at a medium to long distance, are unlikely to create a significant visual impact. Very short distance views toward the valve station will occur from areas surrounding the residence, with some partial screening provided by tree planting within the property.	Power Station: 3.2km Communication Tower: 3.7km Valve Station: 680m	Low	Potentially Long Term	High	**Power Station** Low **Communication Tower** Low **Valve Station** Low

View Location	Category of Viewer	View Context	Approx. distance from Project elements	Relative number of viewers	Estimated period of view	Viewer sensitivity	Potential Visual Impact
R15	Resident	Long distance views north east toward the proposed power station and communication tower from residential dwelling are largely screened by vegetation surrounding the residence. Medium distance views toward the valve station will be screened by scattered tree cover and low undulating landform to the east of the residence.	Power Station: 3.8km Communication Tower: 4.8km Valve Station: 2.2km	Low	Potentially Long Term	High	**Power Station** Low **Communication Tower** Low **Valve Station** Nil
R16	Resident	Long distance views north east toward the proposed power station and communication tower from residential dwelling are generally screened by influence of topography and vegetation. Potential views may extend toward the upper portions of the exhaust stacks which, at a medium to long distance, are unlikely to create a significant visual impact. Medium distance views toward the valve station will be screened by scattered tree cover and low undulating landform to the east of the residence.	Power Station: 3.2km Communication Tower: 4km Valve Station: 1.5km	Low	Potentially Long Term	High	**Power Station** Low **Communication Tower** Low **Valve Station** Nil
R17	Resident	Medium and long distance views north east and east toward the proposed power station and communication tower from residential dwelling are generally screened by vegetation surrounding the residence. Potential views may extend toward the upper portions of the exhaust stacks which, at a medium to long distance, are unlikely to create a significant visual impact. Medium distance views will extend toward the valve station.	Power Station: 2.8km Communication Tower: 3.5km Valve Station: 1.1km	Low	Potentially Long Term	High	**Power Station** Low **Communication Tower** Low **Valve Station** Low

Chapter 10 Landscape and Visual

View Location	Category of Viewer	View Context	Approx. distance from Project elements	Relative number of viewers	Estimated period of view	Viewer sensitivity	Potential Visual Impact
R18	Resident	Medium and long distance views north east and east toward the proposed power station and communication tower from residential dwelling are generally screened by vegetation surrounding the residence. Potential views may extend toward the upper portions of the exhaust stacks which, at a medium to long distance, are unlikely to create a significant visual impact. Medium distance views will extend toward the valve station.	Power Station: 2.3km Communication Tower: 2.9km Valve Station: 1.2km	Low	Potentially Long Term	High	**Power Station** Low **Communication Tower** Low **Valve Station** Low
R19	Resident	Medium and long distance views north east and east toward the proposed power station and communication tower from residential dwelling are generally screened by vegetation surrounding and beyond the residence. Potential views may extend toward the upper portions of the exhaust stacks which, at a medium to long distance, are unlikely to create a significant visual impact. Medium distance views toward the valve station will be partially screened by scattered tree cover beyond the residence.	Power Station: 2.3km Communication Tower: 3.4km Valve Station: 2km	Low	Potentially Long Term	High	**Power Station** Low **Communication Tower** Low **Valve Station** Low

View Location	Category of Viewer	View Context	Approx. distance from Project elements	Relative number of viewers	Estimated period of view	Viewer sensitivity	Potential Visual Impact
R20	Resident	Medium distance views south east toward the proposed power station and communication tower from the residential dwelling are largely screened by vegetation surrounding the residence. Long distance views toward the valve station will be screened by vegetation surrounding and beyond the residence.	Power Station: 2.3km Communication Tower: 3.7km Valve Station: 4.6km	Low	Potentially Long Term	High	**Power Station** Low **Communication Tower** Low **Valve Station** Nil
R21	Resident	Medium distance views south east toward the proposed power station and communication tower from residential dwelling are partially screened by vegetation. Potential views may extend toward the mid to upper portions of the exhaust stacks which, at a medium to long distance, are unlikely to create a significant visual impact. Long distance views toward the valve station will be blocked by landform and tree cover to the south and east of the residence.	Power Station: 2.9km Communication Tower: 4.3km Valve Station: 5.2km	Low	Potentially Long Term	High	**Power Station** Low **Communication Tower** Low **Valve Station** Nil

Chapter 10 Landscape and Visual

View Location	Category of Viewer	View Context	Approx. distance from Project elements	Relative number of viewers	Estimated period of view	Viewer sensitivity	Potential Visual Impact
R22	Resident	Long distance views west to north west toward the proposed power station, communication tower and valve station from the residential dwelling are screened by the influence of topography and tree cover..	Power Station: 5.9km Communication Tower: 4.4km Valve Station: 6.9km	Low	Potentially Long Term	High	**Power Station** Nil **Communication Tower** Nil **Valve Station** Nil
R23	Resident	Long distance views west to north west toward the proposed power station, communication tower and valve station from the residential dwelling are screened by the influence of topography and tree cover as well as localised vegetation surrounding the residence. Distant view toward the communication tower may extend from open agricultural areas within the property boundary.	Power Station: 5.3km Communication Tower: 4km Valve Station: 7.3km	Low	Potentially Long Term	High	**Power Station** Nil **Communication Tower** Low **Valve Station** Nil
R24	Resident	Long distance views west to north west toward the proposed power station, communication tower and valve station from the residential dwelling are screened by the influence of topography and tree cover.	Power Station: 4.4km Communication Tower: 4km Valve Station: 7.5km	Low	Potentially Long Term	High	**Power Station** Nil **Communication Tower** Nil **Valve Station** Nil

View Location	Category of Viewer	View Context	Approx. distance from Project elements	Relative number of viewers	Estimated period of view	Viewer sensitivity	Potential Visual Impact
R25	Resident	Long distance views west to north west toward the proposed power station, communication tower and valve station from the residential dwelling are screened by the influence of topography and tree cover.	Power Station: 6km Communication Tower: 5.7km Valve Station: 9.2km	Low	Potentially Long Term	High	**Power Station** Nil **Communication Tower** Nil **Valve Station** Nil
R26	Resident	Long distance views west to north west toward the proposed power station, communication tower and valve station from the residential dwelling are screened by the influence of topography and tree cover.	Power Station: 5.7km Communication Tower: 5.6km Valve Station: 8.9km	Low	Potentially Long Term	High	**Power Station** Nil **Communication Tower** Nil **Valve Station** Nil
R27	Resident	Long distance views west to north west toward the proposed power station, communication tower and valve station from the residential dwelling are screened by the influence of topography and tree cover.	Power Station: 5.4km Communication Tower: 6km Valve Station: 8.6km	Low	Potentially Long Term	High	**Power Station** Nil **Communication Tower** Nil **Valve Station** Nil

View Location	Category of Viewer	View Context	Approx. distance from Project elements	Relative number of viewers	Estimated period of view	Viewer sensitivity	Potential Visual Impact
R28	Resident	Long distance views west to north west toward the proposed power station, communication tower and valve station from the residential dwelling are screened by the influence of topography and tree cover.	Power Station: 4.2km Communication Tower: 5.2km Valve Station: 7km	Low	Potentially Long Term	High	**Power Station** Nil **Communication Tower** Nil **Valve Station** Nil
R29	Resident	Long distance views south toward the proposed power station from residential dwelling are generally screened by influence of topography and vegetation.	Power Station: 5.4km Communication Tower: 6.5km Valve Station: 8.1km	Low	Potentially Long Term	High	**Power Station** Nil **Communication Tower** Nil **Valve Station** Nil
R30	Resident	Long distance views south toward the proposed power station from residential dwelling are generally screened by influence of topography and vegetation.	Power Station: 4.7km Communication Tower: 6km Valve Station: 7.4km	Low	Potentially Long Term	High	**Power Station** Nil **Communication Tower** Nil **Valve Station** Nil

View Location	Category of Viewer	View Context	Approx. distance from Project elements	Relative number of viewers	Estimated period of view	Viewer sensitivity	Potential Visual Impact
R31	Resident	Long distance views south toward the proposed power station from residential dwelling are generally screened by influence of topography and vegetation.	Power Station: 5.1km Communication Tower: 5km Valve Station: 8.3km	Low	Potentially Long Term	High	**Power Station** Nil **Communication Tower** Nil **Valve Station** Nil
R32	Resident	Long distance view west to south west toward the proposed power station from residential dwelling are likely to be screened by the influence of topography and vegetation as well as tree cover surrounding the residence. Short to medium distance views from the residence toward the communication tower will be partially screened by tree cover surrounding the residence.	Power Station: 3.2km Communication Tower: 2.1km Valve Station: 5.5km	Low	Potentially long Term	High	**Power Station** Low **Communication Tower** Low **Valve Station** Nil

Chapter 10 Landscape and Visual

10.5.4 Summary of Visibility Assessment

A total of thirty four potential view locations were identified as part of the visual assessment process.

For the proposed Power Station layout, an assessment of the visibility rating for each potential view location indicated the following:

- a **NIL** visibility rating for 16 of the 34 view locations has been determined, while a **LOW** visibility rating has been determined for 18 view locations;

For the proposed Communication Tower infrastructure, an assessment of the visibility rating for each potential view location indicated the following:

- a **NIL** visibility rating for 15 of the 34 view locations has been determined, while a **LOW** visibility rating has been determined for 19 view locations; and

For the proposed Valve Station:

- a **NIL** visibility rating for 22 of the 34 view locations has been determined, while a **LOW** visibility rating has been determined for 12 view locations.

Given the extent and combination of existing natural and cultural character surrounding the Project, the capability of the landscape to absorb the key components of the Project is considered to be high.

There are unlikely to be any significant views toward the power station from local roads or access tracks. Views are likely to be restricted to portions of the exhaust stacks and would be generally for a short duration where visible. All 19 view locations likely to be impacted by views towards the communications tower have been determined as having a low visibility rating for this feature. A significant consideration in the assessment has been that distant views toward the tower are likely to be influenced by atmospheric conditions which would tend to reduce the visibility of the tower.

External to the AGL Site boundary, the proposed valve station would be set back approximately 25m from Walshs Road. The assessment has concluded that the valve station is unlikely to result in significant visual impacts due to its location within an area of low density population as well as the small number of motorists travelling along Walshs Road on a daily basis. Appropriate mitigation measures would reduce the visual contrast of the infrastructure and therefore reduce the visual impact of this infrastructure from passing traffic and the nearest residential view locations.

The access road, control building, ancillary infrastructure and constructed gas pipeline would generally not be visible from most view locations.

10.6 Mitigation Measures

The overall potential visual impact of the Project has been assessed as low, however reducing the extent of visual contrast between the visible portions of the Project's structures and the surrounding landscape would further mitigate the impact.

A summary of the visual mitigation measures is presented in **Table 10-4**.

Table 10-4 Summary of Visual Mitigation Measures

Mitigation Measures	Implementation of mitigation measures		
	Design	Construction	Operation
Materials utilised in the construction of the power station and valve station would be generally dark in tone and where possible non reflective.	✓	✓	✓
Lighting would avoid direct line of sight towards homesteads beyond the site.	✓	✓	✓
Top of the stacks would not have lighting unless required for aviation safety.	✓	✓	✓
Large floodlights not to be used other than for emergency lighting.			✓
Security lighting would not spill onto neighbouring residences. This would be achieved through the use of down lights and motion sensor lighting.			✓

Traffic and Transport – Summary of Key Outcomes

The Dalton Power Project is located to the east of Walshs Road, approximately 3 km north of the town of Dalton. Access to the Site would be via a new access road to be developed from Walshs Road where the road takes a 90 degree turn to the west. The access road, approximately 1.9 km in length, would extend from Walshs Road in a north east direction to the Site, and would be a shared easement with the northern portion of the proposed gas pipeline. AGL proposes to construct the new access road in compliance with applicable standards for the purposes of constructing and operating the Dalton Power Project.

The traffic and transport assessment found that the arterial road network can satisfactorily and safely accept the additional traffic generated by the development during the construction, operational and maintenance phases. Over-mass and over-dimensional loads such as the gas turbines, generators and transformers would be transported to Site under RTA and NSW Police permit conditions and along approved routes. Temporary works may be required along approved routes for these over-mass and over-dimensional loads and would be defined in further consultation with the RTA and relevant Councils.

Chapter 11 Traffic and Transport

11.1 Introduction

This traffic and transport assessment addresses the traffic related impacts associated with the construction and operation of the proposed Dalton Power Project. The assessment was conducted by URS and is presented in full in **Appendix F**.

11.2 Existing Context

11.2.1 Regional and local context

The regional road network is dominated by the Hume Highway (State Highway 31), which provides a connection between Sydney and Melbourne. Dalton is approximately 205 km (by road / travelling distance) south west of Sydney and 48 km from Goulburn, which is the nearest regional centre. The Site would therefore be accessed from the Hume Highway via Collector Road, Yass Street, Warrataw Street, Dalton Road, Walshs Road, and a new access road extending approximately 1.9 km in a north east direction from Walshs Road property to the Facility.

The Site is approximately 18.1 km from the Hume Highway. The regional and local road context is illustrated in **Figure 11-1 and Figure 11-2.**

From Gunning, Dalton Road travels in a north-west direction. Approximately 3.4 km along Dalton Road, Walshs Road intersects Dalton Road travelling in a northern direction. Following a 90-degree turn west, Walshs Road continues north and adjoins the Site as the western boundary to the former "Holmes" property.

A preliminary route survey report for the haulage of over-mass and over-dimensional equipment associated with the Project indicated that the preferred route to Walshs Road and the site would be via the Hume Highway, Hume Street, Grovenor Street and Dalton Road.

11.2.2 Level of Service

Rural Roads - Two-Lane, Two-Way

In accordance with the *Guide to Traffic Engineering Practice, Part 2: Roadway Capacity*, the Levels of Service relevant to rural local roads are summarised in **Table 11-1**. The threshold volumes for the vehicles per day (vpd) associated with each Level of Service, are based on the combined counts for both directions. These traffic volumes account for total vehicle movements.

Table 11-1 Levels of Service Rural Two-Way, Two-Lane Roads

Level of Service	Traffic Volume Threshold (Rolling Terrain)	Traffic Volume Threshold (Level Terrain)	Definition
A	700 vpd	1,600 vpd	Free-flow conditions with a high degree of freedom for motorists to select speed and manoeuvre within traffic flow
B	1,800 vpd	3,200 vpd	Stable flow conditions, reasonable freedom to select speed and manoeuvre within traffic flow
C	3,500 vpd	5,300 vpd	Stable flow conditions, restricted freedom to select speed and manoeuvre within traffic flow
D	5,300 vpd	9,000 vpd	Approaching unstable flow conditions, severely restricted to select speed and manoeuvre within traffic flow
E	9,900 vpd	15,200 vpd	Close to capacity, virtually no freedom to select speed and manoeuvre within traffic flow. Small increases in traffic volume would generally cause operational problems.

Roads operating at a Level of Service of C or better are generally considered to have acceptable flow conditions.

11.2.3 Road Environs

Walshs Road

Walshs Road is a two-way unsealed access road, with a width of approximately 6 m along the majority of its length. There are two 90-degree bends in Walshs Road adjacent to the “Springwood” property (Lot 201) and at Darby’s Road. Walshs Road has a posted speed limit of 50 km/ hour. A truck warning sign is posted near the point where the road makes a 90-degree turn west. The condition of the gravel is poor in some locations with potholing including in the vicinity of this bend in the road.

There are a number of large trees within the clearzone of the trafficable lanes along the length of Walshs Road.

There is a culvert located approximately 80 m east of the access to the “Wilmont” property (Lot 343). A flood / causeway across Walshs Road, consists of relatively steep grades on both approaches and the carriageway narrows at this location.

The southern portion of Walshs Road, which is signposted as a Loop Road, is a two-way unsealed access road with a width of approximately 6 m along the majority of its length. There are two 90-degree bends in this road.

Traffic counters were installed on the southern portion of Walshs Road, north of Dalton Road for a period of one week. Based on the traffic surveys conducted, Walshs Road is likely to be currently operating at Level of Service A.

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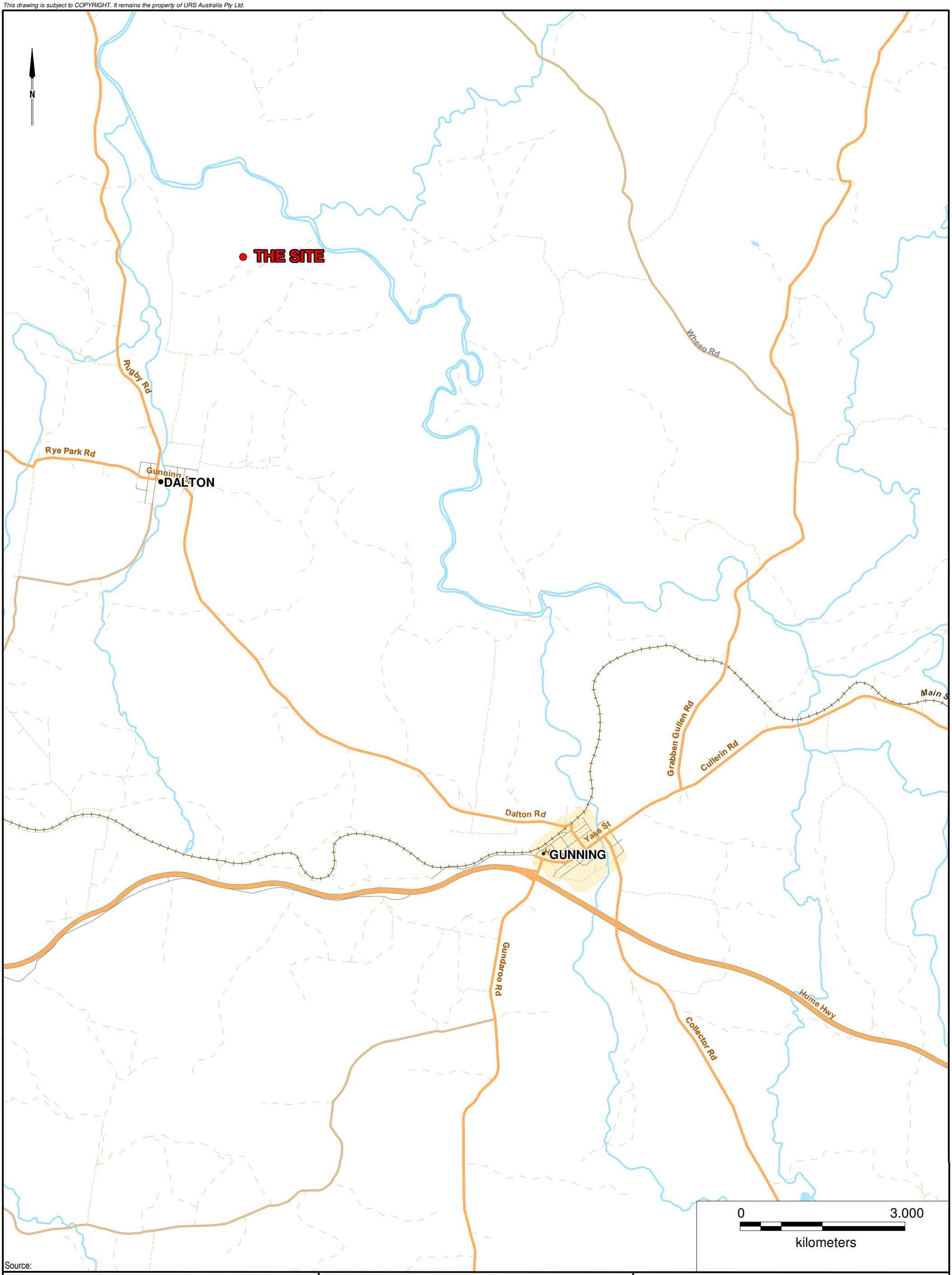
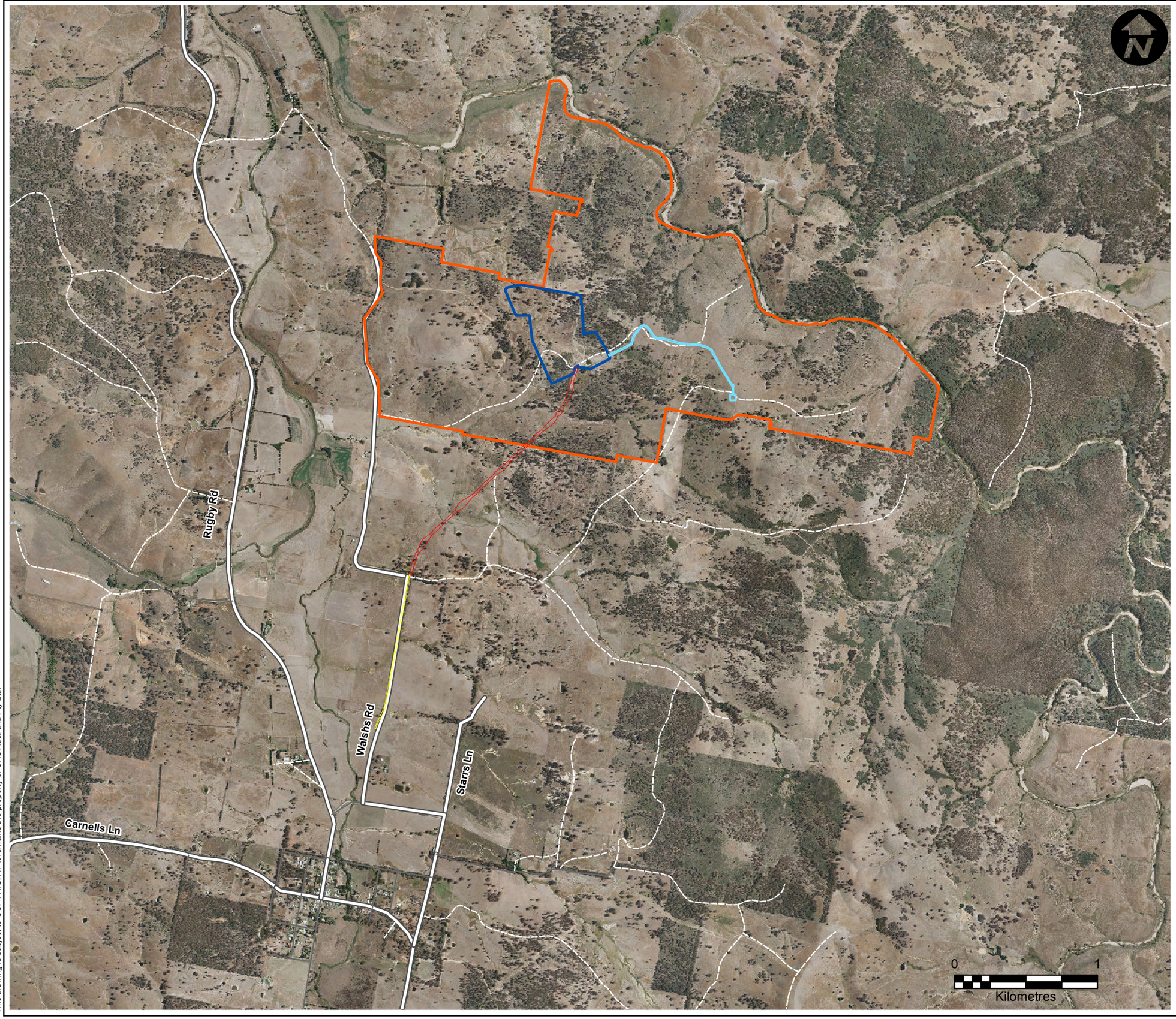


Source:

Client: AGL	Project: DALTON POWER PROJECT		Title: **REGIONAL TRAFFIC NETWORK**
URS	Drawn: AO	Approved: KT	Date: 24/02/2011
	Job No: **43177661**	File No: 43177661.003.wor	Figure: **11-1**



Legend

- AGL Site Boundary
- Plant Footprint
- Gas Pipeline (northern) and Access Road
- Gas Pipeline (southern)
- Communications Tower and Hut Footprint
- Communication Tower Services and Access Track
- Main Connecting Roads

0 1
Kilometres

Source: Aerial Image from AGL

Drawn: SB/AY	Approved: KT	Date: 15/02/2011
Job No.: 43177661	File No.: 43177661.051.mxd	

Client

AGL

Project

DALTON POWER PROJECT

Title

MAIN CONNECTING ROADS TO SITE

Figure: 11-2

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Chapter 11 Traffic and Transport

Dalton Road

Dalton Road is a two-lane, two-way configuration approximately 6.5 to 7 m in width, with a shoulder along its entire length of between 0.5 and 1 m. The posted speed limit is 100 km / hour. There are overtaking opportunities in both directions for the majority of its length.

Dalton Road consists of an undulating terrain and is tree-lined, with some large trees within the clear zone. There are a limited number of accesses to rural properties from Dalton Road.

Based on the traffic surveys conducted east of Medways Lane, Dalton Road is currently operating at Level of Service A.

Warrataw Street

Warrataw Street, Gunning consists of a two-lane, two-way configuration, with a posted speed limit of 50 km / hr. The railway overpass on Warrataw Street is very narrow, with tight bends and poor sight distances for opposing vehicles and traffic turning from Grovenor Street. Potential safety issues associated with this would be further investigated by AGL during the detailed design phase, and may involve establishing specific traffic management measures particularly during over-mass and over-dimensional load transport

Based on the traffic surveys conducted, Warrataw Street is currently operating at Level of Service A.

Hume Street (Yass Street)

Hume Street, Gunning, is a two-lane, two-way configuration, with a wide carriageway and approximately 2 m shoulder along the majority of its length. There are a number of overhead powerlines located across Hume Street. A school zone and pedestrian crossing is located on Hume Street, southwest of its intersection with Warrataw Street.

Based on the traffic surveys conducted, Hume Street is currently operating at Level of Service A.

Collector Road

Collector Road, Gunning, is a two-lane, two-way configuration, with a lane width of approximately 3.5 m. Collector Road provides access to the on and off-ramps for the Hume Highway.

Based on the traffic surveys conducted, Collector Road is currently operating at Level of Service A.

Hume Highway

The Hume Highway is classified National Highway 31 and State Highway 2. The Hume Highway is part of the Auslink National Network and is a vital link for road freight transport between Sydney and Melbourne. For approximately 92 % of its length in NSW and in close proximity to Gunning, the Hume Highway consists of a dual carriageway (two lanes in each direction) with a posted speed limit of 110 km / hr.

The RTA sample count station nearest to the Project site, 1 km west of Gundaroo Road (MR52), records the latest Annual Average Daily Traffic (AADT) two-way volume of 13,094 vehicles per day (RTA, 2006).

11.2.4 Key Intersections

SIDRA Intersection, version 3.2 was used to analyse the existing operation of the Warrataw Street, Grovenor Street and Dalton Road intersection.

The following key intersections were analysed:

- Warrataw Street / Grovenor Street / Dalton Road, Gunning;
- Grovenor Street / Hume Street, Gunning; and
- Gundaroo Street / Hume Street, Gunning.

All the above intersections are give-way controlled. The results of the analysis is presented in **Appendix F**. These key intersections all currently operate at Level of Service A.

Operational traffic is not likely to have a significant impact on the key intersections, accounting for up to five vehicle trips within the peak hours. This increase in traffic volume is likely to be dissipated in normal traffic fluctuations.

As discussed in **Chapter 4** *Project Description*, post construction maintenance would occur once every 3 years at the most. Ongoing maintenance activity would therefore not be expected to have a significant impact on the surrounding road network.

11.3 Traffic Generation

11.3.1 Construction Traffic Generation

The Dalton Power Project would be constructed in two stages, and would involve the installation of up to a total of six gas turbine units. The Stage 1 of the project would involve the majority of site preparation works and road construction, as well as the installation of up to four turbine units and ancillary works. The construction program for Stage 2 would involve installing the residual generating capacity for a completed maximum of six turbines on site.

Although it is assumed that the construction activities would be generally similar to the first stage, the intensity is likely to be lower for Stage 2 as the majority of site preparation works and infrastructure would be already established. For the purposes of this assessment, discussion of the 'construction phase' impact may apply to either Stage 1 or 2 project phases.

The number of vehicle movements is summarised in **Table 11-2** and has been based upon usual construction practices and activities and the anticipated level of staffing that is expected for the construction of the Facility. Operating hours, staffing details and information on construction vehicles is presented in **Chapter 4.**

Table 11-2 Construction Traffic Generation Predicted Average

Stage	Duration (Months)	Per Month		Per Week		Per Day	
		HV	LV	HV	LV	HV	LV
Construction	24	271	694	68	173	12	28

HV=Heavy vehicle
LV= Light vehicle

11.3.2 Over-dimensional, Over-mass Transport

The large gas turbines, generator and high voltage transformer components are to be imported into Australia and transported to site by special road convoy. A total of 24 over-dimensional and / or over-mass escorted truck convoys of pre-assembled gas turbine, generator and transformer units would occur for the gas turbine facility. These over-dimensional and / or over-mass deliveries assumes six convoys of up to four over-mass / over-size vehicles towing one multi-wheel transport unit as the maximum for either Stage 1 or 2. The cumulative total does not need to be considered as construction for Stage 1 would not coincide with Stage 2.

It is anticipated the majority of heavy plant items would be transported from Port Kembla (Wollongong) during the construction stage. A preliminary route survey by a haulage contractor was commissioned by AGL to determine the preferred route for the haulage of equipment, and the preliminary route selection for the transportation of large items to the Site is discussed in more detail in Section 3.2 of **Appendix F**.

When assessing the route to carry the heavy plant items, the following issues must be addressed:

- grade along each route;
- width of cross-section;
- degree of works required to accommodate over-mass, over-dimension vehicles;
- co st; and
- dire ctness of route.

No improvements or temporary upgrades of the state road network are envisaged at this time between Port Kembla and Gunning. However, works may be required between Gunning and the Site to accommodate over-mass and over-dimensional loads. The preliminary haulage study identified the following potential constraints and requirements:

- Hume Highway crossing of Paddy's River at Marulan: bridge constraints require a temporary alternate low level crossing over River at this point;
- Gunning Rail Bridge: bridge constraints require either replacement of the bridge or identifying alternate route via a temporary low level crossing;
- Walshs Road (south, as known locally as Cowper St), Dalton: 90 degree corners and floodway constrain access potentially requiring upgrades.

Further assessment and planning is required during the detailed design phase to identify and cater for any necessary temporary remedial treatments to facilitate passage of over-mass and over-dimensional loads once the actual weight and dimensions of the proposed plant equipment is known.

Management by experienced haulage contractors and liaison with the permit section of the RTA, NSW Police and local governments will be undertaken to ensure the safety and amenity of the greater community. AGL would continue liaison and engagement with the RTA and relevant Councils responsible for the infrastructure that may require upgrade. AGL would support the remedial treatments required through some mechanism of financial approval pending Project Approval.

11.3.3 Operational Phase

During the operational phase of the development, staff numbers are expected to average seven full-time staff per day, which equates to twelve to fourteen vehicle trips per day with four to five vehicle trips during the peak hours. The peak periods can be defined as the time of day during which the largest number of vehicles populate the road carriageway. Generally, these time periods would coincide with vehicle trips associated with the journey to and from work by power plant employees, work related deliveries and local residents.

11.3.4 Major Facility Maintenance Phase

Major maintenance is likely to occur once every three years at the most, and would be conducted over a period of four to six weeks. Major maintenance is expected to require up to 100 contractors on-site, generating approximately 90 vehicle trips during the peak hour, equating to 180 vehicle trips per day.

11.3.5 Water Supply

AGL is considering a number of options for water supply to the Facility during operation. Water for the Project could be sourced through a number of options. Site water could be sourced from a range of sources including: tankering water (by road) to the Site; groundwater extraction; and via the augmentation of the Dalton or Gunning supply and/or from the Gunning Sewerage Treatment Plant if the water quality is suitable and sufficient water quantities are available. It is assumed that the Facility

would not be supplied entirely by trucking water. For the purposes of the traffic assessment, a maximum of 12.5 ML per annum and no more than 10 truck deliveries per day for each of Stage 1 and Stage 2 of the project (25 ML per annum in total) is assumed. Assuming a standard road tanker of 20 kL, up to approximately 400 kL/d, or 20 truck deliveries per day, could be supplied to the site in any single day. This equates to 40 vehicle movements per day of which it is assumed that 10 % of these movements would occur during the AM peak hour. For the purposes of the traffic assessment, it is assumed that the reminder of water supply is provided by on-site groundwater or via the augmentation of the Dalton or Gunning supply.

Feed tankage would need to be provided to accommodate variable demand.

11.4 Assessment of Potential Impacts

11.4.1 Road Environs

Walshs Road South

Access to the Site would be via a new access road to be developed from Walshs Road where the road takes a 90 degree turn to the west. The 1.9 km access road would extend from Walshs Road in a north east direction to the Site, and would be a shared easement with the northern portion of the proposed gas pipeline.

The impact on Walshs Road with respect to increased traffic volumes is summarised in **Table 11-3**. All traffic volumes account for total vehicle movements.

Table 11-3 Estimated Weekday Traffic Flow Impacts - Walshs Road (sth)

Activity	Average Daily Traffic (Construction)	Average Daily Traffic (Operation)	Average Daily Traffic (Major Maintenance)
No Development			
Traffic Flow	23 23 23		
Level of Service	A	A	A
With Development			
Construction Traffic (Peak Construction)	160	0	0
Major Maintenance	0	0	180
Water Supply for Operation of Facility[4]	40		
Operational Traffic	0	10	10
Total Traffic Flow	183[1]	73[2]	213[3]
Percentage Change (from No Development)	+696%	+217%	+826%
Midblock Level of Service	A	A	A

Notes:
1. Approximately 11 percent heavy vehicle component;
2. Approximately 55 percent heavy vehicle component;
3. Less than one percent heavy vehicle component; and
4. Worst case assuming water supply is by truck delivery and peak summer requirement for Stage 2 (1500 MW).

Despite this significant increase in traffic volumes, the Level of Service for Walshs Road (south) remains unchanged at Level of Service A. Level of Service A is considered acceptable for Walshs Road (south) during the periods indicated.

Dalton Road

The impact on Dalton Road with respect to increased traffic volumes is summarised in **Table 11-4**. All traffic volumes account for total vehicle movements.

Table 11-4 Estimated Weekday Traffic Flow Impacts - Dalton Road

Activity	Average Daily Traffic (Construction)	Average Daily Traffic (Operation)	Average Daily Traffic (Major Maintenance)
No Development			
Traffic Flow	287	287	287
Level of Service	A	A	A
With Development			
Construction Traffic (Peak Construction)	160	0	0
Major Maintenance	0	0	180
Operational Traffic	0	10	10
Water Supply for Operation of Facility[4]	40		
Total Traffic Flow	447[1]	337[2]	477[3]
Percentage Change (from No Development)	+56%	+17%	+66%
Midblock Level of Service	A	A	A

Notes:
1. Approximately four percent heavy vehicle component;
2. Approximately 12 percent heavy vehicle component;
3. Less than one percent heavy vehicle component; and
4. Worst case assuming water supply is by truck delivery and peak summer requirement for Stage 2 (1500 MW).

In the peak traffic periods the Level of Service is maintained at Level of Service A, which is acceptable for Dalton Road during the periods indicated.

Warrataw Street

The impact on Warrataw Street with respect to increased traffic volumes is summarised in **Table 11-5**. All traffic volumes account for total vehicle movements.

Table 11-5 Estimated Weekday Traffic Flow Impacts - Warrataw Street

Activity	Average Daily Traffic (Construction)	Average Daily Traffic (Operation)	Average Daily Traffic (Major Maintenance)
No Development			
Traffic Flow	230	230	230
Level of Service	A	A	A
With Development			
Construction Traffic (Peak Construction)	160	0	0
Major Maintenance	0	0	180
Operational Traffic	0	10	10
Water Supply for Operation of Facility[4]	40		
Total Traffic Flow	390[1]	280[2]	420[3]
Percentage Change (from No Development)	+70%	+22%	+83%
Midblock Level of Service	A	A	A

Notes:
1. Approximately five percent heavy vehicle component;
2. Approximately 14 percent heavy vehicle component;
3. Less than one percent heavy vehicle component and
4. Worst case assuming water supply is by truck delivery and peak summer requirement for Stage 2 (1500 MW).

In the peak traffic periods the Level of Service is maintained at Level of Service A, which is acceptable for Warrataw Street during the periods indicated.

Hume Street

The impact on Hume Street with respect to increased traffic volumes is summarised in **Table 11-6**. All traffic volumes account for total vehicle movements.

Table 11-6 Estimated Weekday Traffic Flow Impacts - Hume Street

Activity	Average Daily Traffic (Construction)	Average Daily Traffic (Operation)	Average Daily Traffic (Major Maintenance)
No Development			
Traffic Flow	710	710	710
Level of Service	A	A	A
With Development			
Construction Traffic (Peak Construction)	160	0	0
Major Maintenance	0	0	180
Operational Traffic	0	10	10
Water Supply for Operation of Facility[4]	40		
Total Traffic Flow	870[1]	760[2]	900[3]
Percentage Change (from No Development)	+23%	+7%	+27%
Midblock Level of Service	A	A	A

Notes:
1. Approximately two percent heavy vehicle component;
2. Approximately five percent heavy vehicle component;
3. Less than one percent heavy vehicle component;
4. Worst case assuming water supply is by truck delivery and peak summer requirement for Stage 2 (1500 MW).

In conclusion, despite increases in peak traffic on all of the affected roads, the Level of Service is maintained at Level of Service A, which is acceptable for these roads during the periods indicated.

11.4.2 Key Intersections

The key intersections have been analysed for impacts associated with construction traffic. **Table 11-7** summarises the results of this analysis.

Table 11-7 Analysis of Key Intersections - Peak Construction Traffic (AM Peak Hour)

Intersection	Scenario	Degree of Saturation (vehicle / capacity)	Average Delay (seconds)	Level of Service	95% Back of Queue Length (metres)
Dalton Road / Grovenor Road / Warrataw Street	No Development	0.02	4	A	1
	With Development	0.67	6	A	2
Grovenor Road / Hume Street	No Development	0.02	8	A	1
	With Development	0.53	7	A	2
Gundaroo Road / Hume Street	No Development	0.03	8	A	0
	With Development	0.56	8	A	0

Source: URS, September 2009, using SIDRA Intersection, version 3.2

Operational traffic is not likely to have a significant impact on the key intersections as the total number of vehicles generated during the operational phase peak hours is less than those experienced in the construction phase peak hours. The intersection analysis for the construction phase AM Peak Hour indicates no impact in each intersection's Level of Service and therefore this would also apply to the operation phase AM peak hour.

Major maintenance is expected to occur relatively infrequently, once every three years at the most. Ongoing maintenance requirements would therefore not be expected to have a significant impact on the key intersections.

11.4.3 Over-dimensional, Over-mass Transportation

The gas turbine, generator and high voltage transformer components are to be imported into Australia and then transported to site by road. Typically the components might be up to 14 m in length and 5 m in width, 5 m in height and weigh nominally up to 350 tonnes.

A total of 24 over-dimensional and / or over-mass escorted truck convoys of pre-assembled gas turbine, generator and transformer units would occur for the gas turbine facility. These over-dimensional and / or over-mass deliveries assumes six convoys of up to four over-mass / over-size vehicles towing one multi-wheel transport unit as the maximum for either Stage 1 or 2. The cumulative total does not need to be considered as construction for Stage 1 would not coincide with Stage 2.

Chapter 11 Traffic and Transport

As described in **Chapter 4** ***Project Description***, the Project would also encompass the construction of one or two additional transmission structures to be located at the southern end of the facility footprint within the existing transmission line easement, and a communication tower to be constructed approximately 1.5km to the east of the power station. The tower components would be prefabricated sections delivered to site on flat bottom semi-trailers, ready for assembly on site. The estimated number of semi-trailer deliveries to site would be around 9 truck movements for the one or two transmission towers, as well as the communications tower required for the Project.

An estimate of the number of vehicles required to deliver the gas turbine, communications tower components and equipment for construction is summarised in **Table 11-8**. The traffic generated by equipment transportation is assumed to occur during site establishment in off-peak periods. These estimates have not been considered in the estimates associated with construction traffic generation.

Table 11-8 Turbine Components and Equipment Delivery Traffic Estimates

Component	Purpose	Traffic Generation		
		Semi-Trailer	Over-Size	Over-Mass
Cranes	Assembling fabricated building items and positioning plant equipment	9		
Bulldozers	Clearing of vegetation, removal of topsoil, development of internal roads and drainage swales	1		
Scrapers	Removal of topsoil, development of internal roads and drainage swales and basins	2		
Graders Site	levelling		2	
Excavators Ex	cavation of soil, grading and levelling the site		5	
Backhoe Excavators	Trenching		3	
Compactor, Rollers	Earth, road base, foundation and pad compaction	5		
Turbine Components	Facility			24[1]
Tower Components	Transmission line connection and Communications Tower	9		
Total		**18**	**18**	**24**

Notes:
1. Assumed six convoys of up to four over-mass / over-size vehicles towing one multi-wheel transport unit.

11.4.4 Operational Phase

Although operational activities would increase traffic levels, all roads assessed maintained a Level of Service A. It is anticipated that the operational traffic would be readily accepted by the surrounding road network.

Parking would be catered for on site for plant employees and business vehicles in accordance with the RTA's Guide to Traffic Generating Developments, Australian Standards and council requirements. No impact or treatment is necessary to facilitate parking on the state road network, with the exception of any temporary stop locations identified during the haulage of over-dimensional plant equipment.

11.5 Mitigation Measures

The main impacts from construction traffic are likely to occur:

- during the morning peak between 7.00 to 9.00 AM when construction staff and early delivery vehicles coincides with the peak periods on the surrounding road network;
- through regular daily traffic generated by delivery trucks for equipment, plant and materials with intermittent peaks associated with concrete pours; and
- occasionally outside of peak periods, through the delivery of large equipment (turbines, generators and transformers) from Port to the site.

Table 11-9 presents a summary of the traffic mitigation measures.

Table 11-9 Summary of Traffic Mitigation Measures

Mitigation Measure	Implementation		
	Design	Construction	Operation
AGL would continue liaison with the relevant regulatory authorities about over-mass, over-dimension transport requirements throughout the detailed design phase.	✓		
Once details are confirmed about widening and re-grading works required to facilitate the movement of over-mass, over-dimension vehicles, AGL would implement or pay for required temporary improvements, pending project approval.	✓	✓	
Development of detailed Transport Plan (including obtaining approvals) for the transportation of turbine and tower components and equipment.	✓	✓	
Development of detailed Traffic Management Plan for the construction phase.	✓		
Undertake a detailed pavement and structure analysis on all affected sections of road prior to, and following construction. Provide Upper Lachlan Shire Council with a copy of the assessment.		✓	
Undertake an analysis of the horizontal and vertical alignment to determine the adequacy of the affected public road network for all expect traffic types prior to construction. Provide Upper Lachlan Shire Council with a copy of the assessment.		✓	
Development of a Traffic Management Plan for the operational phase if required.			✓
Transport of over-mass and over- dimensional loads to be undertaken under RTA and NSW Police permit conditions and approved routes.		✓	

Noise Assessment – Summary of Key Outcomes

This chapter provides an overview of the potential noise impacts of the construction activities and operation of Project.

The noise assessment for operation of the Facility addressed general continuous operations, potential for sleep disturbance and low frequency and tonal noise. The noise assessment for construction addressed construction activities for the Facility, gas pipeline and access road, communications tower infrastructure (including access track) and off site traffic noise on public roads generated during construction. Vibration impacts of the proposed construction and operation have not been assessed in detail given the substantial distances from the Facility to the nearest residential receptors.

The predicted noise impacts of the proposed development upon the nearest potentially affected noise sensitive receptor locations have been assessed with consideration of the following guidelines:

- NSW Office of Environment and Heritage (OEH) *Industrial Noise Policy* (INP, EPA 1999) for the assessment of the operational noise of the proposed development;
- NSW OEH *Environmental Criteria for Road Traffic Noise* (ECRTN, EPA 1999) for the assessment of the off-site traffic noise on public roads; and
- NSW OEH *Interim Construction Noise Guidelines* (ICNG, DECC, 2009) for the assessment of the noise from construction of the proposed development.

The adopted noise limits are the lowest permissible noise limits as specified in the NSW *Industrial Noise Policy*.

The study concluded that the noise criteria can be achieved with no further noise mitigation measures beyond those already proposed by AGL.

The following provides a summary of the outcomes of the assessment of potential acoustic impacts:

- Operation:
  - Noise levels generated by the proposed operation would be within the established noise limits at all receptor locations under neutral and the prevailing meteorological conditions at the Site.
- Sleep Disturbance:
  - Predicted noise levels are within the sleep disturbance noise limits established taking into consideration in accordance with the INP, ECRTN and WHO guidelines.
- Low Frequency and Tonal Noise:
  - The assessment indicates that low frequency noise may exceed the INP Low Frequency Noise criteria at three residences.
  - An alternative assessment of low frequency and tonal noise impacts undertaken in line with an alternative assessment model, and the application of which is supported by international research, suggests that the predicted low frequency noise would not be at a level to cause annoyance to any residential receptors. Consequently, no adjustment to the A-weighted predicted operational noise levels would be required under this model.

- Notwithstanding this, AGL will commence discussions with receptors B, C and D (see **Table 12-3**) regarding this assessment, with a view to reaching agreement with them on noise management for the project consistent with other developments.

- Con struction Noise:
  - No exceedance of the noise limit is expected at any residential locations during the proposed construction phase of the power station.
  - During pipeline construction, some exceedances may be experienced at Receptor D.
- Off-Site Traffic Noise:
  - Construction: The predicted increases in road traffic noise levels are up to 2 dB at the most potentially affected dwellings. The resulting levels remain within the off-site traffic noise criteria.

On the basis of this assessment, it is concluded that noise impacts of the proposed construction and operation of the plant and proposed gas pipeline and access road are not expected to degrade the existing acoustic environment nor create annoyance to the residential receptor locations surrounding the Facility.

12.1 Introduction

Potential noise impacts associated with the proposed construction and operational activities are assessed in accordance with the following NSW Office of Environment and Heritage (OEH) guidelines:

- NSW *Industrial Noise Policy* (INP, EPA 2000) for the assessment of the operational noise of the proposed development;
- NSW *Environmental Criteria for Road Traffic Noise* (ECRTN, EPA 1999) for the assessment of the off-site traffic noise on public roads; and
- NSW *Interim Construction Noise Guidelines* (ICNG, DECC 2009) for the assessment of the noise from construction of the proposed development.

Potential for sleep disturbance has also been assessed as the proposed development is a 'peaking' power station and could operate at any time.

12.2 Methodology

12.2.1 Assessment Process

The INP outlines processes to help strike a feasible and reasonable balance between the establishment and operation of industrial activities and the protection of the community from noise levels that are intrusive or unpleasant.

In summary, noise management in accordance with the INP involves the following main steps:

1) Determining the project specific noise levels for intrusiveness and amenity that are relevant to the Project.
2) Measuring and determining existing background and ambient noise levels, using the method relevant to the expected level of impact.
3) Where the proposed development is expected to produce annoying noise characteristics, adjustments are to be applied to the noise levels produced by the development in question.
4) Predicting or measuring the noise levels produced by the development in question, having regard to meteorological effects (such as wind, temperature inversions).
5) Comparing the predicted or measured noise level with the project-specific noise levels and assessing impacts.
6) Considering feasible and reasonable noise mitigation strategies where the project-specific noise levels are exceeded.
7) Negotiation between the regulatory / consent authority and the proponent and between the community and the proponent to evaluate the economic, social and environmental costs and benefits from the proposed development against the noise impacts.
8) The regulatory / consent authority sets statutory compliance levels that reflect the achievable and agreed noise limits for the development.

9) Monitoring of environmental noise levels from the development to determine compliance with the consent / licence conditions.

Steps 1 to 6 were included as part of the noise assessment. Steps 7 to 9 will follow as part of the approvals process (if required).

12.2.2 Understanding Noise

Sound may be defined as any pressure variation that the human ear can detect. As the ear responds logarithmically to stimuli, it is more practical to express acoustic parameters as a logarithmic ratio of the measured value to a reference value. This logarithmic ratio is called a decibel or dB. The smallest perceptible change is about 1 dB.

The most common frequency weighting in current use is “A-weighting” providing results often denoted as dB(A), which conforms approximately to the response of the human ear.

For reference, **Table 12-1** presents the sound pressure levels of some common sources.

Table 12-1 Sound Pressure Levels of Some Common Sources

Sound Pressure Level (dB)	Sound Source	Typical Subjective Description
140	Propeller aircraft; artillery fire, gunner’s position	Intolerable
120	Riveter; rock concert, close to speakers; ship’s engine room	
110 Grindi	ng; sawing	
100	Punch press and wood planers, at operator’s position; pneumatic hammer or drilling (at 2 m)	Very noisy
80	Kerbside of busy highway; shouting; Loud radio or TV	Noisy
70	Kerbside of busy traffic	
60	Department store, restaurant, conversational speech	
50	General office	Moderate to quiet
40	Private office; Quiet residential area	Quiet
30	Theatre; quiet bedroom at night	
20	Unoccupied recording studio; Leaves rustling	Very quiet
10	Hearing threshold, good ears at frequency of maximum sensitivity	
0	Hearing threshold, excellent ears at frequency maximum response	

The most important factors affecting the way noise travels through the air and how it arrives at the receiver are:

- type of source (point or line);
- distance from source;
- atmosp heric absorption;
- wind;
- temperature and temperature gradient;

- obstacles such as barriers and buildings;
- grou nd absorption;
- reflec tions;
- humidity; and
- pre cipitation.

12.2.3 Construction and Operational Noise Calculation

Noise levels due to the proposed construction and operation of the plant at the identified noise sensitive receptor locations have been predicted using an acoustic computer model created in SoundPLAN Version 6.5. This program is used and recognised internationally. It is also considered as a preferred computer noise model in NSW by OEH.

The noise model was developed to allow the prediction of cumulative noise levels from the plant and construction activities by calculating the contribution of each noise source. The noise model takes into account:

- sound power levels of each source;
- recepto r locations;
- digital terrain map with 1m height interval;
- screening effects due to topography;
- meteorological effects and attenuation due to distance; and
- ground and atmospheric absorption.

The assessment considered the following operational scenarios:

- Stage 1: Power generation of 250 MW– 750 MW comprising:
  - two to four "E" class machines (125 MW to 180 MW each); or
  - two to three "F" class machines (200 MW to 250 MW each)
- Stage 2: Power generation of 750 MW – 1500 MW comprising additional E or F class turbines taking the maximum number of turbines to six.
  - six “E” class machines (125 MW to 180 MW each); or
  - six “F” class machines (200 MW to 250 MW each)

For the purposes of noise modelling, four operational scenarios were considered as presented in **Table 12-2**.

Chapter 12 Noise Assessment

Table 12-2 Operational Scenarios

Scenario	Stage	Machine Type	Quantity of Machine	Maximum Power Generation of Each Machine	Total Power Generation
A	1	13E2 Class	4	180 MW	720 MW
B		109FA Class	3	250 MW	750 MW
C	2	13E2 class	6	180 MW	1080 MW
D		109FA Class	6	250 MW	1500 MW

The sound power levels for both the E and F Class machines are presented within the Noise Assessment (**Appendix G**).

Attenuation of the sound power level due to the proposed noise mitigation measures for some primary components of the proposed gas turbines have been incorporated in the sound power levels and therefore the modelling of the impacts of the Facility. Noise mitigation measures for the primary components of the proposed gas turbines assumed include:

- acoustic enclosure of turbine compartments consists of single layer of 2 mm thick steel outer plate, 75 mm thick rockwool insulation and perforated steel inner plate;
- acoustic enclosure of exhaust diffusers consists of single layer of 4 mm thick steel outer plate, 150 mm thick rockwool insulation and 4 mm thick steel inner plate; and
- silencing on the inlet system via an 8 foot long parallel acoustic baffle.

The noise modelling was based on likely maximum operating conditions. All sources were conservatively positioned within designated operating areas. The following assumptions were made to assess the cumulative noise impacts of the proposed operation of the plant:

- each noise generating component operates continuously; and
- all the equipment operates continuously and simultaneously.

Adverse meteorological conditions have the potential to increase noise levels at a receptor. Such phenomena generally occur during temperature inversions and where there is a wind gradient with wind direction from the source to the receptor. It is known that these meteorological effects typically increase noise levels by 5 to 10 dB, and even higher than 10 dB in extreme conditions.

Temperature inversions generally occur during the night-time and early morning periods during the winter season, thus the most significant meteorological effect during the daytime period is wind.

The prevailing meteorological conditions for the site were assessed using historical meteorological data collected from a BOM weather station located in Goulburn Airport, and the results incorporated into the acoustic assessment. Further discussion is presented in Section 3.1 and 5.2 of the Acoustic Assessment (**Appendix G**).

12.2.4 Vibration

Vibration impacts of the proposed construction and operation have not been assessed in detail. Generally, the main activities that could create vibration during construction are driven piling and blasting. These activities are unlikely to be required for this project. Foundations for structures within the AGL site would likely be supported on bored piles. Essentially this is a drilling activity resulting in minimal vibration levels. The minimum distance between the nearest residences and the site is in the order of 2 km. Given the unlikelihood of vibration causing activities as well as the significant distance of the site from the closest residential receptors, the potential impact of vibration is considered negligible.

Vibration during operation could be associated with rotating equipment. Gas turbine plant operate at high rotational speed and are very sensitive to vibration and hence very well balanced preventing vibration at levels that could be intrusive to surrounding receptors.

12.3 Existing Environment

12.3.1 Residential Receivers

The nearest potentially affected noise sensitive receptor locations shown in **Table 12-3** have been identified from examination of aerial photographs using Google Earth and a site inspection. These locations are highlighted in **Figure 12-1**.

Table 12-3 Noise Sensitive Receptors

Receptor	Location	Approx Distance from Centre of Facility (km)	Indicative Noise Amenity Area[1]	Nearest Site Boundary
A	Rugby Road, Dalton (David Hallam)	4.2 Rural	Residence	NNW
B	"Mt. Pleasant", 421 Walshs Road, Dalton	2.4 Rural	Residence	NW
C	308 Rugby Road, Dalton	2.4	Rural Residence	SW
D	Cowper Street, Dalton	2.3	Rural Residence	SSW
E	Bushs Lane, Dalton	3.7	Rural Residence	S
F	Alton Hill Road, Dalton	5.7	Rural Residence	SE
G	Alton Hill Road, Dalton	4.9	Rural Residence	E
H	Castle Hill Road, Dalton	4.2	Rural Residence	NNE
I	Castle Hill Road, Dalton	3.3	Rural Residence	N
J	Alton Hill Road, Adj. Merrill Creek	3.0 Rural	Residence	NNE

Notes: 1. According to the NSW Industrial Noise Policy.

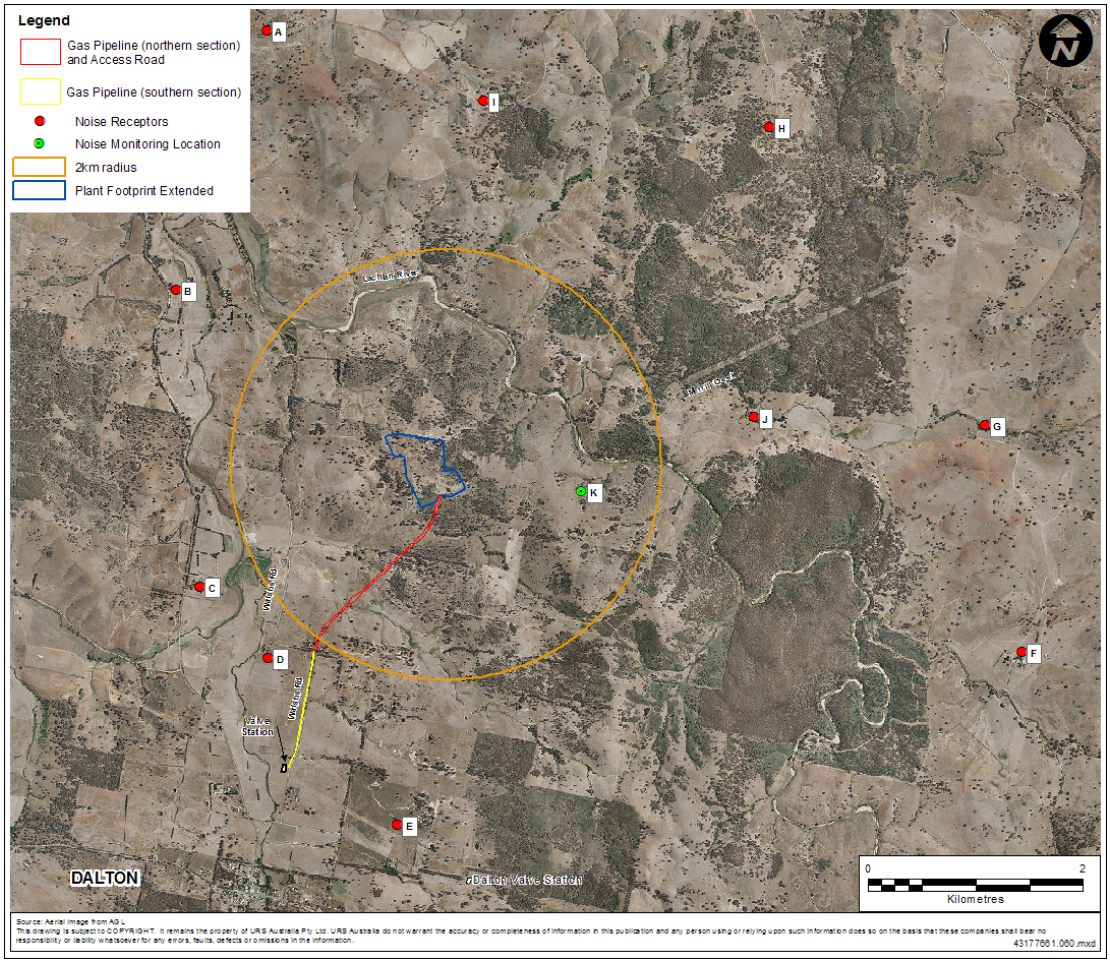
12.3.2 Traffic Noise

NSW Environmental Criteria for Road Traffic Noise (ECRTN)

Criteria for off site road traffic noise are specified in the NSW *Environmental Criteria for Road Traffic Noise* (ECRTN). The criteria applicable are summarised in **Table 12-4**. The location of the worst potentially affected receptor locations fall under the ECRTN category of:

- Land use developments with potential to create additional traffic on local road (Locations L and M); and
- Land use developments with potential to create additional traffic on collector road (Locations N and O).

Figure 12-1 Site and Noise Sensitive Receptor Locations



Regular vehicle movement within the Facility is considered as an industrial noise source and thus, is to be assessed in accordance with the INP.

Table 12-4 Environmental Criteria for Road Traffic Noise

Type of Development	Day $L_{Aeq,1hr}$ dB(A)	Night $L_{Aeq,1hr}$ dB(A)	Where criteria are already exceeded
Land use developments with potential to create additional traffic on local roads	55 50		Where feasible and reasonable, existing noise levels should be mitigated to meet the noise criteria. Examples of applicable strategies include appropriate location of private access roads; regulating time of use; using clustering; using 'quiet' vehicles; and using barriers and acoustic treatments. In all cases, traffic arising from the development should not lead to an increase in existing noise levels of more than 2 dB.
Land use developments with potential to create additional traffic on collector roads	60 55		
Notes: • Day: 7.00 am – 10.00 pm / Night: 10.00 pm – 7.00 am.			

In accordance with the above guidelines, traffic noise criteria applicable for each receptor location within the study area are presented in **Table 12-5**.

Table 12-5 Traffic Noise Criteria for Receptors

Receptor	Address	Type of Road (Table 4-7)	Noise Criteria ($L_{Aeq,1hr}$) dB(A)	
			Day	Night
D	Walshs Road (Cowper Street)	Local Road	55	50
L	Dalton Road	Local Road	55	50
M	Warrataw Street	Local Road	55	50
N	Gundaroo Street	Collector Road	60	55
O	Collector Road	Collector Road	60	55

12.3.3 Background Monitoring

Noise monitoring locations were chosen after examination of satellite imagery of the locality and a site inspection. Consideration was given to selecting monitoring locations to establish the representative noise trend across the nearest receptors to the site. The locations were also chosen so that the noise loggers would not be affected by extraneous noise (e.g. cattle, pumps, etc) which could result in unrepresentative elevated background noise levels.

Two residential receptor locations were selected for the long-term noise monitoring in addition to one location near the site eastern boundary. Several short-term attended locations were also chosen to supplement the long-term noise monitoring. These locations are considered representative of the most potentially affected noise sensitive receptor locations near the Facility.

Table 12-6 provides a summary of the background monitoring locations representing each receiver.

Table 12-6 Background monitoring locations representing each receiver

Receptor	Location	Representative Background Monitoring Location
A	Rugby Road, Dalton	B (421 Walshs Road)
B	421 Walshs Road, Dalton	B
C	308 Rugby Road, Dalton	C (308 Rugby Road)
D	Walshs Road (Cowper Street), Dalton	C
E	Bushs Lane, Dalton	C
F	Alton Hill Road, Dalton	K (Site eastern boundary)
G	Alton Hill Road, Dalton	K (Site eastern boundary)
H	Castle Hill Road or Street, Dalton	B
I	Castle Hill Road or Street, Dalton	B
J	Alton Hill Road, Dalton (Merrill Ck)	K (Site eastern boundary)

It is noted that Location K (near site eastern boundary) was chosen as a representative location as AGL have not obtained permission to have the noise monitoring undertaken at Locations F, G or J. The noise monitoring at this location (Location K) would have provided conservative noise levels as the location was not exposed to noise sources other than local fauna such as birds, insects and cattle.

Table 12-7 presents a summary of overall ambient and background noise levels at each monitoring location.

Table 12-7 Summary of Measured Noise Levels – All Monitoring Locations

Location	Rating Background Level (RBL) L_{A90} dB(A)			Ambient Noise Level L_{Aeq} dB(A)		
	Day	Evening	Night	Day	Evening	Night
B: 421 Walshs Road	26	26	24	50	48	38
C: 308 Rugby Road	27	26	25	46	43	42
K: Site eastern boundary	25	27	25	45	44	39

The measured noise levels, or rating background levels (RBLs) presented were used to derive day, evening and night-time noise limits for this noise impact assessment of the proposed construction and operation of the plant.

The NSW INP states that where the rating background level is found to be less than 30 dB(A), then it is set to 30 dB(A). Therefore, the rating background levels for Locations B, C and K have been adjusted as shown in **Table 12-8** below.

Table 12-8 Rating Background Noise Levels – All Monitoring Locations

Location	Rating Background Level (RBL), L_{A90} dB(A)		
	Day	Evening	Night
B: 421 Walshs Road	30	30	30
C: 308 Rugby Road	30	30	30
K: Site eastern boundary	30	30	30

12.3.4 ECRTN Assessment

Additional noise monitoring locations were chosen after examination of the proposed traffic route and a site inspection. Consideration was given to selecting the monitoring locations to enable unattended long-term noise monitoring to establish the representative noise trend at the worst potentially affected receptor locations. The locations were also chosen so that the noise loggers would not have been affected by extraneous noise (e.g. cattle, pumps, etc) which could result in unrepresentative elevated background noise levels.

Two residential receptor locations were selected for the long-term traffic noise monitoring (Location M and N). Several short-term attended locations were also chosen to supplement the long-term noise monitoring (Locations L, M, N and O).

The worst potentially affected noise sensitive receptor locations are shown in **Table 12-9.**

Table 12-9 Summary of Noise Sensitive Receptors – ECRTN Assessment

Receptor	Location
D	Walshs Road (Cowper Street), Dalton
L	Dalton Road, Gunning
M	Warrataw Street, Gunning
N	Gundaroo Street, Gunning
O	Collector Road, Gunning

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Figure 12-2 Monitoring locations used to measure existing road traffic noise

The results of the long-term noise monitoring are summarised into representative traffic noise levels in **Table 12-10**. Further detail on the individual noise measurements at these locations is presented in **Appendix G**. For the purpose of the ECRTN assessment, the following time of day is defined:

- Day: 7.00 am – 10.00 pm, all days; and
- Night: 10.00 pm – 7.00 am, all days.

Table 12-10 Representative Traffic Noise Levels

Date	Average L_{Aeq} Levels, dB(A)		Highest $L_{Aeq,1hr}$ Levels, dB(A)	
	Day ($L_{Aeq,15hr}$)	Night ($L_{Aeq,9hr}$)	Day	Night
5 Warrataw Street, Gunning (Location L)[2]	54 48		58	54
1 Gundaroo Street, Gunning (Location M)[3]	55 48		58	51

Notes:
1. Represents logarithmic average of measured traffic levels. Further detail on individual measurements is provided in Appendix G.
2. Measured 1-5 April 2009
3. Measured 5-8 April 2009

12.3.5 Operational Noise - Continuous

NSW Industrial Noise Policy

The INP is designed to assess "industrial noise" using the more stringent of the following two approaches:

- intrusive noise impacts in the short term for residences; and
- amenity for particular land uses such as residences.

The INP's intrusive goal is set 5 dBA above the RBL for each time period (daytime, evening or night time) of interest. The RBL's are derived from the measured L_{A90} noise levels as per the OEH guidelines.

The amenity criterion is established to limit continuing increases in noise levels, the maximum ambient noise level within an area from industrial noise sources should not normally exceed the acceptable noise levels specified in the INP. **Table 12-11** is a summary of the noise levels from the INP showing amenity criteria applicable to the different types of receptors and areas within the study area.

Table 12-11 Recommended L_{Aeq} Noise Levels from Industrial Noise Sources

Type of Receptor	Indicative Noise Amenity Area	Time of Day	Recommended L_{Aeq} Noise Level dB(A)	
			Acceptable (ANL)	Recommended Maximum
Residence	Rural	Day	50 55	
		Evening	45 50	
		Night	40 45	
	Suburban	Day 55		60
		Evening 45		50
		Night 40		45

Notes:
- Shaded levels represent the Amenity Criteria applicable to this assessment.

Chapter 12 Noise Assessment

For the receptor locations considered in this assessment, the amenity area of "Rural" has been adopted for the purpose of establishing the project-specific noise levels. "Rural" area means an area with an acoustical environment that is dominated by natural sounds, having little or no road traffic.

In addition, the INP specifies that modification is to be implemented where the existing noise level from industrial noise sources is close to the acceptable noise level (ANL) or already exceeds the ANL for the area in question. However, modification to Acceptable Noise Level (ANL) is not required for the residential locations in this assessment as the L_{Aeq} noise levels obtained for these locations were dominated by natural sounds and not affected by industrial sources, as discussed in **Section 12.3.3** of this document.

The PSNL reflect the most stringent noise level requirement from the criteria derived from both the intrusive and amenity criteria to ensure that intrusive noise is limited and amenity is protected.

Table 12-12 summarises the noise criteria applicable to the operation of the Facility.

Table 12-12 Project-Specific Noise Levels (PSNL)

Receptor Location	Intrusive Criterion $L_{Aeq,15min}$ dB(A)			Amenity Criterion $L_{Aeq,period}$ dB(A)		
	Day	Evening	Night	Day	Evening	Night
All Receptor Locations	**35**	**35**	**35**	50	45	40

Notes: Shaded results represent the PSNL applicable to the assessment.

It can been seen in the table above that the controlling noise criteria will be the intrusive criteria, which are based on the representative rating background levels for each assessment period. It should be noted that 35 dB(A) $L_{Aeq,15min}$ is the lowest permissible noise limit in accordance with the INP.

The PSNL is the noise contribution from the operation of the proposed power station only, i.e. excluding the contribution from the background noise level.

In assessing noise levels at residences, the noise level is to be assessed at the most affected point on or within the residential property boundary or, if this is more than 30 m from the residence, at the most affected point within 30 m of the residence.

As the proposed operations are up to 24 hours a day, the controlling noise criterion is the night-time criterion. For the purpose of this assessment, the night-time criterion is considered because compliance with that target leads to compliance at all other times.

Operational Noise Criteria - Sleep Disturbance

An assessment of sleep disturbance for the potentially affected noise sensitive receptors has also been considered in this study. Where there exists the possibility that instantaneous, short-duration, high-level noise events may occur during night-time hours (10.00pm – 7.00am), consideration should be given to the potential for the disturbance of sleep within residences.

Section 2.2 of the INP states that meeting the Acceptable Noise Limit (ANL) shown on **Table 12-11** will protect against sleep disturbance which recommends the acceptable external noise level for rural areas to be 40 dB(A) L_{Aeq} at night.

The World Health Organisation (WHO) suggests that the noise level inside bedrooms should be limited to 30 – 35 dB(A) L_{Aeq} and 45 dB(A) L_{Amax}. When considering internal noise levels from an external noise source, it is common practice to assume that windows are partially open to allow natural ventilation. The noise reduction through partially opened windows is estimated to be 10 dB(A), as specified in *AS 3671-1989: Acoustics – Road Traffic Noise Intrusion – Building Siting and Construction*.

The *Application Notes* to the INP state that:

- OEH reviewed research on sleep disturbance in the NSW Environmental Criteria for Traffic Noise (ECRTN), and the review concluded that the ECRTN sleep disturbance criterion of an $L_{A1,1min}$ not exceeding the $L_{A90,15min}$ by more than 15 dB(A) is not ideal.
- However, as there is insufficient evidence to determine what should replace it, OEH will continue to use this criterion as a guide to identify the likelihood of sleep disturbance. Where the criterion is met, sleep disturbance is not likely, but where it is not met, a more detailed analysis is required.

To achieve the internal noise levels described above, the noise levels inside and outside bedroom windows, should be limited to 45 dB(A) $L_{A1,1min}$ and 55 dB(A) $L_{A1,1min}$ which is in line with the $L_{A90,15min}$ + 15 dB(A) criterion provided in the INP Application Notes.

Table 12-13 summarises the sleep disturbance criteria that are applied to the nominated residential receptors.

Table 12-13 Sleep Disturbance Criteria

Receptor	Internal Noise Level ($L_{A1,1min}$ or L_{Amax}) dB(A)	External Noise Level ($L_{A1,1min}$ or L_{Amax}) dB(A)
All receptors	30 + 15 = 45	45 + 10 = **55**

The external noise levels are assessed at the most exposed side of residential premises. Sleep disturbance thresholds are also determined by factors including noise character and pitch, perceived personal danger, degree of habituation, age, illness or fatigue and the point in time when the noise occurs during the sleep period. For example, noisy events are generally less disturbing to people if confined to the earlier period of the evening when it is still possible to retrieve deep sleep.

It is noted that the nominated sleep disturbance noise criterion is greater than the project-specific noise levels. Therefore, where the project-specific noise levels are not exceeded at residential receptor locations, the sleep disturbance criterion would also be satisfied, and no additional noise control measures would be required.

Low Frequency and Tonal Noise

The following guideline was used to assess potential low frequency noise impacts:

- NSW Industrial Noise Policy (INP, NSW EPA, 2000)

The INP recommendations for low frequency noise involve an assessment to be conducted on the difference between C and A weighting levels. The most common frequency weighting in current use is “A-weighting” providing results often denoted as dB(A), and approximate the response of the human ear at low sound levels. A “C-weighting” curve is also used, particularly when evaluating very loud or low-frequency sounds. In accordance with the INP:

- If a difference greater than 15 dB exists between the A and C weighted levels, a correction of 5 dB is to be applied to the measured or predicted levels.

This approach provides an assessment for potential for low frequency noise.

Low Frequency and Tonal Noise Alternative Assessment

Recent international research has shown that the use of the INP difference approach is not suitable when the noise levels are low, since the low frequencies may then be below the threshold of hearing levels (A review of Published Research on Low Frequency Noise and its Effects, Report for Department for Environment, Food and Rural Affairs (UK) by Dr Geoff Leventhall, 2003).

The following documents have additionally been considered for an alternative assessment approach to low frequency noise in this assessment:

- World Health Organisation (WHO), *Guidelines for Community Noise*, 1999
- Proposed Criteria for the Assessment of Low Frequency Noise Disturbance, 2005, Prepared for DEFRA by Dr. Andy Moorhouse, Dr. David Waddington, Dr. Mags Adams
- Procedure for the Assessment of Low Frequency Noise Complaints, 2005, Prepared for DEFRA by Dr. Andy Moorhouse, Dr. David Waddington, Dr. Mags Adams.
- A Noise Limit on Low Frequency Noise Emission due to Power Plants, Dr. N. Broner, 2008
- NSW Leafs Gully Gas Turbine Power Station – Noise & Vibration Assessment, Wilkinson Murray, 2008
- NSW Leafs Gully Gas Turbine Power Station – Director General's Report and Project Approval issued by NSW Department of Planning

Construction Noise

The noise criteria set out in the *Interim Construction Noise Guideline* (DECC, July 2009) have been used to assess the potential construction noise impact. This guideline is not mandatory although it will be used to assist OEH in setting statutory conditions in licences or other regulatory instruments for construction noise.

The construction noise criteria guideline for noise at residences and other sensitive land uses is discussed further in **Appendix G**.

Table 12-14 summarises the criteria for construction noise which has been deemed appropriate for this particular investigation.

Table 12-14 Project-specific Construction Noise Management Levels

Receptor Location	Rating Background Level L_{A90} dB(A)	Noise Affected Level $L_{Aeq,15min}$ dB(A)	Highly Noise Affected Level $L_{Aeq,15min}$ dB(A)
All Receptors	30	30 + 10 = **40**	**75**

12.4 Assessment of Impacts

12.4.1 Operational Noise Assessment

The noise modelling using the CONCAWE and ISO calculation methods considering neutral (Stability Class of D with a wind speed of 0 m/s) and adverse meteorological conditions (Stability Class of C with a wind speed of 4 m/s for daytime and Stability Class of F and a wind speed of 2 m/s for evening and night-time) compared to the INP Noise Limits are presented in **Table 12-15, Table 12-16, Table 12-17, Table 12-18 and Table 12-19**.

Scenario A – Four 13E2 Class Machines

Table 12-15 Predicted Operational Noise Levels – Scenario A

Receptor Location	Predicted Noise Levels (L_{Aeq}) dB(A)				Criterion (L_{Aeq}) dB(A)	Exceedance
	Neutral Met Conditions		Adverse Met Conditions		All Periods	
	Day	Evening / Night	Day	Evening / Night		
A	< 20	< 20	< 20	< 20	35	No
B 24		24	27	27	35	No
C 24		25	28	28	35	No
D 26		27	30	30	35	No
E	< 20	< 20	21	22	35	No
F	< 20	< 20	< 20	< 20	35	No
G	< 20	< 20	< 20	< 20	35	No
H	< 20	< 20	< 20	< 20	35	No
I	< 20	< 20	< 20	20	35	No
J 20		21	24	25	35	No

The results presented in **Table 12-15** show that the noise levels would be within the established noise limits at all receptor locations under all meteorological conditions.

Scenario B – Three 109FA Class Machines

Table 12-16 Predicted Operational Noise Levels – Scenario B

Receptor Location	Predicted Noise Levels (L_{Aeq}) dB(A)				Criterion (L_{Aeq}) dB(A)	Exceedance
	Neutral Met Conditions		Adverse Met Conditions		All Periods	
	Day	Evening / Night	Day	Evening / Night		
A	< 20	< 20	< 20	< 20	35	No
B 25		26	28	28	35	No
C 24		25	27	28	35	No
D 26		27	30	30	35	No
E	< 20	< 20	< 20	< 20	35	No

Receptor Location	Predicted Noise Levels (L_{Aeq}) dB(A)				Criterion (L_{Aeq}) dB(A)	Exceedance
	Neutral Met Conditions		Adverse Met Conditions		All Periods	
	Day	Evening / Night	Day	Evening / Night		
F	< 20	< 20	< 20	< 20	35	No
G	< 20	< 20	< 20	< 20	35	No
H	< 20	< 20	< 20	< 20	35	No
I	< 20	< 20	< 20	21	35	No
J <	20	20	23	24	35	No

The results presented in **Table 12-16** show that the noise levels would be within the established noise limits at all receptor locations under the considered meteorological conditions.

Scenario C – Six 13E2 Class Machines

Table 12-17 Predicted Operational Noise Levels – Scenario C

Receptor Location	Predicted Noise Levels (L_{Aeq}) dB(A)				Criterion (L_{Aeq}) dB(A)	Exceedance
	Neutral Met Conditions		Adverse Met Conditions		All Periods	
	Day	Evening / Night	Day	Evening / Night		
A	< 20	< 20	< 20	< 20	35	No
B 25		26	28	29	35	No
C 26		27	29	30	35	No
D 27		28	31	31	35	No
E	< 20	< 20	23	23	35	No
F	< 20	< 20	< 20	< 20	35	No
G	< 20	< 20	< 20	< 20	35	No
H	< 20	< 20	< 20	< 20	35	No
I <	20	21	21	22	35	No
J 21		22	25	26	35	No

The results presented in **Table 12-17** show that the noise levels would be within the established noise limits at all receptor locations under the considered meteorological conditions.

Scenario D – Six 109FA Class Machines

Table 12-18 Predicted Operational Noise Levels – Scenario D

Receptor Location	Predicted Noise Levels (L_{Aeq}) dB(A)				Criterion (L_{Aeq}) dB(A)	Exceedance
	Neutral Met Conditions		Adverse Met Conditions		All Periods	
	Day	Evening / Night	Day	Evening / Night		
A	< 20	< 20	< 20	< 20	35	No
B 27		28	31	31	35	No

Receptor Location	Predicted Noise Levels (L_{Aeq}) dB(A)				Criterion (L_{Aeq}) dB(A)	Exceedance
	Neutral Met Conditions		Adverse Met Conditions		All Periods	
	Day	Evening / Night	Day	Evening / Night		
C 26		27	30	30	35	No
D 28		29	32	32	35	No
E	< 20	< 20	< 20	23	35	No
F	< 20	< 20	< 20	< 20	35	No
G	< 20	< 20	< 20	< 20	35	No
H	< 20	< 20	< 20	< 20	35	No
I	< 20	21	< 20	24	35	No
J 22		23	28	28	35	No

The results presented in **Table 12-18** show that the noise levels would be within the established noise limits at all receptor locations under the considered meteorological conditions.

ISO Calculation Method – All Scenarios

The highest predicted noise levels, using the ISO calculation method compared to the INP Noise Limits, are presented in **Table 12-19**.

Table 12-19 Predicted Operational Noise Levels – ISO Conditions

Receptor Location	Predicted Noise Levels (L_{Aeq}) dB(A)				Criterion (L_{Aeq}) dB(A)	Exceedance
	Scenario A	Scenario B	Scenario C	Scenario D	All Periods	
	Night	Night	Night	Night		
A	< 20	< 20	< 20	< 20	35	No
B	30 30 32	33			35	No
C	30 30 32	33			35	No
D	31 31 33	34			35	No
E	26 25 28	28			35	No
F	20 19 22	22			35	No
G	< 20	20 23 24			35	No
H	< 20	15 18 19			35	No
I	23 23 24	26			35	No
J	26 25 28	29			35	No

The results presented in **Table 12-19** show that the noise levels would be within the established noise limits at all receptor locations under moderate meteorological conditions.

Chapter 12 Noise Assessment

The results shown in tables from **Table 12-15** to **Table 12-19** present A-weighted noise levels predicted using SoundPLAN.

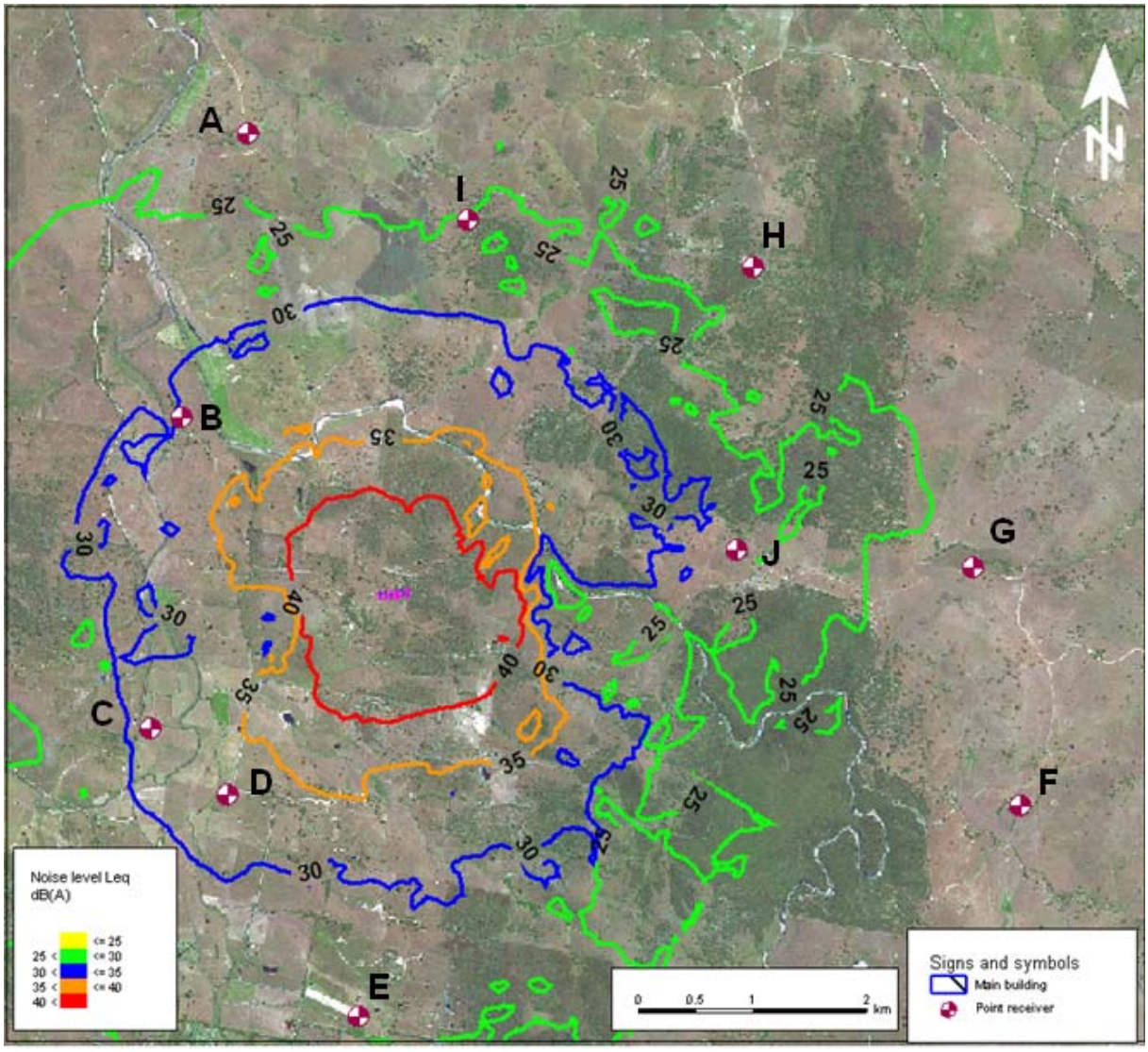
Comparing the results using the CONCAWE calculation method (**Tables 12-15, 12-16, 12-17, 12-18**) with the ISO results (**Table 12-19**) they predict similar noise levels at all receptor locations. The minor variations are primarily due to down-wind setting used in each calculation method.

Figures 12-3 and **12-4** present the noise contours for Stage 2 (i.e maximum number of turbines). It is noted that the calculated (point to point) levels as presented in **Tables 12-15 to 12-19** are more accurate than contours.

Due to the commercially sensitive nature of this data, noise data provided to URS was only available in octave band frequencies, which did not allow URS to undertake a detailed assessment to foresee if the proposed operation would generate noise containing prominent tonal components.

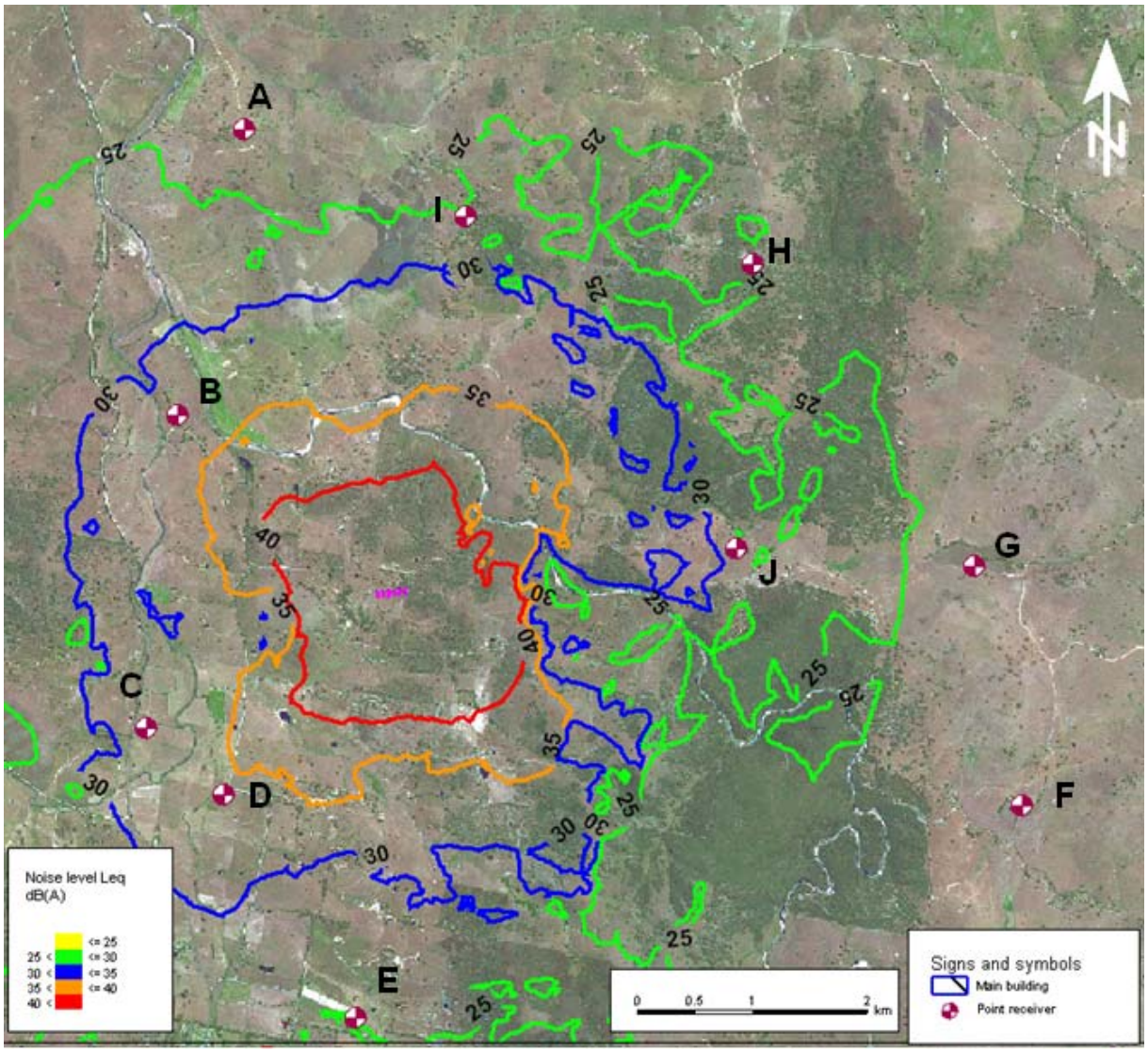
Noise emanating from the proposed operation is not expected to contain tonality or impulsiveness, however, AGL is committed to ameliorating any tonal or impulsive noise issues if they arise, and propose a noise monitoring program during commissioning as discussed further in **Table 12-24**.

Figure 12-3 Noise Contours for Stage 2 – Operation of 6 "E" Class Machines



Chapter 12 Noise Assessment

Figure 12-4 Noise Contours for Stage 2 – Operation of 6 “F” Class Machines



Assessment of Low-Frequency and Tonal Noise

To assess potential low frequency noise impacts, C-weighted noise levels of octave band frequency have been predicted by noise modelling using SoundPLAN. . The predicted C-weighted noise levels at the receptors were then compared with the predicted A-weighted noise levels to examine if the difference between the C and A-weighted noise levels is greater than or equal to 15 dB. The result of the comparison with the criteria identified in **Chapter 12.3.5** is presented in **Table 12-20**.

Table 12-20 presents C-weighted noise levels predicted using SoundPLAN based on indicative turbine spectra.

Table 12-20 Predicted Operational Noise Levels (A- and C-weighted) – Worst-case Scenario

Receptor Location	Difference between C- and A-weighted Predicted Noise Levels (L_{eq}), dB	
	Worst-case Scenario	Exceeds INP LFN[1] Criterion
A	52 – 20 > 15	Yes
B	56 – 33 > 15	Yes
C	56 – 33 > 15	Yes
D	57 – 34 > 15	Yes
E	53 – 28 > 15	Yes
F	49 – 22 > 15	Yes
G	50 – 24 > 15	Yes
H	52 – 20 > 15	Yes
I	54 – 26 > 15	Yes
J	52 – 29 > 15	Yes
Note: 1. Low Frequency Noise		

It can be seen in **Table 12-20** that the difference between C and A-weighted noise levels would exceed the INP Low Frequency Noise criterion. Using the INP approach, the A–weighted noise predictions at the receptors would require a 5 dB(A) adjustment. This impact and subsequent comparison to the Project-Specific Noise Level (PSNL) of 35 dB(A) is presented in **Table 12-21**. The results indicate that the predicted noise levels would exceed the PSNL at Receptors B, C and D.

Based on the information provided by AGL, it is considered that noise emanating from the proposed facility is not expected to contain tonality or impulsiveness.

Table 12-21 Predicted Operational Noise Levels (adjusted A-weighted) –Worst-case Scenario

Receptor Location	Predicted Noise Levels (L_{Aeq}) dB(A)				Criterion (L_{Aeq}) dB(A)	Exceedance
	Scenario A	Scenario B	Scenario C	Scenario D	All Periods	
A 20	*(25)* 20	*(25)* 20	*(25)*	20 *(25)*	35	No

Receptor Location	Predicted Noise Levels (L_{Aeq}) dB(A)				Criterion (L_{Aeq}) dB(A)	Exceedance
	Scenario A	Scenario B	Scenario C	Scenario D	All Periods	
B 30	*(35)* 30	*(35)* 32	***(37)*** 33	***(38)***	35	**Yes**
C 30	*(35)* 30	*(35)* 32	***(37)*** 33	***(38)***	35	**Yes**
D 31	***(36)*** 31	***(36)*** 33	***(38)*** 34	***(39)***	35	**Yes**
E 26	*(31)* 25	*(30)* 28	*(33)* 28	*(33)*	35	No
F 20	*(25)* 20	*(25)* 22	*(27)* 22	*(27)*	35	No
G 20	*(25)* 20	*(25)* 23	*(28)* 24	*(29)*	35	No
H 20	*(25)* 20	*(25)* 20	*(25)* 20	*(25)*	35	No
I 23	*(28)* 23	*(28)*	24 *(29)* 26	*(31)*	35	No
J	26 (31)	25 (30)	28 (33)	29 (34)	35	No

Notes:
- Adjustment shown in brackets in italics.
- Exceedance of the criterion shown in brackets in bold italics.

Alternative Approach to Low Frequency and Tonal Noise

Recent international research has shown that the use of the INP difference approach is not suitable for use in assessments when the noise levels are low, since the low frequencies may then be below the threshold of hearing levels (A review of Published Research on Low Frequency Noise and its Effects, Report for Department for Environment, Food and Rural Affairs (UK) by Dr Geoff Leventhall, 2003).

URS has additionally reviewed the following noise policies and guidelines for an alternative assessment of potential low frequency noise impacts:

- A review of Published Research on Low Frequency Noise and its Effects, Report for Department for Environment, Food and Rural Affairs (UK) by Dr Geoff Leventhall, 2003
- Proposed criteria for the assessment of low frequency noise disturbance, prepared for UK DEFRA by Dr. Andy Moorhouse, Dr. David Waddington, Dr. Mags Adams, 2005
- Procedure for the assessment of low frequency noise complaints, prepared for UK DEFRA by Dr. Andy Moorhouse, Dr. David Waddington, Dr. Mags Adams, 2005
- Proposed Criteria for Low Frequency Noise from Combustion Turbine Power Plants, Noise – Con 2004, Baltimore, Maryland, G. F. Hesseler Jr, 2005 (as referenced in Broner, 2008)
- Proposed Criteria for Low Frequency Industrial Noise in Residential Communities, Journal of Low Frequency Noise, Vibration and Active Control 24, No 2, G. F. Hessler Jr, 2005 (as referenced in Broner, 2008)
- ANSI S12.9 – 2005/ Part 4 Quantities and Procedures for Description and Measurement of Environmental Sound – Part 4: Noise Assessment and Prediction of Long-term Community Response (as referenced in Broner, 2008)
- US Oregon Department of Environmental Quality, Noise Control Regulations for Industry and Commerce OAR 340-035-0035 (as referenced in Broner, 2008)

- A Noise Limit on Low Frequency Noise Emission due to Power Plants, Dr. N. Broner, 2008
- NSW Leafs Gully Gas Turbine Power Station – Noise & Vibration Assessment, Wilkinson Murray, 2008
- NSW Leafs Gully Gas Turbine Power Station – Director General's Report and Project Approval issued by NSW Department of Planning

Current research suggests that (dB(C) – dB(A)) difference should not be used as an annoyance predictor, but as a simple indicator of whether further investigation may be necessary (Low Frequency Noise and Annoyance, Noise & Health 2004, 6:23, 59-72).

For protecting residential areas against potential low frequency noise issues caused by combustion turbine open cycle plants, Broner (2008) makes reference to Hessler's research which proposed C-weighted levels supplementary to the A-weighted site criteria as follows:

- For intermittent daytime only or seasonal source operation:
  - 70 dB(C) for normal suburban / urban residential areas, where background level (L_{A90}) is higher than 40 dB(A),
  - 65 dB(C) for quiet suburban or rural residential areas, where background level (L_{A90}) is lower than 40 dB(A),
- For extensive or 24/7 source operation:
  - 65 dB(C) for normal suburban / urban residential areas, where background level (L_{A90}) is higher than 40 dB(A),
  - 60 dB(C) for very quiet suburban or rural residential areas, where background level (L_{A90}) is lower than 40 dB(A).

Following a review of the INP assessment method and the aforementioned papers, URS proposes the following to be the most appropriate criterion to adopt for a low frequency noise assessment for this project. It is based on a combination of the INP and Hessler (as referenced in Broner's paper [Broner, 2008]) approach.

The research indicates that the use of the approach provided in the NSW Industrial Noise Policy (INP) is not the best available assessment methodology when the predicted resultant noise levels are low.

The Dalton Power Project would operate intermittently. Additionally, there will be a seasonal component (associated with peak electricity demand) to its operation, and the Project is proposed to be located in a rural area with background noise levels below 40 dB(A). For this situation, the Hessler/Broner studies cited above suggest a criterion of 65 dB(C).

- Measure / assess C and A weighted levels over same time period.
- If the difference between the C and A weighted levels is 15 dB or more:
  - Apply **5 dB correction** to the measured/predicted levels, if the overall noise level is **greater than L_{eq} 65 dB(C)**.
  - Apply **no correction** to the measured/predicted levels, if the overall noise level is **less than L_{eq} 65 dB(C)**.

It is noted that this low frequency noise criterion is consistent with that imposed for AGL's recently approved power station development in Leafs Gully, NSW. The Leafs Gully power station is to be located in a rural area where background noise levels are similar to those of Dalton.

As with the Leafs Gully Project, the impact assessment process undertaken for the Dalton Project involved the review of relevant overseas research related to assessment of the potential for low frequency noise.

The NSW Department of Planning and Infrastructure accepted the approach on the Leafs Gully Project. That approach considers a noise level not greater than 65 dB(C) as unlikely to cause low frequency noise annoyance impacts at sensitive receptors. For the Leafs Gully Project, the Department concluded that the 5 dB(A) adjustment to the noise criteria should only to be applied if the difference between the C and A-weighted noise levels is greater than or equal to 15 dB when the measured noise levels is greater than 65 dB(C).

Discussion of Low Frequency and Tonal Noise

The results shown in **Table 12-20** and **Table 12-21** indicate that the predicted noise levels would exceed the PSNL at Receptors B, C and D. However international research suggests that the predicted low frequency noise would not be at a level to cause annoyance to residential receptors as the overall C-weighted noise levels would not exceed 65 dB(C) at any receptor locations (Hessler/Broner method [Broner, 2008]).

Accordingly, and based on the approach to this assessment of the combination of the INP and international methods, no adjustment to the A-weighted predicted operational noise levels would be required.

Notwithstanding this, AGL will commence discussions with receptors B, C and D (see **Table 12-3**) regarding this assessment, with a view to reaching agreement with them on noise management for the project as consistent with other developments.

Assessment of Sleep Disturbance

The potential for sleep disturbance within the residences would potentially be greatest during the early morning hours (notionally, 2.00 am-4.00 am) when background noise levels are at their lowest. It should be noted that this time period is not when the demand for a peaking power plant is likely to occur and as such operation of plant is unlikely. However, the potential for sleep disturbance has been assessed for completeness.

AGL has confirmed that there are no sources that would produce instantaneous or short-duration high noise level events. If a turbine begins or ceases operation in the early hours of the morning, this would occur in a gradual process. If operation occurs during night or early morning period, the process is relatively steady state and free of instantaneous events. The main pressure from the gas line would be adequate and therefore no gas compressor is required for this operation.

Any repairs or maintenance works would be scheduled during the daytime period.

Given that the noise from the proposed operation would be steady rather than fluctuating, it was considered that the difference between L_{Aeq} and L_{Amax} noise levels would be less than 10 dB. Based on this, the ECRTN and INP sleep disturbance criterion of 45 dB(A) $L_{A1,1min}$ or L_{Amax}, when measured inside bedroom, is not expected to be exceeded.

Therefore, the proposed operation is not predicted to give rise to sleep disturbance.

12.4.2 Construction Noise

The Stage 1 construction phase is anticipated to take around 24 months and will involve the construction of concrete footings for the generator units, the formation of unsealed site roads, installation of turbine units, construction of a switchyard and transmission connection, installation of the gas pipeline and gas receiving station, fencing, commissioning and other minor works.

The construction program for the second stage would comprise construction activities to achieve the residual generating capacity for a completed maximum of six turbines on site. Although it is assumed that the construction would be generally similar to the first stage, the intensity is likely to be lower as the majority of site preparation works and infrastructure would be established in the first stage.

Based on similar sized projects, the construction period for each stage is expected to take around 24 months with a peak period of up to 6 months.

The main construction activities would involve the following activities:

- Removing the layer of vegetation and levelling,
- Bulk earthworks including site grading and excavation work,
- Establishing concrete foundations for plant and buildings,
- Construction of buildings and installation of equipment and machinery, and
- Pipe line construction.

The noise levels generated by the indicative construction activities listed above have been predicted at each receptor location. Noise emissions would vary as construction progresses. The noise modelling has been carried out considering the adverse meteorological conditions. The results are presented in **Table 12-22**.

Table 12-22 Predicted Construction Noise Levels

Receptor	Predicted Noise Level, $L_{Aeq,15min}$ dB(A)	Noise Criterion $L_{Aeq,15min}$ dB(A)		Exceedance
		Daytime	Evening/Night	
A <	20	Noise Affected: 40 Highly Noise Affected: 75	35	No
B	24 – 27			No
C	23 – 26			No
D	24 – 27			No
J	Up to 22			No
E, F, G, H and I	< 20			No

The predicted construction noise levels presented in **Table 12-22** show that no exceedance of the noise limit is expected at any receptor locations.

Table 12-23 Predicted Noise Levels during Pipeline Construction

Receptor	Approx Distance from Pipeline (km)	Predicted Noise Level, $L_{Aeq,15min}$ dB(A)	Noise Criterion $L_{Aeq,15min}$ dB(A)		Exceedance
			Daytime	Evening/Night	
A 4.2		< 20			No
B	2.5	22 – 28			No
C	1.3	32 – 40			No
D 0.5		**43 – 52**			Up to 12 dB (day) and 17 dB (evening and night)
E	1.3	31 – 39	40 35		Up to 4 dB (evening and night only)
F 6		< 20			No
G 6.5		< 20			No
H 3.6		< 20			No
I 3.6		< 20			No
J	2.8	20 – 26			No

Note: * Although the corresponding predicted noise level (lower end of the range) exceeds the evening/night noise criteria, the construction scenario modelled would be considered a reasonable "worst case" daytime construction scenario. It would be still be feasible to conduct some selected construction activities at night whilst still achieving the noise criteria.

The predicted daytime construction noise levels presented in **Table 12-23** show that no exceedance of the "Noise Affected" noise level is predicted at all residential locations except for Receptor D, but no exceedances of the "Highly Affected" noise level at all residential locations.

The "Noise Affected" level would be exceeded if the standard daytime construction were to occur during the evening and night-time however, construction activities would be scheduled to be undertaken at an appropriate time of the day for the activity in question. The construction activities generating the most noise would be conducted during the day.

12.5 Off-Site Traffic Noise

The potential off-site traffic noise impact associated with the proposed construction and operation has been assessed based on the URS Traffic Study undertaken for the development.

To predict the increase in traffic noise levels, potentially caused by the proposed construction and operation of the facility, the United States' Federal Highway Administration Model (FHWA Model) was used. The model was verified and calibrated using the short-term noise monitoring results obtained for this assessment.

The assessment concluded that the increased road traffic noise levels due to the proposed construction of the facility would be within the ECRTN noise criteria. There would be some increase in noise levels (2 dB) at receptor locations, however this is not predicted to cause a noise impact on residences.

It is assumed that off-site traffic noise associated with the proposed construction would be minimised as much as is practically possible by limitations on construction hours, and Australian Design Rules which apply to road-registered vehicles.

The ongoing operation of the Facility would generate significantly less traffic than the construction phase of the Project. The operational phase is likely to generate up to 14 vehicle trips within the peak hour periods. This assumes 10 vehicle trips for operation and 4 vehicle trips for water truck deliveries based on a worst case assuming water supply is by truck delivery and peak summer requirement for Stage 2 (assuming total generation capacity of up to 1500 MW) and that 10 % of these movements would occur during the AM Peak Hour. The increase in traffic from the daily operation of the power station is accounted for in the general growth in traffic for the region. An increase in traffic volumes is expected during maintenance which would take place every 3 years at the most.

Therefore the operational traffic generated by the proposed operation is expected to be similar to traffic currently generated in the assessment area, and a further detailed assessment is not deemed necessary.

12.6 Mitigation Measures

12.6.1 Construction

While the proposed construction activities have limited potential for impact on the local ambient noise environment, noise management strategies can be applied which would further reduce the potential for noise issues during the construction period. A Construction Noise Management Plan is to be developed as part of the CEMP to confirm assumptions made in the assessment and to investigate reasonable and feasible noise mitigation measures if necessary. The Construction Noise Management Plan should consider measures such as:

- Carrying out all noisy construction works during the standard daytime construction hours.
- Scheduling construction to minimise multiple use of the noisiest equipment or plant items near noise sensitive receptors.
- Strategic positioning of plant items to reduce the noise emission to noise sensitive receptors, where possible.
- Awareness training for staff and contractors in environmental noise issues.
- Minimising the use of horn signals and maintaining to a low volume and consideration of alternative methods of communication.
- Switching off any equipment not in use for extended periods during construction work.
- Minimising heavy vehicles' entry to site and departure from site outside the nominated construction hours.
- Use of temporary barriers (if required).
- Consideration of the positioning of construction plant / processes.
- Retrofitting reversing alarms that are quieter and display less annoying characteristics.

- Where noise level exceedances cannot be avoided, consideration should be given to applying time restrictions and/or providing quiet periods for nearby residents.
- Community consultation with local residents to assist in the alleviation of community concerns.
- Maintaining a suitable complaint register. Should noise complaints be received, undertake noise monitoring at the locations concerned. Reasonable and feasible measures would need to be implemented to reduce noise impacts

12.6.2 Operation

The exhaust stack is required to be designed to comply with the INP requirements.

The noise mitigation measures for the primary components of the proposed gas turbines which have already been incorporated in the noise modelling for this assessment include:

- acoustic enclosure of turbine compartments consists of single layer of 2 mm thick steel outer plate, 75 mm thick rockwool insulation and perforated steel inner plate;
- acoustic enclosure of exhaust diffusers consists of single layer of 4 mm thick steel outer plate, 150 mm thick rockwool insulation and 4 mm thick steel inner plate; and
- silencing on the inlet system via an 2.4 m long parallel acoustic baffle.

Beyond these measures, the noise assessment did not identify a requirement for further mitigation.

Noise emissions from the plant operation would be verified during commissioning stage to confirm compliance with the project noise criteria. An Environmental Management Plan (EMP) is expected to be prepared with a noise monitoring and management programme included.

The proposed development would require licensing under the provisions of the POEO Act. This Environment Protection Licence administered by OEH is likely to include operation noise limits for the plant and requirements for compliance noise monitoring.

Table 12-24 presents a summary of mitigation measures as a result of the noise assessment.

Table 12-24 Summary of Mitigation Measures

Mitigation Measures	Implementation of mitigation measures		
	Design	Construction	Operation
A Construction Noise Management Plan is to be developed as part of the CEMP to confirm assumptions made in the assessment and to investigate reasonable and feasible noise mitigation measures if necessary.		✓	
Carrying out all noisy construction works during the standard daytime construction hours.		✓	
Scheduling construction to minimise multiple use of the noisiest equipment or plant items near noise sensitive receptors.		✓	
Strategic positioning of plant items to reduce the noise emission to noise sensitive receptors, where possible.	✓	✓	

Mitigation Measures	Implementation of mitigation measures		
	Design	Construction	Operation
Carrying out maintenance work away from noise sensitive receptors, where practicable.		✓	
Ensuring engine covers are closed, maintenance of silencers and mechanical condition. Regular maintenance and noise testing for major items of construction equipment that are significant contributors to construction noise levels.		✓	
Awareness training for staff and contractors in environmental noise issues including.		✓	
Minimising the use of horn signals and maintaining to a low volume. Alternative methods of communication should be considered.		✓	
Avoiding any unnecessary noise when carrying out manual operations and when operating plant.		✓	
Switching off any equipment not in use for extended periods during construction work.		✓	
Minimising heavy vehicles' entry to site and departure from site outside the nominated construction hours.	✓	✓	
Where noise level exceedances cannot be avoided during construction, consideration should be given to applying time restrictions and/or providing quiet periods for nearby residents.		✓	
Community consultation with local residents and building owners to assist in the alleviation of community concerns.		✓	
Maintaining a suitable complaint register. Should noise complaints be received, undertake noise monitoring at the locations concerned. Reasonable and feasible measures would need to be implemented to reduce noise impacts.		✓	
Noise emissions from the plant operation to be verified during commissioning stage to confirm assumptions made regarding noise attenuation and compliance with the project noise criteria.			✓
The exhaust stack is required to be designed to comply with the INP requirements.	✓		✓
AGL will commence discussions with receptors B, C and D (see Table 12-3) regarding this assessment, with a view to reaching agreement with them on noise management for the project as consistent with other developments.	✓		

Flora and Fauna Assessment – Summary of Key Outcomes

A Flora and Fauna Assessment of the proposed development footprint has been undertaken. The results of the assessment indicate that there are a number of ecological values associated with the Site. A range of mitigation measures would be implemented to minimise impacts to native species within the locality.

A total of 26 threatened species and one endangered ecological community (EEC) listed under the New South Wales *Threatened Species Conservation Act 1995* (TSC Act) were considered to have the potential to occur within the development footprint and as such have been assessed. A total of nine threatened species and one EEC listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) were considered to have the potential to occur within the development footprint, and as such have been assessed via the Commonwealth Significant Impact Criteria assessment guidelines.

Nine threatened fauna species were observed during field surveys. However, no threatened flora species were observed. Two EECs were found to occur within the development footprint; *White Box – Yellow Box – Blakely's Red Gum Woodland* – referred to as Box Gum Woodland, listed under the TSC Act and *Natural Temperate Grassland of the southern Tablelands of NSW and the ACT* – referred to as Natural Temperate Grasslands, listed under the EPBC Act. The proposed works will involve the clearing of approximately 5.94 hectares (ha) of Box Gum Woodland and 9.07 ha of Natural Temperate Grassland.

Initial survey results suggested that the development footprint and surrounding site (the study area) supported both Natural Temperate Grassland as well as Commonwealth listed Box Gum Woodland. Consequently, the project has been the subject of an EPBC Act Referral.

Following review of the referral, on 11 June 2010, the Project was declared a Controlled Action under the EPBC Act. Consultation with SEWPaC commenced on 16 June, 2010 and supplementary DGRs were issued by DoP on 5 July, 2010 to take into account the EPBC Act referred matters.

Since that time, further survey work has been undertaken across the study area to assess all vegetation formations with a particular emphasis on the EECs and their extent and condition. Results have determined that the Box Gum Woodland within the study area did not adequately meet the Commonwealth criteria for the listing of the Box Gum Woodland EEC, although it was confirmed to meet the criteria relevant to the TSC Act listing of Box Gum Woodland EEC.

The results of the assessment of the Dalton Power Project suggest that it has the potential to adversely impact to the TSC Act listed EEC Box Gum Woodland, but would not result in a significant impact to any other threatened species or populations listed under the TSC Act.

To minimise the potential impact of this Project, detailed recommended mitigation measures would be implemented. These measures include the production of management plans for the construction and operational stages of the project, clearing strategies, habitat replacement plans and rehabilitation and land management strategies. Each of these mitigation measures would be addressed during the construction and operational phases of the Dalton Power Project.

In addition to these measures, and in order to offset the potential loss of Box Gum Woodland (5.94 ha loss) and Natural Temperate Grassland (9.07 ha loss), AGL proposes to reach agreement with the NSW OEH and SEWPaC the following offsets:

- 77.57 ha of Box Gum Woodland to be managed for environmental purposes in perpetuity within the AGL owned lands adjoining the development footprint, and
- 80.71 ha of Native Temperate Grassland and 24.97 ha of exotic pasture with the potential if managed to become Natural Temperate Grassland to be managed for environmental purposes in perpetuity within the AGL owned lands adjoining the development footprint.

With AGL's commitment to the biodiversity offset strategy and mitigation measures for the Project, it is considered that the overall biodiversity of the local area would be 'maintained or improved' as is required under biodiversity assessment guidelines under Part 3A of the EP&A Act. The offset arrangements are also consistent with the Commonwealth's principles for environmental offsets established under the EPBC Act (Department of Environment and Water Resources, 2007a; Department of Environment and Water Resources, 2007b).

13.1 Introduction

This chapter considers the flora and flora impacts of the Dalton Power Project with regard to Commonwealth and NSW State planning and environmental legislation, including the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), the *Environmental Planning and Assessment Act 1979* (EP&A Act), the *Threatened Species Conservation Act 1995* (TSC Act), *Native Vegetation Act 2003* (NV Act)*, State Environmental Planning Policy No. 44 Koala Habitat Protection* (SEPP 44) and the *Noxious Weeds Act 1993* (NW Act). The full Flora and Fauna Assessment is presented in **Appendix H** of this Environmental Assessment.

13.2 Methodology

The methodology for the Flora and Fauna Assessment included the following elements:

- literature review;
- flora survey;
- fauna survey;
- reporting; and
- consultation.

The assessment and field surveys were conducted generally in accordance with the following guidelines and protocols:

- Threatened Biodiversity and Assessment; Guidelines for Developments and Activities Working Draft (DEC, 2004);
- Guidelines for Threatened Species Assessment (DEC/DPI July 2005);
- BioBanking Assessment Methodology and Credit Calculator Operational Manual (DECC 2008c);
- Random meander surveys (Cropper 1993);
- Office of Environment and Heritage (OEH) Threatened Species Profiles and Recovery Plans;
- NSW Department of Industries and Investment (I&I NSW) Threatened Species Profiles and Recovery Plans; and
- SEWPaC Threatened Species, Profiles and Recovery Plans.

In addition to these protocols and guidelines, an assessment of the suitability of habitats present for both TSC Act and EPBC Act listed species within the Site was made during literature reviews and field surveys. Fauna habitat suitability was based on the level of breeding, nesting, feeding and roosting resources available. Flora habitat suitability was based on the vegetation communities present within

the local area, geography, topography, land use and potential for seed bank and Site resilience. The development footprint was walked and all significant habitat features, such as fallen timber, hollow bearing trees, stags, or stands of Box Gum Woodland species likely to provide foraging or nesting habitat for threatened fauna species was plotted using a handheld GPS unit.

Habitat assessments are important in determining the potential for listed species to use the Site rather than relying solely on one off surveys that are subject to seasonal and weather limitations and provide a snapshot of ecological assemblages present.

13.2.1 Literature Review

A literature review was undertaken to identify threatened species, populations and ecological communities listed under the TSC Act, FM Act and EPBC Act that could be expected to occur within the Site and surrounds, based on suitable habitats present. To this end, the following material was reviewed prior to undertaking field investigations:

- The NSW National Parks and Wildlife Service Atlas of NSW Wildlife online database selected for a 10 km buffer around the Site (NSW National Parks and Wildlife Service 2010).
- A Geographic Information System (GIS) data request was sent to the Spatial Data Programs at the NSW Office of Environment and Heritage (OEH) for all records of threatened species within the Gunning 8728 1:100,000 map sheet on 7 June 2010.
- The Commonwealth EPBC online Protected Matters Search Tool, selected for a 10 km buffer of the Site on 7 June 2010 (Department of Environment, Water, Heritage and the Arts 2010).
- The OEH 'Find by Geographic Region' threatened species, populations and ecological communities online search tool for the Lachlan Catchment Management Authority (CMA) Murrumbateman sub-region (Department of Environment and Climate Change 2010).
- The NSW Department of Industries and Investment 'Threatened fish and marine vegetation – find a species by geographic region' online search tool for the Lachlan CMA (NSW DII 2010).
- The Forest Ecosystem Classification and Mapping for the Southern Comprehensive Regional Assessments (SCRA) Region (Thomas *et al*. 2000) was accessed and descriptions were used as reference points for vegetation community descriptions within the Site.
- Ocean Shores to Desert Dunes: the native vegetation of New South Wales and the ACT. (Keith 2004) was used to as reference material for vegetation community descriptions within the Site.
- The NSW Biometric Database (DECC 2008a) was used as a guide to vegetation communities within the CMA area.

13.2.2 Flora Survey

Surveys were targeted towards threatened species identified in the desktop review as potentially occurring on Site, and on habitat suitability assessments conducted during the literature review and field visits. Techniques included vegetation community surveys, flora surveys (including gathering of floristics data), weed assessments and opportunistic observations including identification of potential habitat. Flora surveys were consistent with the guidelines and protocols listed in **Section 13.1**.

Aerial photographs and regional vegetation mapping data available for the Site was studied prior to visiting the Site. Field surveys have been undertaken on the following dates:

- 31 March– 2 April, 2009;
- 22 -23 February, 2010;
- 8 July, 2010;
- 27-30 July, 2010;
- 10-11 February, 2011;
- 21-24 February, 2011;
- 6-7 June, 2011; and
- 20-21 June, 2011.

Survey techniques included vegetation community surveys, flora surveys (including gathering of floristics data), weed assessments and opportunistic observations including identification of potential habitat.

The location of the proposed access road and pipeline easement has changed since the beginning of field investigations. Consequently, field surveys were undertaken in many of the surrounding areas as well as the preferred development footprint. This has at times necessitated multiple field surveys to ensure the entire development footprint has been appropriately and adequately assessed.

The primary objectives of the vegetation mapping survey were to:

- map and describe the vegetation communities present within the development footprint; and
- map and describe the vegetation communities present within the broader AGL Site boundary for use in consideration of offsets.

Data included within the NSW Biometric vegetation community data *Definitions of vegetation types for CMA areas* (DECC 2008a) was used as a guide to vegetation communities that were likely to occur within the locality. This was supplemented by *Ocean Shores to Desert Dunes: the native vegetation of New South Wales and the ACT* (Keith 2004), which was used as reference material for vegetation community descriptions within the Site. Existing vegetation mapping including Keith (2004) and the *Forest Ecosystem Classification and Mapping for the Southern Comprehensive Regional Assessments (SCRA) Region* (Thomas *et al*. 2000) was used as a basis for URS mapping. Vegetation

community floristics described by URS are a combination of URS mapping, biometric vegetation communities (DECC 2008a) and expert opinion.

Endangered Ecological Community Surveys were undertaken during the field work to determine the EECs present across the development footprint. Mapping of EECs was undertaken during 27 – 30 July, 2010 and in 10 – 11 February, 2011. The primary objectives of the EEC surveys included describing and mapping the extent of vegetation community associations, and to assess the condition according to OEH and SEWPaC threatened ecological community profiles as well as Biobanking assessment methodologies. Initial vegetation mapping was refined during the course of the Project (post EPBC Referral) by URS botanical staff.

Targeted Threatened Flora Species Survey was carried out using random meander surveys (Cropper 1993) to determine the distribution of any threatened flora species, communities and their habitat within the development footprint. Species targeted included all flora species considered likely to occur within the development footprint based on the desktop literature review and the presence of suitable habitat.

13.2.3 Fauna Survey

Surveys were targeted towards threatened species identified in the desktop review as potentially occurring on Site, and on habitat assessments conducted during the field visit. Techniques included diurnal bird counts, active reptile searches, funnel traps, walking transects, active searches for flying insects, spotlighting, nocturnal call playback, use of ultrasonic call recording (Anabat) to identify presence of microchiropteran bat species, and opportunistic observations including identification of scats and tracks. Survey effort was concentrated on suitable areas of habitat within the development footprint. Targeted fauna surveys were carried out on 31 March – 2 April 2009, with additional habitat assessments conducted in February 2010. Additional survey was also undertaken on June 6 - 7 and 20 - 21, 2011. Survey techniques were generally consistent with the requirements of *Threatened Biodiversity and Assessment; Guidelines for Developments and Activities Working Draft* (DEC 2004), and *Draft Guidelines for Assessment of Threatened Species for Part 3A Projects* (DEC/DPI, 2005).

Based on the results of the desktop literature review, surveys were performed targeting the Golden Sun Moth (*Synemon plana*). Surveys were undertaken in areas of potential habitat during suitable 10 – 11 February 2011 and 21 – 24 February 2011. Methods were consistent with DEWHA (2009b) *EPBC Act Policy Statement 3.12 - Significant Impact Guidelines for the Critically Endangered Golden Sun Moth (Synemon plana)*, with the exception of survey timing.

Active reptile searches were undertaken on 10 – 11 February 2011 and 21 – 24 February 2011. Active searches included turning rocks and fallen timber within the development footprint. Survey methods for reptiles excluded the use of pitfall traps, due to potential disturbance to threatened species habitat, and potential increased risk of predation from foxes (many of which have been seen on site) as outlined in detail in **Appendix O** of **Appendix H**.

13.2.4 Consultation

Following completion of preliminary surveys, consultation was undertaken with stakeholders to ensure that all concerns were addressed and appropriate assessment was conducted for specific issues. The consultation process included one Site meeting with stakeholders and ongoing telephone and email communication.

As a result of initial survey efforts it was thought that the development footprint and surrounding site may support both Natural Temperate Grassland and the Commonwealth listed Box Gum Woodland. Consequently, the Project was the subject of an EPBC Referral (11 May, 2010) to the Minister of the Department of Environment, Water, Heritage and the Arts (DEWHA, now the Department of Sustainability, Environment, Water, Population and Communities (SEWPaC). As a result of the Referral, on 11 June, 2010 the Project was declared a Controlled Action under the EPBC Act. Consultation with SEWPaC commenced on 16 June, 2010 and supplementary DGRs were issued on 5 July, 2010 to take into account the EPBC Act referred matters.

13.2.5 Survey Limitations

Survey effort and results were influenced by weather conditions in the months prior to all survey times, as well as the current and previous land uses in the area. Fauna surveys tended to focus on the proposed area of works, and did not encompass areas outside the area of proposed works. To ensure consideration of the full range of species that could potentially be expected to occur on Site, a habitat assessment was conducted to ensure the majority of species that may be impacted by the proposal were considered. Even so, it is possible that some species that utilise the Site on a periodic or seasonal basis were not likely to use the Site during the survey period. Also, as fauna species are mobile and transient by nature it is possible that not all species (resident or transitory) were assessed during the survey period. In addition, some threatened flora species flower according to a range of seasonal conditions such as after rainfall, including annual, ephemeral or cryptic species, such as orchids. The habitat assessments conducted for the Site allows for identification of suitable habitat for all such species.

Further, the absence of previous surveys in the area was likely to have resulted in a lower than required number of target species to be surveyed during field survey periods. Consequently, the full list of species ‘known or predicted’ to occur within the CMA-subregion was assessed to ensure that the occurrence of as full a species complement as possible was addressed as part of the assessment process.

Field surveys were limited in some areas by physical constraints such as steep gullies, rocky access preventing vehicular access, fence lines and access to private property. Additionally, time and scope of works posed constraints to the duration and type of surveys that were able to be conducted. Project timing also limited the seasons during which works were undertaken.

As outlined in **Appendix H**, the initial survey was undertaken following a period of prolonged drought and long-term grazing of grassland vegetation within the development footprint. Biotic conditions on site were severely degraded, with little to no grassland present in areas that had been grazed. The little grassland vegetative material that was present was severely desiccated and had been subject to grazing.

Many areas that presented as grassland in later survey periods, initially presented as bare earth paddocks covered in sheep droppings. The second vegetation survey took place following periods of rainfall, and after stock was removed across much of the proposed footprint. Significant improvement in biotic, and therefore vegetation, conditions was apparent during these surveys, with large tracts of grassland in reasonable condition then presenting on site.

Final vegetation surveys were undertaken in the months following heavy and prolonged rain events, and after several months of stock exclusion. Improvement in vegetation condition was obvious throughout the Site, with large areas of grassland present. Recovery was evident in understorey diversity, and in vegetation condition i.e. vegetation was no longer desiccated or grazed and soil condition had improved.

Changes in the abiotic and biotic conditions on site since surveys commenced has resulted in significant changes to the vegetation communities on site, and has demonstrated the resilience of the Site's vegetation communities given appropriate management regimes and more benign climatic conditions.

13.3 Results of Assessment

13.3.1 Literature Review

Flora

The results of the online OEH Atlas of NSW Wildlife database search show no records of any threatened flora species within 10 km of the Site since 1980. The GIS request to the Spatial Data Programs department of the NSW OEH indicated that no records of threatened flora species exist within 10 km of the Site.

The Commonwealth EPBC Online Protected Matters Database search tool noted that three flora species and two threatened ecological communities are "likely to occur within area". In addition, two threatened ecological communities are also noted as "likely to occur within area".

The OEH 'Find by Geographic Region' threatened species, populations and ecological communities online search tool for the Lachlan Catchment Management Authority (CMA) Murrumbateman sub-region indicated that 3 flora species and two endangered ecological communities are known or predicted to occur within the sub-region.

The I&I NSW 'Find threatened fish or marine vegetation by region' online search tool for the Lachlan CMA indicates that one endangered ecological community is predicted to occur within the CMA.

Fauna

The results of the online OEH Atlas of NSW Wildlife database search show no records of any threatened fauna species within 10 km of the Site since 1980. The GIS request to the Spatial Data Programs department of the NSW OEH provided records for five threatened fauna species within 10 km of the Site.

The Commonwealth EPBC Online Protected Matters Database search tool indicated that 11 threatened species or their habitat may occur within 10 km of the Site, including four birds, one frog, one insect, one mammal, two ray-finned fish and two reptiles.

The OEH 'Find by Geographic Region' threatened species, populations and ecological communities online search tool for the Lachlan Catchment Management Authority (CMA) Murrumbateman sub-region indicated that 31 threatened fauna species are known or predicted to occur within the sub-region.

The I&I NSW 'Find threatened fish or marine vegetation by region' online search tool for the Lachlan CMA indicates that five threatened species and one endangered population are predicted to occur within the CMA.

Following the determination of this project as a controlled action, Supplementary Director-General's Requirements (Supplementary DGRs) were issued (**Appendix A**). These Supplementary DGRs specify species for consideration within the survey process. Species listed in the Supplementary DGRs requiring assessment include:

- Golden Sun Moth (*Synemon Plana*);
- Grassland Earless Dragon (*Tympanocryptus pinguicolla*);
- Pink-tailed Worm-lizard (*Aprasia parapulchella*); and
- Striped Legless Lizard (*Delma impar*).

Based on the results of the desktop literature review it was concluded that the Grassland Earless Dragon was not likely to occur within the study area. The current distribution of the species is restricted to areas defined within the *National Recovery Plan for the Grassland Earless Dragon Tympanocryptis pinguicolla*, all of which occur within or south of the Australian Capital Territory, and much further to the south than the proposed Site. Given the current range of the species, it is considered unlikely that the species occurs within the Dalton locality and hence, this species has not been considered further within this report.

13.3.2 Field Survey

Flora

One hundred and thirty six flora species were identified during URS quadrat surveys that focussed on the development footprint. No threatened flora species were identified during field surveys conducted within the development footprint.

Chapter 13 Flora and Fauna

Vegetation communities recorded within the Site including their conservation significance, are summarised in **Table 13-1** and discussed below. The distribution of vegetation communities within the Site is shown in **Figure 13-1**.

Of the vegetation communities identified on Site, two are endangered ecological communities;

- Natural Temperate Grassland, listed as an EEC under the EPBC Act; and
- Box Gum Woodland, listed as an EEC under the TSC Act.

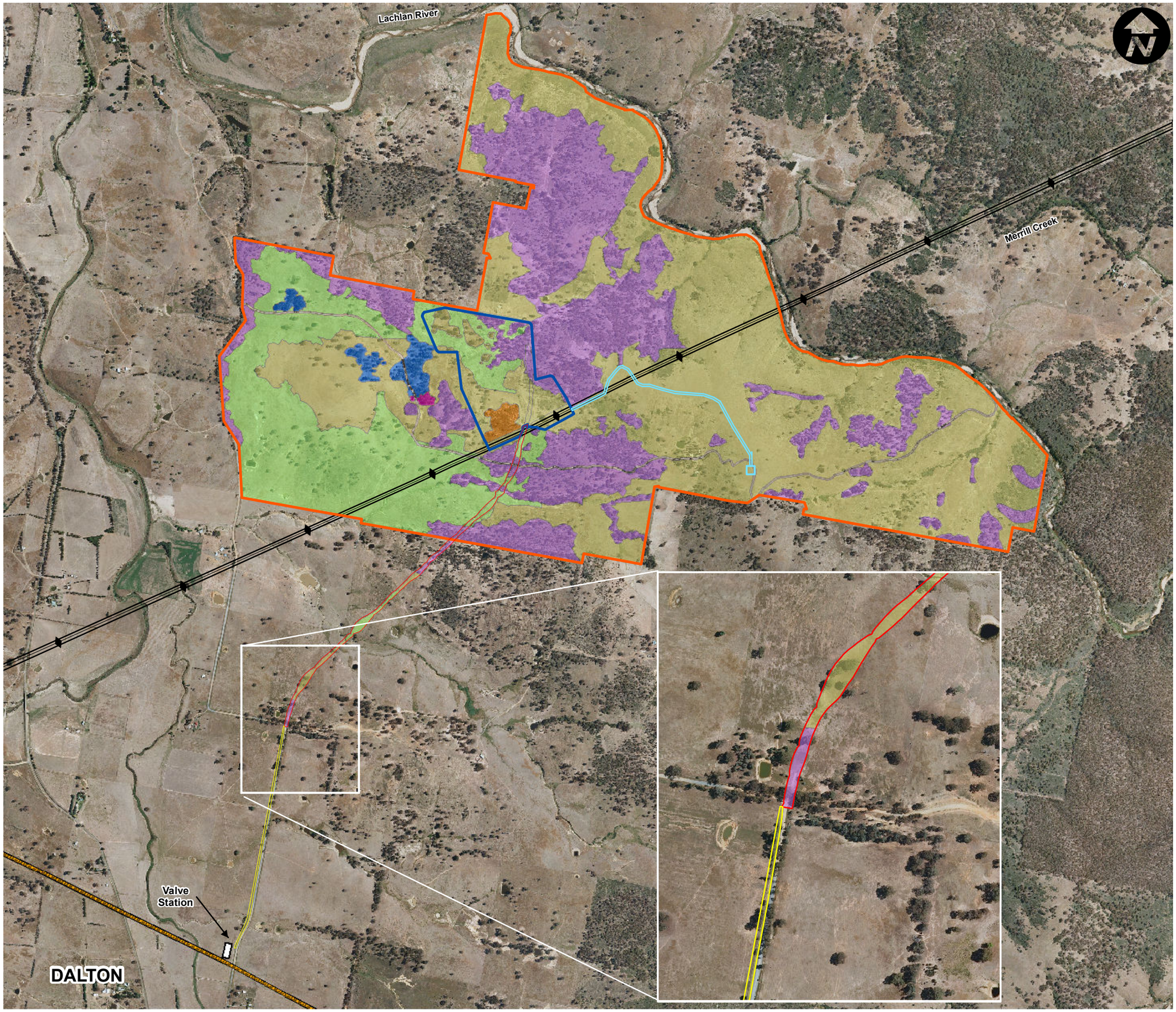
Habitat assessments were conducted across the Site to evaluate habitat quality and assess the potential for threatened species not observed during the field surveys to occur on Site.

Five declared noxious weeds for Upper Lachlan Shire Council were recorded on Site, discussed in detail in **Appendix H**.

Table 13-1 Vegetation communities recorded within AGL owned lands

Vegetation Community	EPBC Act Status	TSC Act Status	Total Area Mapped (Hectares)
Grey Box over Exotic Pasture	Not Listed	Not Listed	6.20
Red Stringybark over Exotic Pasture	Not Listed	Not Listed	0.49
Box Gum Woodland	N/A*	Endangered Ecological Community	147.24
Natural Temperate Grassland	Endangered Ecological Community	Not Listed	92.58
Exotic Pasture	Not Listed	Not Listed	258.72
Disturbed Shrubland	Not Listed	Not Listed	2.19
Total			**507.42**

*Community condition does not meet the condition required to be classified as Box Gum Woodland, under EPBC Act.



Legend

- AGL Site Boundary
- Plant Footprint
- Gas Pipeline (northern) and Access Road
- Gas Pipeline (southern)
- Communications Tower and Hut Footprint
- Communication Tower Services and Access Track
- Moomba-Sydney Pipeline
- Transmission Line
- Waterway

Vegetation Communities (URS):

- Natural Temperate Grassland^
- Box-Gum Woodland*
- Grey Box over Exotic Pasture
- Red Stringybark over Exotic Pasture
- Disturbed Shrubland
- Exotic Pasture

* TSC Listed Community
^ EBPC Listed Community

0 1
Kilometres

Source: Aerial Image from AGL

Drawn: AO/SB	Approved: JW	Date: 03/03/2011
Job No.: 43177661	File No.: 43177661.043.mxd	

Client: AGL

Project: DALTON POWER PROJECT

Title: VEGETATION COMMUNITIES

Figure: 13-1

URS

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Fauna

A total of 107 fauna species, comprising 69 birds, 19 reptiles and 19 mammals were recorded during the field surveys.

The majority of fauna species identified were common species for the area. Six bird species listed as threatened, and one species listed as migratory was recorded during field surveys conducted within the Site, as detailed below.

The following were recorded during field surveys conducted within the Site:

- Gang Gang Cockatoo (*Callocephalon fimbriatum*);
- Speckled Warbler (*Pyrrholaemus saggitatus*);
- Brown Treecreeper (*Climacteris picumnus victoriae*);
- Diamond Firetail (*Stagonopleura guttata*);
- Flame Robin *(Petroica phoenicea);*
- Little Eagle (*Hieraaetus morphnoides*);
- Varied Sittella (*Daphoenositta chrysoptera*);
- Scarlet Robin (*Petroica boodang*); and
- White-fronted Chat (*Epthianura albifrons*).

One Commonwealth listed migratory species, under the EPBC Act was recorded during field surveys:

- Rainbow Bee-eater (*Merops ornatus*).

Two Gang Gang Cockatoos were observed foraging in Box Gum Woodland along the existing access track to the west of the Site. The Brown Treecreeper, Speckled Warbler, Diamond Firetail, Scarlet Robin and Flame Robin were observed opportunistically. The Little Eagle was observed opportunistically flying overhead, and was not seen to return to the study area or use any habitat features within the Site. A small flock of Varied Sittellas were observed outside of the development footprint but still within AGL owned land. A moderate sized flock of White-fronted Chats were observed foraging on property outside of, but immediately adjacent to AGL owned land.

No evidence of koalas or koala habitat was recorded during the field surveys. SEPP 44 defines 'potential koala habitat' as 'an area of native vegetation where the trees of the types listed in Schedule 2, constitute at least 15 % of the total number of trees in the upper or lower strata of the tree component'. No trees listed in Schedule 2 were recorded during the field surveys of the Site; hence no areas qualify as potential koala habitat. Core koala habitat, is defined as 'an area of land with a resident breeding population of koalas, evidenced by attributes such as breeding females and recent sightings and historical records of a population'. No evidence of koala activity was recorded during field surveys and there are no recent records of koalas within 10 km of the Site.

No endangered terrestrial populations of any threatened fauna species were found to occur within the development footprint.

Habitat suitability assessments were conducted across the Site to evaluate habitat quality and assess the potential for threatened species not observed during the field surveys to occur on Site. Habitat values recorded include:

- structural and floristic diversity of vegetation layers, particularly presence or absence of mid-storey (shrubs and juvenile canopy species) and/or presence of native tussock grasses;
- presence and quantity of litter layer and fallen dead timber;
- shelter, breeding, roosting and nesting resources available;
- presence of hollows;
- exfoliated bark, feed trees and shrubs;
- connectivity;
- presence of rocky outcrops or partially buried rocks; and
- size of remnant communities.

The habitat suitability assessment undertaken during field surveys conducted within the Site informed the detailed habitat table included as **Appendix F** in **Appendix H**.

Minimal aquatic habitat is present within the development footprint. Although the Lachlan River is to the north of the Site, it is extremely degraded, with limited fringing vegetation and at the time of the field surveys, no water flows, instead being restricted to a series of shallow sandy pools.

Water resources within the development footprint are restricted to several farm dams, which appear to be quite shallow and up to 10 m^2 in size. Most dams observed had a small amount of fringing vegetation, with growth of sedges and occasional macrophytes, and were in close proximity to Box Gum Woodland Vegetation. However, all water bodies in the study area provide potential foraging habitat for microbats, given the proximity to intact woodland and hollow-bearing trees.

The site contains a number of sensitive receptors which could be impacted by changes to surface and groundwater flows, including:

- rivers and creeks;
- ephemeral drainage lines; and
- farm dams which may provide important aquatic habitat within the degraded and dry local environment.

All project works would aim to limit the amount of increased sedimentation and/or run-off that results from proposed actions, and as outlined in **Appendix H**, all water way crossings to be designed and constructed in accordance with the I&I NSW Policy and Guidelines for *Fish Friendly Waterway Crossings* and *Why Do Fish Need to Cross the Road?* (Fairfull. and Witheridge, 2003; NSW DPI, 2004).

13.3.3 Threatening Processes

A 'key threatening process' (KTP) is defined under the TSC Act as 'a threatening process specified in Schedule 3' of the Act. A 'threatening process' is defined as 'a process that threatens, or may have the capability to threaten the survival or evolutionary development of species, populations or ecological communities'. Evidence of the following KTPs was recorded during the survey:

- competition and grazing by the feral European rabbit;
- competition from feral honeybees;
- invasion of native plant communities by exotic perennial grasses; and
- predation by the European red fox.

13.3.4 Critical Habitat

The NSW National Parks and Wildlife Service is responsible for the identification of critical habitat within NSW. Critical habitat is an area of land that is crucial to the survival of a particular threatened species, populations or ecological communities. These areas are declared and listed on a register of critical habitats managed by the OEH.

There are no areas of recommended or declared critical habitat listed on the register of Critical Habitat kept by the Director-General, OEH or I&I NSW that are relevant to the development footprint or the surrounding locality.

13.4 Assessment of Potential Impacts

13.4.1 Overview

The results of the habitat assessments (Appendix E and F of **Appendix H**) indicate that four threatened flora species, 23 threatened fauna species and two endangered ecological communities listed under the TSC Act and/or EPBC Act have either been recorded or are considered as likely to occur within the development footprint, based on habitats present. Accordingly, assessments pursuant to section 5A of the EP&A Act (the NSW assessment of significance) and Commonwealth significant impact criteria assessments for these species were undertaken and are included as Appendix K and L of **Appendix H**.

13.4.2 Threatened Flora

The results of the online database searches indicate that seven threatened flora species have the potential to occur within the Site. Following the habitat suitability assessment it has been determined that the development footprint has the potential to support four of these species, however no threatened flora species were identified during field surveys. An Assessment of the Significance and Significant Impact Criteria assessments of the proposed development on these threatened species

has been undertaken. The NSW and Commonwealth assessment outcomes concur that the proposed development would not have a significant impact on any threatened flora species (see **Appendices K** and **L** of **Appendix H** for detailed assessments of significance and significant impact criteria assessments).

13.4.3 Threatened Fauna

Of the total 42 threatened fauna species listed in Appendix F of **Appendix H** that have the potential to occur on the development footprint according to the results of the various online database searches, the development footprint provides suitable habitat for 23 of these species. Of the 23 potentially present species, targeted survey has been undertaken for all species during appropriate survey times, with the exception of the Golden Sun Moth.

Due to project constraints the survey effort for Golden Sun Moth was undertaken outside the optimal survey period. Consequently, it is recommended that further surveys be undertaken prior to construction, and within the optimal survey period for this species. It has been recommended that surveys targeting this species be undertaken in December (Friends of Grasslands, pers. comm. February 2011), however the optimal survey period for this species is during the flying season which is the period between late October – early January (DEWHA 2009b). It should be noted that an Assessment of Significance, as well as a Significant Impact Criteria assessment have been undertaken for this species, both of which concluded there would not be a significant impact. In addition to these assessments, field surveys were undertaken on site by qualified botanists. Although a key grass species *Austrodanthonia* is present over much of the site within the Native Temperate Grassland community, areas where this grassland species dominates are limited in extent, grassland within the plant footprint, gas pipeline, communications tower, hut footprint, services and access track are particularly deficient in required species (DEWHA 2010g). Therefore, while it is considered unlikely that the Golden Sun Moth would occur within these key areas on site, due to a lack of preferred *Austrodanthonia* species, it is recommended that surveys for this species are undertaken during the optimal survey period.

As the Golden Sun Moth is listed under both the EPBC Act and TSC Act, AGL will be notified immediately should the species be identified on site during pre-clearing surveys. SEWPaC and OEH will then be advised of any records by AGL.

Assessment of the significance of the potential impact of the Project on these threatened species (in the form of NSW Assessments of Significance and Commonwealth significant impact criteria assessments), have been prepared (Appendix K and L of **Appendix H**). These assessments concluded that the Project would not have a significant impact on any threatened fauna species, including the Golden Sun Moth.

13.4.4 Threatened Populations

No listed threatened populations were identified through the desktop review process nor were any identified during field surveys conducted within the Site.

13.4.5 ndangered Ecological Communities

Two endangered ecological communities were found to occur within the development footprint;

- Box Gum Woodland (listed under the NSW TSC Act); and
- Natural Temperate Grassland (listed under the Commonwealth EPBC Act).

Approximately 5.94 ha of Box Gum Woodland and 9.07 ha of Natural Temperate Grassland would be cleared as a result of the proposal. An assessment of significance of the proposed development has been undertaken for Box Gum Woodland (Appendix K of **Appendix H**) and a significant impact criteria assessment for Natural Temperate Grassland (Appendix L of **Appendix H**). The assessment concluded that the Project would not have a significant impact on any endangered ecological community as listed under the TSC Act. The results of the significant impact criteria assessment for Natural Temperate Grassland conclude that the Project would have a significant impact on the community. Consequently, a referral to the Minister has been prepared and submitted.

Table 13-2 summarises the vegetation that would be impacted by the proposed works.

Table 13-2 Vegetation Communities Affected by the proposed works

Vegetation Community	EPBC Act Status	TSC Act Status	Total Area Mapped within AGL Owned Land	Total Area to be Cleared
Grey Box over Exotic Pasture	Not Listed	Not Listed	6.20	0.00
Red Stringybark over Exotic Pasture	Not Listed	Not Listed	0.49	0.00
Exotic Pasture	Not Listed	Not Listed	258.75	15.23
Box Gum Woodland	N/A*	Endangered Ecological Community	147.24	5.94
Natural Temperate Grassland	Endangered Ecological Community	Not Listed	92.58	9.07
Disturbed Shrubland	Not Listed	Not Listed	2.19	2.19
Total			**507.43**	**32.43**

*Community condition does not meet the condition required to be classified as Box Gum Woodland, under EPBC Act.

13.4.6 Threatening Processes

The Project may potentially cause an increase in the following key threatening processes:

- bushrock removal;
- clearing of native vegetation;
- competition and grazing by the feral European rabbit;
- competition from feral honeybees;
- invasion of native plant communities by exotic perennial grasses;
- loss of hollow bearing trees;
- predation by the European red fox;
- removal of dead wood and dead trees; and.
- alteration to the natural flow regimes of rivers, streams, floodplains & wetlands

13.5 Indirect and Operational Impacts

A range of indirect and operational impacts could be expected as a result of the proposed works, including:

- artificial lighting;
- roads and access;
- groundwater and hydrology;
- edge effects and habitat fragmentation; and
- long term impacts.

These impacts are discussed in detail in **Appendix H**.

Provided the mitigation measures outlined in **Appendix H** are adopted, any impacts resulting from the proposed action are unlikely to be detrimental to the biodiversity values of the local area. Further mitigation measures are likely to ameliorate many of the flora and fauna associated impacts.

13.6 Biodiversity Maintenance and Improvement

Appendix H identifies a range of measures that would be employed in order to avoid, mitigate and offset impacts on biodiversity values associated with the Project. This has been structured according to the principles stated in the DEC (2005) guidelines for Part 3A biodiversity assessments.

13.6.1 Impact Avoidance

Impacts on biodiversity have been avoided where possible, through the following means:

- delineating the proposed development footprint as far as possible to comprise cleared areas, aiming to avoid native vegetation; and
- the development footprint comprises highly modified vegetation and habitats, and is dominated by areas of grassland.

In addition, Golden Sun Moth surveys will be undertaken in Spring by a qualified biologist prior to determination.

13.6.2 Impact Mitigation

Mitigation and environmental management measures are recommended to mitigate some of the impacts that may result of from the proposed action. The following mitigation measures (detailed in Section 7.2 of **Appendix H** and summarised in **Section 13.6**) aim to reduce the potential impact on biodiversity within the local area:

- Construction Environmental Management Plan;
- Operational Environmental Management Plan;
- Flora and Fauna Management Plan;
- Vegetation Clearing Strategy;
- Pre-clearing Survey Strategy;
- Two-stage Clearing Strategy;
- Habitat Replacement Strategy;
- Habitat Corridor and Connectivity Plan;
- Groundcover Clearance Strategy;
- Site Management Plan;
- Grazing Management Plan;
- Edge Effects Strategy;
- Sediment and Erosion Control Plan;
- Weed and Pest Management Plan; and
- Complementary Planting and Rehabilitation Plan.

13.6.3 Impact Offset

A key principle presented in the DEC (2005) guidelines is that project proposals should 'maintain or improve' biodiversity values (i.e. there is no net impact on threatened species or native vegetation). Where impacts cannot be avoided or mitigated then it is necessary to identify a suitable biodiversity 'offset' in order to maintain or improve biodiversity values.

As a key component of the Dalton Power Project, a biodiversity offset is proposed, along with resources for its management in perpetuity. Management arrangements for the offset site, located on land already under AGL ownership, will be confirmed through discussions between AGL, OEH and SEWPaC so as to ensure that biodiversity values are 'maintained or improved'. This offset would ensure that any loss of EEC vegetation and threatened species habitat is appropriately managed and matched with the conservation of land containing similar vegetation and habitat resources that is acceptable to all parties.

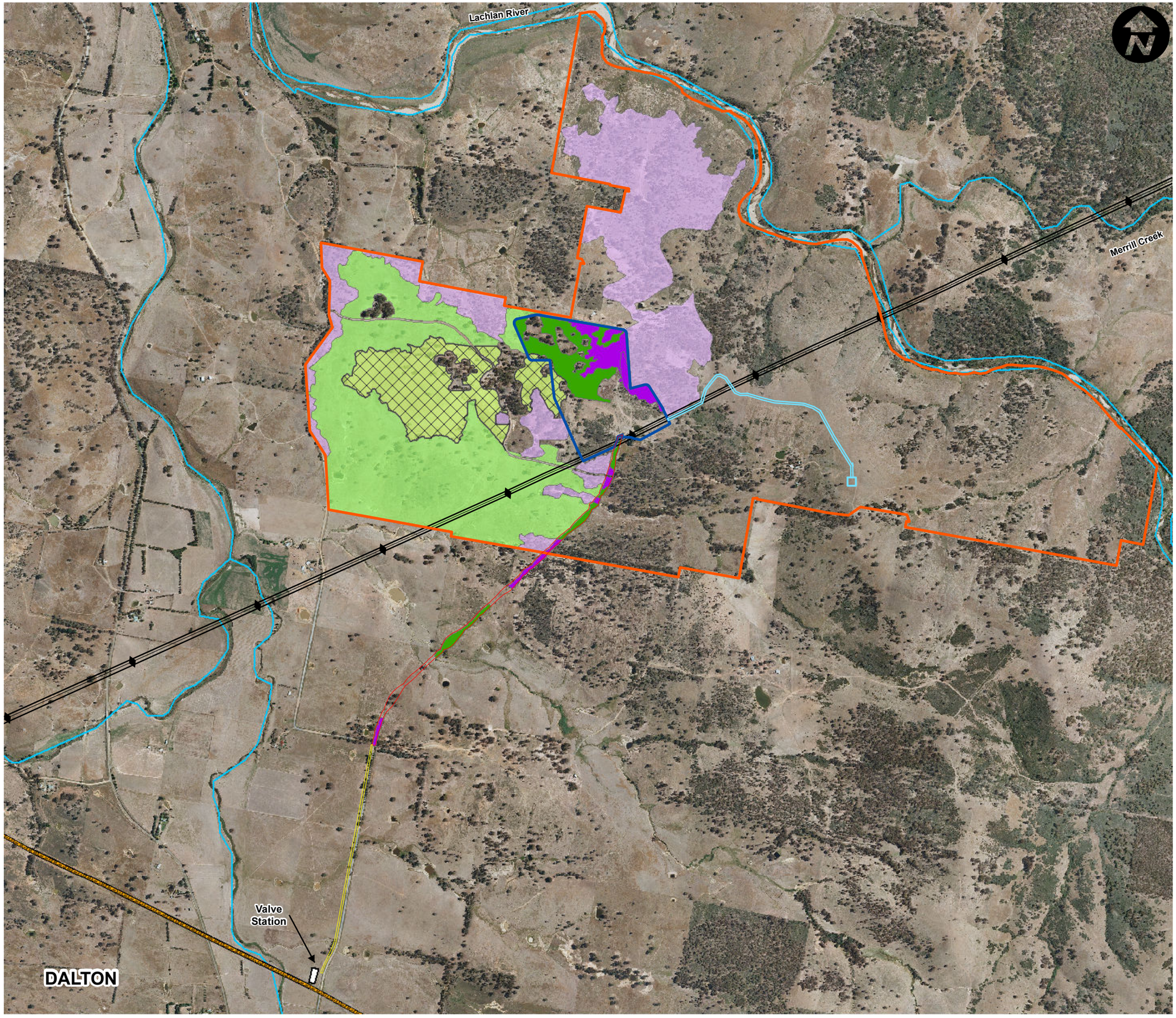
The offset site would be managed so that the condition of the relevant EECs are improved, and to ensure that the overall vegetation condition within the AGL owned land is maintained, taking into consideration the following abiotic and biotic factors:

- habitat connectivity and condition;
- habitat resources such as existing hollow bearing trees, rocky outcrops, fallen timber, recruitment trees that would develop hollows in the future;
- vegetation patch size;
- species diversity and cover; and
- the condition of abiotic elements within the community (e.g. investigations to determine soil invertebrate composition which can be used as indicators of soil health or is the current flow regime of water within the catchment natural, if not can it be restored).

The offset site would take into consideration the habitat requirements of all known and predicted threatened biota, given the requirements of individual species is highly variable and in more natural setting ecological communities are heterogeneous. Ecological communities will often contain several ecological niches providing mosaic patches of habitat for a variety of species. Natural mosaic habitat patches are often produced from events such as fire, floods etc.

Vegetation clearing for the proposed development, and associated potential loss of biodiversity values, would be offset with the long-term protection and enhancement of vegetation condition and connectivity as well as the addition of significant habitat features within the proposed offset Site.

The loss of biodiversity associated with this Project is a result of the removal of vegetation classified as one of two EECs. These are Natural Temperate Grassland (9.07 ha), and Box Gum Woodland (5.94 ha). In addition, there would be a reduction in significant habitat features including; stag trees, hollow bearing trees, feed trees, fallen timber and rocky outcrops. All of these features may provide breeding, nesting and/or foraging sources for threatened species in the local area. To compensate for the loss of biodiversity, AGL proposes to set aside and maintain land in areas adjacent to the development footprint for conservation. The proposed offset area is located on AGL owned land and is shown in **Figure 13-2**.



Legend

- AGL Site Boundary
- Plant Footprint
- Gas Pipeline (northern and Access Road)
- Gas Pipeline (southern)
- Communications Tower and Hut Footprint
- Communications Tower Services and Access Track
- Moomba-Sydney Pipeline
- Transmission Line

EEC's impacted by construction (URS):

- Natural Temperate Grassland^
- Box-Gum Woodland*

EEC's for Offset (URS):

- Natural Temperate Grassland^
- Box-Gum Woodland*
- Potential Natural Temperate Grassland

* TSC Listed Community
^ EBPC Listed Community

0 1
Kilometres

Source: Aerial Image from AGL

Drawn: AO/SB	Approved: KT	Date: 16/06/2011
Job No.: 43177661	File No.: 43177661.044.mxd	

Client

AGL

Project

DALTON POWER PROJECT

Title

URS VEGETATION MAPPING OFFSETS

Figure: 13-2

URS

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Chapter 13 Flora and Fauna

URS has provided a comprehensive assessment of all tree hollows to be removed from within the Project footprint, and of all tree hollows found within the proposed offset area (**Appendix O**).

The value of hollow-bearing tree habitat in the proposed offset site was found to be significantly higher than that found within the proposed development footprint. The proposed offset site would conserve 49 hollow-bearing trees which were found to support ≥ 108 hollows, whilst the clearing of land within the development footprint would result in the removal of 33 hollow-bearing trees which were found to support ≥ 55 hollows. Furthermore, the hollow-bearing trees present in the proposed offset area (supporting 71 small, 22 medium and 16 large hollows) provide a more diverse range of hollows, when compared to those found in the development footprint (supporting 38 small, 17 medium and no large hollows) (**Appendix O** of **Appendix H**).

The key threatened species identified (or assumed present) on site that are dependent on hollow-bearing tree resources, include the following:

- Brown Treecreeper (*Climacteris picumnus victoriae*); and
- Gang Gang Cockatoo (*Callocephalon fimbriatum*).

Table 13-3 outlines the characteristics of tree hollows used by the key threatened species identified for the site. The data demonstrate that the broad range of tree hollow characteristics required by each species have been provided in the offset area. As such, the proposed offset area would provide more valuable hollow-bearing tree resources for the key threatened species in terms of number and diversity of hollows (Appendix O of Appendix H), than those found in the proposed development footprint.

Table 13-3 Characteristics of tree hollow types used by key threatened species

	EPBC Act	TSC Act	Height (cm)	Mean DBH* (cm)	DBH range	Mean entrance height (m)	Entrance height range (m)	Mean entrance diameter (cm)	Entrance diameter range (cm)	Hollow depth (cm)	Preferred Tree Species	References
Brown Treecreeper *Climacteris picumnus victoriae*	-	V	17				1.5-15	6		35		(Franks and Franks 2003; DEC NSW 2005h)
Gang-gang Cockatoo *Callocephalon fimbriatum*	-	V	34				20-30	25		70-200	Eucalypts	(Simpson and Day 1999; Gibbons and Lindenmayer 2003)
Barking Owl *Ninox connivens*	-	V	40	120	60-260	10	5-19	27.8	14-76	104	Eucalypts & Melaleuca	(Taylor et al 2002 in Goldingay 2009, Gibbons and Lindenmayer 2003)
Little Lorikeet *Glossopsitta pusilla*	-	V	16	-	-	6.8	2-15	3.2	2.7-3.9	>65		(Courtney and Debus 2006 in Goldingay 2009)
Powerful Owl *Ninox strenua*	-	V	55	130	77-180	20	14-28	-	-	-		(Kavanagh 1996 in Goldingay 2009)
				163	88-233	22	8-40	-	-	-		(McNabb 1996 in Goldingay 2009)
Superb Parrot *Polytelis swainsonii*	V	V	38	115	-	10.1	5-20	>11	4-16+	<1-10		(Manning et al 2004 in Goldingay 2009)
Squirrel Glider *Petaurus norfolcensis*	-	V		93	35-159				4-51		Eucalypts	(Traill and Lill 1997; Crane et al 2008)
Swift Parrot *Lathamus discolor*	E	E	24	10	-	14	6-35	-	4-20	30-60	Eucalypts	(Higgins 1999 in Goldingay 2009; Gibbons and Lindenmayer 2003)
Turquoise Parrot *Neophema pulchella*	-	V	20	9/19	6-32	1/1.4	0.2-6	-	5-11	40	Eucalypts & Casuarina	(Higgins 1999 in Goldingay 2009; Quin and Baker-Gabb 1993 in Goldingay 2009; Gibbons and Lindenmayer 2003)

***DBH = Diameter at breast height**

In addition, the proposed mitigation measures include the provision of further compensatory habitat for key threatened species, through the installation of nest boxes in the offset area. As the design and position of nest boxes can influence the patterns of occupancy by different species (Gibbons and Lindenmayer 2003), it is recommended that nest boxes be designed in alignment with those measurements specified in **Table 13-3**, in order to meet the specific habitat requirements of key threatened species.

The proposed offset site would involve the permanent conservation of existing native vegetation including Natural Temperate Grassland and Box Gum Woodland and the associated habitat features that provide habitat for such threatened fauna species such as; Pink-tailed Worm-lizard, Striped Legless Lizard and Golden Sun Moth, Gang-gang Cockatoo, Turquoise Parrot, Swift Parrot, Little Lorikeet, Superb Parrot, Speckled Warbler, Hooded Robin, Varied Sittella, Scarlet Robin, Flame Robin, Diamond Firetail and Brown Tree Creeper and threatened flora species such as; Yass Daisy, Silky Swainson-pea, Button Wrinklewort and Hoary Sunray.

A portion of the offset site would include an area of degraded land that, if appropriately managed, would meet the definition of the EEC Natural Temperate Grassland (**Figure 13-2**). Management initiatives for this area would include the elimination of stock through fencing, weed management and assisted natural regeneration with some planting/direct seeding if necessary. This measure is considered to represent an 'offset', as it would successfully maintain and improve the vegetation that is floristically and structurally similar to that which is to be cleared.

The application of the 'maintain or improve' test to the Project is summarised in **Table 13.4**.

Table 13-4 Project Impacts, Mitigation Measures and Potential Offsets

Impact	Mitigation	Offset
• Minimal impacts on vegetation or fauna habitat, corridors in the locality. • Removal of 5.94 ha of Box Gum Woodland EEC vegetation. • Removal of 9.07 ha of Natural Temperate Grassland EEC vegetation. • Removal of exotic pasture. • Removal of paddock trees, including some hollow bearing habitat trees. • Removal of fallen timber, rocky outcrops and feed trees.	• CEMP and OEMP. • Flora and fauna management plan. • Vegetation clearing strategy including two-stage clearing and pre-clearing survey strategies. • Habitat replacement strategy. • Habitat corridor and connectivity plan. • Groundcover clearance strategy. • Site management plan. • Grazing management plan. • Edge effects strategy. • Sediment and erosion control plan. • Weed and pest management plan. • Complementary planting and rehabilitation plan.	• Provision of a biodiversity offset, with approximately 80.71 ha of Natural Temperate Grassland • Provision of a biodiversity offset, with approximately 77.57 ha of Box Gum Woodland • Provision of approximately 24.97 ha of Exotic Pasture that with appropriate management actions may become Natural Temperate Grasslands. • Over 49 hollow bearing trees to be offset within the designated offset area.

On the basis of the above assessment, the offset site is consistent with DEC (2005) and DEWHA (2007) guidelines for offsets, and meets the key criteria for 'like-for-like or better' trade-offs of biodiversity values. Adoption of the proposed mitigation measures outlined in Section 7 of **Appendix H**, along with the proposed offset described above, would compensate for the loss of vegetation associated with the proposal and would result in a net improvement in biodiversity values within the Site in the long term. Hence the current proposal 'maintains or improves' biodiversity values. Consequently, the Project should not produce any negative cumulative impacts with respect to flora and fauna.

13.6.4 Proposed Offset Area

The proposed offset area totals approximately 183.25 ha and is shown in **Figure 13-2**. A decision will be made following the determination of the Project in relation to the precise, and most appropriate, long-term conservation mechanism for the offset area, The proposed offset area reflects the values of the native biodiversity of the development footprint. It encompasses some of the areas of highest relative biodiversity value within the Site. The offset site also includes areas that would otherwise not be conserved either naturally or through existing land management practices. With appropriate management, these the biodiversity values of these areas would be improved, and provide important additions to EEC communities in a long term conservation management regime.

The key features of the offset site include:

- 158.28 ha of native vegetation which comprises vegetation of high conservation significance, namely, endangered ecological communities:
  - Natural Temperate Grassland (80.71 ha); and
  - Box Gum Woodland (77.57 ha).
- 24.97 ha of Exotic Pasture that with appropriate management has the potential to become Natural Temperate Grassland.
- Protection of areas of native vegetation that have the potential to support a range of threatened fauna species, as well as numerous common native species.
- Protection of 49 hollow bearing trees (≥108 hollows) (**Appendix O** of **Appendix H**), providing potential habitat for a range of hollow-dependent threatened fauna species
- Protection of habitat features such as rocky outcrops and fallen timber that may be used by a range of threatened fauna species.

Table 13-5 summarises the potential offset Site suggested by AGL to offset the proposed action.

Table 13-5 Proposed Offset Strategy

Vegetation Community	EPBC Act Status	TSC Act Status	Total Area Mapped	Total Area to be Cleared	Total Area in Proposed Offset
Exotic Pasture (Potential Natural Temperate Grassland)	N/A	N/A	25.82	**0.84**	**24.97**
Box Gum Woodland	N/A*	Endangered Ecological Community	147.24	**5.94**	**77.57**
Natural Temperate Grassland	Endangered Ecological Community	N/A	92.58	**9.07**	**80.71**
Total (hectares)			**265.64**	**15.85**	**183.25**

*Community condition does not meet the condition required to be classified as Box Gum Woodland, under EPBC Act.

13.6.5 Management of Offset Site

The management of the conservation area would be confirmed and agreed through discussions between AGL, OEH and SEWPaC. These discussions would also confirm the proposed management actions outlined in **Section 7.3.2** of **Appendix H**. Full details of the proposed management regime would be included in a management plan that would be prepared in consultation with OEH and, if required, SEWPaC.

Approximate costs for some aspects of offset site management have been provided by AGL, with estimates that works would require site establishment costs of around $15,000 for exclusion fencing, as well as an average cost of rehabilitation of around $24,000 per annum over a 20 year period. These costs are likely to be higher in the first 5 to 10 years than in the second 10 years of rehabilitation works. Detailed costing of the proposed management measures would be determined following development of a detailed management plan for the offset site.

13.7 Summary of Mitigation Measures

Table 13-6 below and **Appendix H,** Flora and Fauna Assessment present both a summary and a range of detailed mitigation measures relating to flora and fauna.

Table 13-6 Summary of Mitigation Measures

Mitigation Measure	Implementation		
	Design	Construction	Operation
A Flora and Fauna Management Plan (FFMP) would be developed and implemented as part of the CEMP and include measures for the minimisation or avoidance of impacts on threatened as well as common native flora and fauna.		✓	
A Vegetation Clearing Strategy for the development footprint would be developed and implemented to ensure clearing only occurs where necessary.		✓	
A Pre Clearing Survey Strategy would be developed and implemented to detail pre-clearance ecology surveys to be undertaken within all areas planned for vegetation clearance. Surveys would be carried out by qualified ecologists prior to all clearing activities. Surveys would target potentially present threatened flora and fauna and threatened fauna species habitat. OEH/SEWPaC would be consulted regarding requirements for further action.		✓	
A Two-Stage Clearing Strategy would be developed and implemented for areas identified as containing habitat trees (trees with hollows and other habitat features such as nests, drays etc).		✓	
A Habitat Replacement Strategy would be developed and implemented to provide effective delivery of replacement habitat in the adjoining proposed offset area in order to compensate for all EPBC Act vegetation habitat removed. AGL estimates that these works would require site establishment costs of around $15,000 for exclusion fencing, as well as an average cost of rehabilitation of around $24,000 per annum over a 20 year period. These costs are likely to be higher in the first 5 to 10 years than in the second 10 years of rehabilitation works.		✓	
A Habitat Corridor and Connectivity Plan would be developed and implemented with the objective that any planned remediation works would aim to increase the value of the Site in regards to connectivity with other remnants in the landscape, through the revegetation of habitat corridors within the offset area.		✓	✓
The Site Management Plan would include commitment to: • Maintain low vehicle speed limits on Site and in the surrounding locality to reduce fauna road fatalities; • Restrict all vehicular and personnel entry into retained vegetation through exclusion fencing, signage, locating access roads and paths to avoid habitat damage; • Educate workers as to the appearance and location of all threatened species and ecological communities as well as noxious weeds present or likely to be present within the Site, and mark their locations onto site plans; • Employ down-lights and motion sensor lighting in order to reduce light spill and the associated secondary impact on nocturnal fauna species potentially using the adjoining vegetation. All lighting should be directed inwards so as to minimise any spill outside the areas of activity; and • Areas identified for clearing should be clearly marked prior to construction using highly visible flagging tape or spray paint to prevent unnecessary clearing		✓	✓

Mitigation Measure	Implementation		
	Design	Construction	Operation
A Grazing Management Plan would be developed and implemented to exclude grazing by cattle and sheep to improve the habitat value and floristic diversity of retained vegetation.		✓	✓
An Edge Effect Strategy would be developed to manage and reduce possible edge effects and fragmentation from the Project.		✓	✓
All water way crossings would be designed and constructed in accordance with the I&I NSW Policy and Guidelines for Fish Friendly Waterway Crossings and Why Do Fish Need to Cross the Road? (Fairfull, S. and Witheridge, 2003 and NSW DPI, 2004) and DWE's Guidelines for Controlled Activities – Watercourse Crossings (DWE, February, 2008).	✓	✓	
A Weed and Pest Management plan would be developed and implemented.		✓	✓
A Complementary Planting and Rehabilitation Plan would be developed and implemented. This would include strategies to utilise plant species to replicate Box Gum Woodland and Natural Temperate Grassland floristic composition. Planting of local provenance seed, propagules, or saplings would be undertaken where possible and utilise best practice bush regeneration techniques.			✓
AGL would implement a Biodiversity Offset Strategy (in consultation with OEH and SEWPaC) to compensate for clearing associated with the Project and in line with the requirements of the offsetting policies of those bodies to provide management the offset area for environmental purposes in perpetuity.			✓
Golden Sun Moth surveys will be undertaken in Spring by a qualified biologist prior to determination.	✓		

In particular the FFMP mentioned above in **Table 13-6** would also need to address the potential impacts and mitigation measures for each EPBC Act and TSC Act listed threatened species that have been identified, or are considered as having the potential to occur within the Project Area. **Table 13-7** below outlines all such species and the associated impacts and mitigation measures.

Table 13-7 Potential impacts & mitigation measures for Matters of NES

Matters of National Environmental Significance (NES)		EPBC Act Statust*	TSC Act Status*	Potential Impacts	Mitigation Measures
Common Name	Scientific Name				
Flora					
Button Wrinklewort	*Rutidosis leptorrhynchoides*	**E**	**E**	• Potential habitat loss due to infrastructure development; and • Weed invasion.	• Protect areas of known habitat; • Undertake weed control on site; • Ensure appropriate fire regimes; • Perform pre-clearing surveys prior to construction; and • Avoid undertaking ploughing in area.
Yass Daisy	*Ammobium craspedioides*	**V**	**V**	• Loss of potential habitat due to land clearing; • Destruction of plants by rabbits; and • Weed invasion.	• Protect areas of known habitat; • Perform pre-clearing surveys prior to construction; • Implement feral animal control (especially rabbit control); and • Undertake weed control on site.
Hoary Sunray	*Leucochrysum albicans var. tricolor*	**E**	**-**	• Potential habitat loss due to infrastructure development; and • Weed invasion.	• Protect areas of known habitat; • Perform pre-clearing surveys prior to construction; and • Undertake weed control on site.
Silky Swainson-pea	*Swainsona sericea*	**-**	**V**	• Potential habitat loss due to land clearing and development; and • Weed invasion.	• Protect areas of known habitat; • Perform pre-clearing surveys prior to construction; and • Undertake weed control on site.
Mammals					
Eastern False Pipistrelle	*Falsistrellus tasmaniensis*	**-**	**V**	• Loss & fragmentation of potential habitat; • Loss of hollow-bearing trees; • Disturbance to potential roost & breeding sites; • Poisoning from application of pesticides in area; and • Injury from barb-wired fences.	• Retain areas of known habitat e.g. understorey and midstorey shrubs; • Conserve hollow-bearing trees;

Matters of National Environmental Significance (NES)		EPBC Act Statust*	TSC Act Status*	Potential Impacts	Mitigation Measures
Common Name	Scientific Name				
Squirrel Glider	*Petaurus norfolcensis*	-	V		• Protect roost and den sites from disturbance; • Minimise the use of pesticides in the area; and • Avoid using barb-wired fences on site
Spotted-tail Quoll	*Dasyurus maculates*	E	V	• Clearing & fragmentation of native vegetation • Feral species impacts (e.g. foxes); and • Increased road mortality.	• Protect areas of known or potential habitat where possible, e.g. latrine sites; hollow logs, rocky outcrops and riparian vegetation • Implement feral animal control (especially cats and foxes); and • Limit vehicle speeds in and around site.
Reptiles					
Grassland Earless Dragon	*Tympanocryptis pinguicolla*	E	E	• Potential habitat loss and fragmentation; • Bush-rock removal; • Altered irrigation; • Weed invasion; and • Feral species impacts (e.g. rabbits).	• Protect areas of known habitat; • Conserve rocks and rocky outcrops wherever possible; • Maintain natural-historic irrigation on site; • Undertake weed control on site; and • Implement feral species control (especially targeting rabbits).
Pink-tailed Worm Lizard	*Aprasia parapulchella*	V	V	• Potential habitat loss & fragmentation; • Bush-rock removal; • Feral species impacts (e.g. rabbits) • Weed invasion; and • Inappropriate replanting strategies (e.g. replanting tree species within grassland areas), resulting in reduction of potential habitat.	• Protect areas of known habitat; • Conserve rocks and rocky outcrops; • Implement feral animal control (especially rabbit control); and • Undertake weed control on site. • Ensure appropriate replanting in all rehabilitation works; and • Implement feral animal control (especially rabbit control); and • Undertake weed control on site.

Matters of National Environmental Significance (NES)		EPBC Act Status*	TSC Act Status*	Potential Impacts	Mitigation Measures
Common Name	Scientific Name				
Striped Legless Lizard	*Delma impar*	**V**	**V**	• Loss of potential habitat; • Feral species impacts (e.g. cats, dogs, foxes); and • Weed invasion.	• Protect areas of known habitat; • Implement feral animal control (especially targeting cats, dogs, foxes); • Conserve rocks and rocky outcrops; • Conduct construction activities outside of warmer months where possible; and • Undertake weed control on site.
Parrots					
Swift Parrot	*Lathamus discolour*	**E**	**E**	• Clearing & fragmentation of potential habitat in wintering range; • Feral species impacts (mainly competition for nectar resources)	• Protect areas of potential habitat where possible; • Implement feral animal control (especially targeting species such as the introduced Feral Bumblebee); and • Rehabilitation works to include flowering Eucalypt species suitable for use by this species where possible.
Superb Parrot	*Polytelis swainsonii*	**V**	**V**	• Clearing, degradation & fragmentation of potential habitat; • Potential hydrological changes; • Loss of hollow bearing trees • Feral species impacts (mainly competition for nest sites); • Use of insecticide sprays resulting in poisoning; and • Loss of potential recruitment trees (those trees that will form hollows over time).	• Protect areas of known or potential habitat where possible; • Maintain natural hydrological regimes; • Conserve hollow-bearing trees where possible; • Implement feral animal control targeting species such as the Indian Myna & feral honey bee; and • Revegetation to include species suitable for use by the species such as Box Gum Woodland canopy species.
Gang-gang Cockatoo	*Callocephalon fimbriatum*	**-**	**V**	• Clearing & fragmentation of potential habitat; • Loss of hollow-bearing trees; and • Feral species impacts	• Retain areas of known or potential habitat where possible; • Conserve hollow-bearing trees where possible; and • Implement feral animal control targeting cats, foxes and the feral honeybee.
Turquoise Parrot	*Noephema pulchella*	**-**	**V**		
Little Lorikeet	*Glossopsitta pusilla*	**-**	**V**		

Matters of National Environmental Significance (NES)		EPBC Act Statust*	TSC Act Status*	Potential Impacts	Mitigation Measures
Common Name	Scientific Name				
Woodland Birds					
Brown Treecreeper	*Climacteris picumnus*	-	V	• Clearing & fragmentation of potential habitat, including remnant woodland; • Loss of hollow-bearing trees; • Removal of habitat resources (e.g. stags, course woody debris and ground litter); and • Feral species impacts (especially nest predation); and • Weed invasion.	• Retain areas of known or potential habitat such as remnant vegetation and paddock trees where possible; • Undertake revegetation or regeneration works to enhance habitat connectivity post construction; and • Conserve hollow-bearing trees and other habitat resources such as stags, ground litter and source woody debris where possible. • Fencing of known or potetial habitat adjacent to the development footprint to protect natural features; • Implement feral animal control, targeting cats, foxes, black rats; and • Undertake weed control on site
Hooded Robin	*Melanodryas cucullata*	-	V		
Speckled Warbler	*Chthonicola sagittatus*	-	V		
Varied Sittella	*Daphoenositta chrysoptera*	-	V		
Diamond Firetail	*Stagonopleura guttata*	-	V		
Flame Robin	*Petroica phoenicea*	-	V		
Scarlet Robin	*Petroica boodang*	-	V		
Birds of prey					
Spotted Harrier	*Circus assimilis*	-	V	• Clearing, degradation and disturbance of potential habitat; • Secondary poisoning from rodenticides and rabbit baiting	• Retain areas of known or potential habitat, especially those areas likely to be used for nesting or foraging activities; and • Rehabilitate areas of potential habitat following completion.
Little Eagle	*Hieraaetus morphnoides*	-	V		
Owls					
Barking Owl	*Ninox connivens*	-	V	• Loss, fragmentation and degradation of potential habitat; • Loss of hollow-bearing trees; • Disturbance to potential nest sites • Removal of potential habitat resources (e.g. stags and course woody debris); • Secondary poisoning from pest control activities; and • Feral species impacts (especially fledgling predation).	• Retain areas of potential habitat where possible; • Conserve hollow-bearing trees where possible; • Retain buffer around known nest sites (≥ 200 m) if any found within Project site; • Protect riparian vegetation to preserve potential roosting areas; • Retain habitat resources e.g. course woody debris, stags and hollow bearing trees; and • Implement feral animal control (especially cats, dogs and foxes).
Powerful Owl	*Ninox strenua*	-	V		

Insects					
Golden Sum Moth (GSM)	*Synemon plana*	**CE**	**E**	• Loss & degradation of Wallaby-grass dominated grassy woodlands; • Soil disturbance at potential Golden Sun Moth sites; • Impacts resulting from landscaping works such as mowing and slashing; • Use of glyphosate-herbicide; and • Planting of trees in grasslands resulting in reduction of potential habitat areas.	• Retain potential habitat (grassland areas) where possible; • Conduct activities outside of Golden Sun Moth breeding season where possible; • Design fences to allow passage of Golden Sun Moth; • Undertake weed control on site; • Implement a biomass management program on site; • Fence habitat on 3 sides; and • Implement feral animal control (especially rabbits).

* CE - Critically Endangered, E - Endangered, V - Vulnerable

Water Management– Summary of Key Outcomes

The water requirements, wastewater production, stormwater management and flooding potential have been assessed for both construction and operation of the Dalton Power Project.

The facility has a small essential water demand, comprising domestic water, utility water and firewater water. In addition it has a discretionary process water demand to improve turbine efficiency. While the Facility can run without process water, it is desirable that it be supplied to allow the turbines to operate significantly more efficiently.

Water for the Project will be sourced through a number of options. Water will be sourced from a range of sources including: tankering (by road) water to the Site; groundwater extraction; and via the augmentation of the Dalton or Gunning supply and/or from the Gunning Sewerage Treatment Plant if the water quality is suitable and sufficient water quantities are available. It is currently proposed that the site water supply may be offsite tankering to meet the essential base domestic and utility water demands, and some or all of the process water demands (depending upon the development option adopted). AGL also proposes to obtain water from on site groundwater extraction to meet the full nominated site water supply requirements. Water may also be obtained from Upper Lachlan Shire Council water supplies.

The most significant potential water demand for the Facility is process water, for supply of gas turbine inlet air evaporative cooling and, if installed, high fogging systems. Deionised water is required for the high fogging demand, and deionised water or high quality (low salinity) potable water can be used to supply the evaporative coolers, A process water treatment plant would be expected to be required on site, regardless of the water supply source, although the level of complexity would change depending upon the source(s) water quality. A potable water supply would be required for domestic purpose, as well as a utility water supply for miscellaneous plant uses. Fire fighting water requires dedicated storage tanks. Landscaping water would be sourced from rainwater, although this may need to be supplemented during flora establishment. There would be provision on site for the delivery of bulk water via tanker trucks.

Process wastewater is generated at the Facility by the process of blow down from evaporative air inlet coolers and wastewater streams arising from process water pretreatment. The specific pretreatment processes would depend on the final water supply selection and wastewater streams that may arise from the plant include: ion-exchange resin regeneration wastewater; filter backwashes; and desalination concentrate. The process water treatment plant would be designed to minimise the generation of wastewater following a cost benefit analysis. If a plant configuration is selected which includes both high fogging and evaporative cooling process water demands, then a brine concentration system may be installed to reduce the wastewater volume, and facilitate recycling of the recovered distilled water.

Process wastewater streams would be collected in evaporation ponds lined with a synthetic liner (such as high density polyethylene) and to minimise the risk of the saline wastewater escaping into the natural groundwater system. Brine would be periodically removed from the evaporation pond(s) (or potentially directly if a brine concentrator is installed) when it is nearly dry to manage the accumulation of salts in the pond. This would occur by road tanker for disposal at a licensed facility.

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Clean rainwater collected from the Facility catchment area would be directed to a sedimentation pond. The outlet of the stormwater system would be designed to maximize the dispersion of these high flows and thereby minimise their potential to cause soil erosion downstream.

Surface water from potentially impacted process areas and bunded areas would discharge to the sedimentation pond via a sediment and oil trap. Bunds would only be drained (manually) after confirmation that the contents are uncontaminated. In the event of contamination, the bund contents would be educted by vacuum truck and transported offsite to a licensed disposal facility.

All construction works for the Project would be undertaken in a manner to minimise the potential for soil erosion and sedimentation. Wastewater volumes have been estimated and management strategies developed to effectively maintain zero discharge from the site except for natural surface flows.

14.1 Introduction

This chapter presents an assessment of the water requirements, wastewater production and stormwater management at the site for the Dalton Power Project. Both the construction and operation aspects have been considered.

This assessment includes:

- an assessment of the water quantity and quality impacts, with particular reference to the water needs of the Project;
- the proposed source(s) of water;
- the implementation of water saving measures;
- identification of the quantity and quality of wastewater and how this wastewater is to be disposed of; and
- the management of stormwater at the Site.

The Project area is managed by the Lachlan Catchment Management Authority and the Dalton area falls under the Lachlan River – Unregulated surface water management and the Lachlan Fold Belt groundwater management unit. **Figure 14-1** indicates the area of the Lachlan River Catchment, with the Project region shaded purple.

14.2 Existing Environment

14.2.1 Topography and Surface Water

The Site is located in the Lachlan River Catchment. The Lachlan River Catchment is shown in **Figure 14-1**, with the subject area shaded. Much of the Site is comprised of undulating hills, with areas of gently sloping plains to the south and west. A large hill is present in the south-west section of the site. The Lachlan River forms a boundary to the north and east of the Site. The western and eastern sections of the Site gently slope towards the river; however some sections of the property in these locations are quite steep.

The majority of the Site drains to the north, while the south-western portion of the Site drains to the west. There are approximately three farm dams within the site that would have historically been used for agricultural purposes.

The northern and eastern boundaries of the Site are formed by the Lachlan River with the most western and eastern sections having areas of land that slope gently towards the river and are suitable for development.

The south-western corner of the Site is characterised by a large hill which is visible from the surrounding properties but which provides some screening of a large part of the remainder of the Site.

The historic land use for the subject area and surrounds includes predominantly rural enterprises, typically sheep and cattle grazing for the wool and dairy industries. The Site currently operates as a rural land holding for sheep and cattle. The majority of the Site is cleared with remnant vegetation

largely confined to banks of some watercourse and ridge lines/steep slopes. Some areas of woodland exist in the centre of the Site.

The Development Footprint, located on the larger property, is shown in **Figure 14-3**. Pre-development contours are shown on the drawing. It can be seen from this that the existing pre-developed site is situated on a ridge line which effectively splits the proposed plant footprint area into two subcatchments, therefore approximately equal volume of surface water runoff currently discharges towards the north and the south. Runoff towards the north discharges into a valley and eventually into the Lachlan River. The southern sub-catchment discharges towards the south into an existing unnamed ephemeral creek, flowing east to west. The unnamed creek is a subsidiary of Oolong Creek, aligned and flowing from the south to the north, which is a tributary of the Lachlan River, towards the north.

14.2.2 Upper Lachlan Catchment Water Quality

Water quality in the upper Lachlan catchment was reviewed by the Department of Sustainable Natural Resources in 2003 (NSW Department of Sustainable Natural Resources, June 2003a).

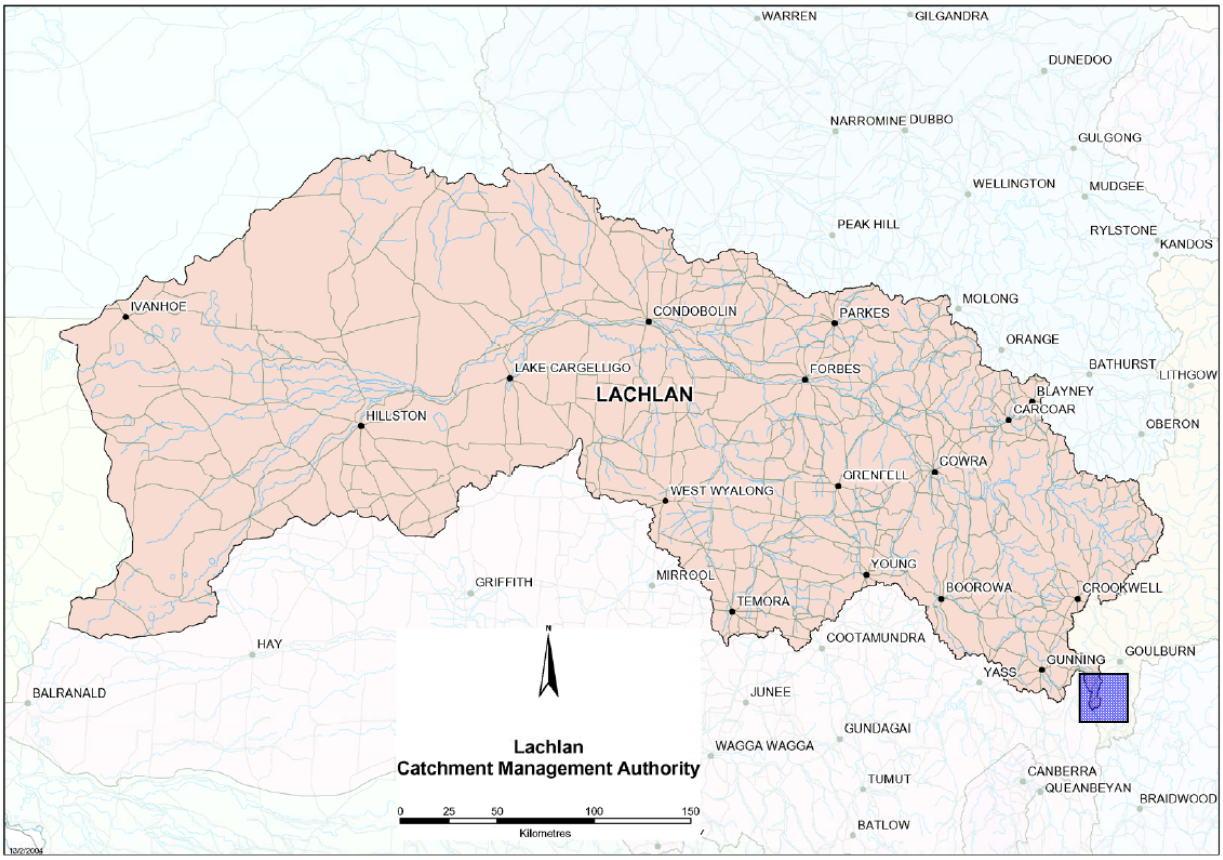
The report indicates that Upper Lachlan River waters are:

- Nutrient enriched with average phosphorus concentrations higher than ANZECC guidelines. However, median phosphorus concentrations are typically below ANZECC trigger values indicating high phosphorus concentrations under flood conditions probably correlated with suspended solids movement.
- Typically high in turbidity particularly during flood events as suspended particulate matter is transported. Turbidity readings are typically well below 50 NTU but under flood conditions turbidity can reach at least 400 NTU.
- High in median nitrogen concentrations often exceeding ANZECC guideline values.

These results suggest a high potential for algal growth with phosphorus limiting conditions.

A review of river salinity in the Lachlan (NSW Department of Natural Sustainable Resources, June 2003b) indicates that waters in the upper Lachlan are considerably more saline than other areas with typical EC readings above 800 µS/cm. The NSW State of Environment Report 2004 shows that EC readings are highly seasonal with winter readings circa 400 µS/cm and summer (low flow) readings ~1000 µS/cm up to ~1200 µS/cm. This seasonal change in EC reflects the increasing dominance of groundwater flows in low flow periods.

Figure 14-1 Lachlan River Catchment



14.2.3 Groundwater

Regional Geology

The Site is located within the very upper reaches of the Lachlan catchment, which is in the north eastern corner of the Murray Basin.

Published geological maps and cross-sections describe the subsurface geology in the study area as Ordovician aged silty sandstone, micaceous siltstone, phyllite, shale and slate. The township of Gunning is flanked to the east and west by north-south trending granites comprising the Silurian aged Wyangala Batholith. The Wyangala Batholith is described as a gneissic and massive biotite and hornblende biotite granite. There are some small areas where Tertiary aged basalts and dolerites outcrop. In the vicinity of Gunning un-named Tertiary aged gravel, sand, clay, claystone and sandstone sediments outcrop (Brunker and Offenberg, 1968).

Regional Hydrogeology

The site is located within the Lachlan River Catchment and within the Lachlan Folds Belt Groundwater Management Area (GWMA). The highest yielding and most actively utilised groundwater targets in the Lachlan Catchment are located in the alluvial aquifers. GWMA's located in the catchment include:

- Lower Lachlan;
- Upper Lachlan Alluvium;
- Belubula Valley Alluvium;
- Young Granite;
- Orange Basalt; and
- Lachlan Fold Belt.

The Lower Lachlan Groundwater Management Area (GWMA) has a water management plan, which commenced in February 2008. The level of entitlement prior to the commencement of the plan exceeded the long-term annual average extraction limit (LTAAEL). The plan reduces the level of water entitlement over ten years to the LTAAEL. Licence holders have also received structural adjustment through the Achieving Sustainable Groundwater Entitlements (ASGE) scheme to alter their enterprises to the reduced level of entitlement.

The Upper Lachlan Alluvium, Belubula Valley Alluvium, Young Granite and Orange Basalt GWMAs are also areas of high groundwater use and entitlement. The Upper Lachlan Alluvium and Belubula Valley Alluvium GWMAs are high yielding aquifers. In these GWMAs the water is mainly used for the irrigation of large areas, such as crops and pasture, whereas in the Young Granite and Orange Basalt GWMAs the groundwater is used for the irrigation of cherries and apples respectively.

The Lachlan Fold Belt GWMA, in which the Dalton Power Project is located, has diverse characteristics due to the large area it covers. In this area the groundwater contributes flows to streams and is the source of spring flows. These systems support a diverse range of aquatic and terrestrial ecosystems, either directly or indirectly. They also ensure the availability of stock and domestic water for landholders.

Local Hydrogeology

The aquifer systems in the vicinity of the Site are limited to a number of basement (fractured rock aquifers) formations. There is no regional scale alluvial aquifer of any note in this portion of the catchment. The basement formations can be categorised into the following:

- Ordovician aged silty sandstone, siltstone, phyllite, shale and slate; and,
- Wyangala Batholith.

Tertiary aged basalts and dolerites and located in proximity to Gunning are unlikely to be utilisable groundwater source in the region due to their limited lateral and vertical extent.

The regional aquifers are fractured rock systems. They support a number of springs, which are registered Groundwater Dependent Ecosystems (GDE) in the area.

Groundwater yields in the aquifers are expected to be highly variable and dependent on the degree and interconnectivity of the fractures. A review of registered groundwater users reported variable yields generally ranging up to 2.5 L/s. Therefore, although typically bore yields are small they are sufficient for stock and domestic purposes.

The nature of fractured systems means that reported flow rates may be an over estimate of the long term sustainable yield given the limited storage in most basement rock systems. The exception to this can be in areas of faulting and/folding where there is extensive, open, fracture systems that are connected to recharge areas. There are a number of these types of features (targets) within the study area, and it is these that would form the basis for any investigation.

There is limited groundwater quality data from the registered groundwater bore information in the study area. Salinity maps of the region suggest that groundwater is within 1,000 and 3,500 mg/L TDS (DWR, 1987) making it suitable for agricultural, domestic and limited industrial use. Salinity concentrations in the vicinity of Gunning are reported to range up to 1,000 mg/L making it suitable for drinking from a salinity aspect (DWR, 1987). This is supported by the actual Dalton groundwater supply quality data discussed in **Section 14.4.2**.

The majority of registered bores located in proximity to the Site are registered for domestic and/or stock purposes.

14.3 Water Demand

14.3.1 Introduction

During operation of the Facility, water would be required for the following uses:

- process water; for evaporative cooling and possibly for high fogging (if a turbine using this technology is selected);
- domestic uses (drinking, toilets, wash basins, etc);
- utility water (turbine wash water, utility hoses, etc);
- fire fighting; and
- land scaping.

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The main water demand for the Facility relates to turbine inlet air densification during warmer weather, by evaporative cooling, to improve turbine efficiency. One turbine option being considered also incorporates high fogging, which has the same effect of densifying the inlet air. Deionised water is required for the high fogging duty and the pretreatment processes to remove dissolved minerals from the raw water supply would generate wastewater. In addition there would be a blowdown wastewater stream from the turbine inlet air evaporative cooling system. This is described in greater detail in **Section 14.3.2**. The requirements for these uses are discussed in more detail below and presented in **Figure 14-2.**

In addition to the main process water demand, a relatively smaller amount of additional water is also required for domestic water supply, site utility water, firewater and landscape watering. These demands are discussed further in the remainder of **Section 14.3**.

Table 14-1 outlines the breakdown of indicative water requirements for specific uses within the plant, outlining indicative water requirements for nominal 750 MW (Stage 1) and 1500 MW (Stage 2) plant options on the basis of supply of the process water demands for 438 hours (5 % of the year).

As noted in **Section 2.5,** the normal operation of the plant is expected to be approximately 260 hours (3% of the year). This is the historical average for the operation hours for AGL's peaking plants. However, this has quite a wide variance. Some years it can be as low as 1% (90 hours) or as high as 5% (450 hrs). AGL is seeking the flexibility to operate the Facility for up to 15% of the year to allow for rare and extreme events. Therefore calculations for water use have been based on the reasonable peak runtime of 5% of the year.

It is important to note that the lack of availability to supply process water beyond the nominated demand (or even any) would not affect the ability of the plant to operate and supply power, merely the efficiency of that generation. Process water also has the effect of marginally reducing the carbon dioxide (CO_2) emissions per unit power generated (~2%). The only water that is essential to facilitate operation is fire water (to fill the tanks), some utility water and a domestic water supply i.e. less than 3 ML/a.

The water requirement nominated in **Table 14-1** is the demand only and the water supply requirement for the Facility would be higher and dependent upon the water supply source and the extent of wastewater treatment and recycling incorporated into the design. Different water sources would have different qualities and therefore different pretreatment requirements. There are water losses (as wastewater streams) associated with the potential pretreatment processes. Potential wastewater treatment options, such a brine concentration, have been considered, which would produce high quality recycle water stream. Water supply sources are discussed in **Section 14.4** and the overall water supply requirement for different water sources and potential pretreatment requirements is estimated in **Section 14.4.7**.

The demands nominated in **Table 14-1** are indicative only and would be refined in later stages of facility design. AGL has considered a range of options for generator cooling water. Further refinement of these options by AGL has narrowed the options to:

- E Class turbines (up to 4 per stage of development) that operate with high fogging all of the time (if water is available), and evaporative cooling in hot weather, and
- F Class turbines (up to 3 per stage of development) that use evaporative cooling only in hot weather.

If high fogging is not included, the overall water demand, as can be seen in **Table 14-1** would be substantially reduced (by about 78 %, noting also that there is one less turbine in the F-Class case). Also, if high fogging is not included, then it is possible to supply high quality (low total dissolved solids) potable water as make-up to the inlet air evaporative coolers rather than the nominated deionised water.

Table 14-1 Indicative Water Demand Requirements

Water Demands	Total Amount (ML/year)						Water Quality Requirement
	E Class Turbines with evaporative cooling and high fogging		F Class Turbines with evaporative cooling only		Minimum Demand (no evaporative cooling or high fogging demand		
	Nominal 750MW Installed Capacity (Stage 1)	Nominal 1500MW Installed Capacity (Stage 2)	Nominal 750MW Installed Capacity (Stage 1)	Nominal 1500MW Installed Capacity (Stage 2)	Nominal 750MW Installed Capacity (Stage 1)	Nominal 1500MW Installed Capacity (Stage 2)	
High fogging water (for turbine inlet air densification)	39.1	78.2	- - - -				Deionised water
Evaporative cooler water (for turbine inlet air cooling)[&]	12.0 24.0	10.0 20.0			-	-	Deionised water or high quality (low TDS) potable water*
Potable water	0.2 0.3	0.2		0.3 0.2	0.3		Potable water
Gas turbine compressor wash	0.4 0.8	0.4 0.8 0.4				0.8 Potabl	e water
Other utility water	1.0 1.5	1.0		1.5 1.0	1.5		Filtered raw water or potable water
Fire fighting system[#]	0.0 0.0	0.0		0.0 0.0	0.0		Filtered raw water or potable water
Landscaping#	0.0	0.0 0.0	0.0 0.0	0.0			Raw or potable water (depending upon dissolved solids of raw water)
Annual Water Demand	**52.7**	**104.7**	**11.6**	**22.6**	**1.6**	**2.6**	

Notes: * High quality (low total dissolved solids) potable water can be used for this demand, but if deionised water is required for high fogging and a deionised water supply would therefore be produced, it is preferable to also supply this water quality for this demand.

There is a 3 ML firewater demand to initially fill up the fire water tanks that would need to met over and above the annual demand. Topping up these tanks associate with minor firewater use e.g. equipment testing, is assumed to be met from the utility water demand. Similarly, a small amount of landscaping water might be required during establishment, but would not be an ongoing demand.

& For the high fogging case, (ie E Class generators) this assumes that the make-up will be deionised water, and for the F-Class case, that the make-up will be high quality potable water, which has an associated higher blowdown rate due to the higher make-up water TDS.

14.3.2 Process Water Requirements

Process water is potentially required for the following:

- high fogging, for densification of gas turbine inlet air:
- evaporative cooling of the gas turbine inlet air cooling.

However, as noted above, the lack of availability to supply process water beyond the nominated demand (or even any) would not affect the ability of the plant to operate and supply power, merely the efficiency of that generation.

Inlet Air Cooling and Densification

The ambient conditions under which a gas turbine operates have a noticeable effect on the power output. At elevated inlet air temperatures, the power output decreases. The power output decreases due to the decreased air flow mass rate or density (the density of air declines as temperature increases). Conversely, the power output increases when the inlet air temperature is reduced. At inlet air temperatures of near 38°C, power output can drop to as low as 90 % of ISO-rated power for typical gas turbines.

At cooler temperatures of about 4 to 10°C, power can increase to as high as 105 % of ISO-rated power. ISO-rated power refers to the power rating of the turbine at an ambient temperature of 15 °C, relative humidity of 60% and ambient pressure at sea level.

The density of air also decreases at altitudes above sea level. Consequently, power output decreases with an increase in altitude.

The decreased power output of gas turbines at high ambient temperatures means that gas turbine performance is at its lowest at the times power is often in greatest demand and most valued (in the local context). Cooling the air entering the turbine by 4 to 10°C on a hot day, thus increasing the air density, can increase power output by approximately 1 to 3%. The decreased power resulting from high ambient air temperatures can be mitigated by inlet-air cooling, including evaporative cooling.

The density of the inlet air can also be increased by directly spraying very finely dispersed water (‘fog’) into the inlet air stream. This is referred to as ‘high fogging’.

Evaporative Cooling

Water flows over baffles and air is drawn into the gas turbine inlet through the baffles. The air is cooled by evaporation as it passes over the baffles. Evaporation of the water reduces the temperature and increases the density of the air, allowing the gas turbine to operate at a higher output. After traversing the baffles the remaining water is collected in a sump and then recycled to the top of the baffles. Water is continually added to replace the evaporated water.

As water evaporates there is an increase in the concentration of dissolved salts (total dissolved solids or TDS). To control the salt concentration and to prevent scaling of the system (precipitation of salts), some water is continually bled off or 'blown down' from the sump. The blow down rate is adjusted to keep the concentration of dissolved salts below the threshold for scaling to occur. The blow down water is proposed to be discharged to an evaporation pond.

The quality of water required for gas turbine inlet air cooling is at least high quality (low TDS) potable water. An indicative water specification for gas turbine inlet air evaporative cooler make-up water is provided in **Table 14-2**. Individual vendors have their own specifications, which are usually tied to equipment warranties. The concentration of TDS in the feed water affects the volume of blowdown required to control salt build-up in the recirculated water. For the water quality specified in **Table 14-2**, the blowdown rate might be of the order of 20 % of the feed water rate. If a lower TDS water supply is available and is used for cooling water make-up, then the blowdown rate would be reduced, potentially significantly. If deionised water is available and is supplied to the coolers, the reduction in blowdown may be very significant. For calculation of water supply requirements and wastewater generation within this assessment a blowdown rate of 5 % of the make-up has been conservatively assumed, but it may be as low as 1 to 2 %.

Table 14-2 Water Quality Criteria for Evaporative Cooling Make-up Water

Constituent	Criteria (parts per million)
Calcium Hardness ($CaCO_3$) 50-1	50
Total Alkalinity (as $CaCO_3$) 50-1	50
Chlorides	<50
Silica <25	
Iron <0.2	
Oil and Grease	<2.0
Total Dissolved Solids	<500
Suspended Solids	<5
pH 7.0-8.5	

The operation of inlet air coolers is generally only required in warmer weather, typically in summer and to a lesser extent in spring and autumn. Consideration has been given to the ambient air conditions at Dalton, and an indicative operating profile, and on this basis it has been nominated that the water supply should be sufficient to meet the process water demand for 438 hours (5 % of the year). The lack of availability to supply process water beyond the nominated demand would not affect the ability of the plant to operate and supply power, merely the efficiency of that generation.

High Fogging

Inlet air densification by high fogging, if installed, would provide power generation efficiency benefits over and above inlet air cooling alone. This has benefits independent of air temperature and, if high fogging is installed, would be applied all year round. There are potential maintenance implications arising from high fogging and it is not preferred or recommended by all generator vendors, but as discussed in **Section 14.3.1**, some generator vendors are expected to include high fogging in their proposal. Consequently, we have included this in nominating the maximum overall water demand case (**Table 14-1**).

The extremely fine water droplets are entrained with the turbine inlet air and thus enter the turbine. The water therefore needs to be of extremely high quality, i.e. very low dissolved solids (TDS) concentration, referred to as deionised water, to prevent erosion and deposition of scale on the surfaces within turbines.

Ion-exchange (I-X) or electro-deionisation (EDI) would be required as one of the pretreatment processes (regardless of the supply source) if high fogging is applied.

14.3.3 Domestic Uses

Water would be required for staff facilities, including drinking water, hand washing and toilet flushing. Water for drinking must be of potable quality. It is estimated that up to 200 kL/annum would be required, which includes consideration of additional personnel being onsite during minor maintenance periods. This figure is based on 10 people normally based onsite, at about 60 L per person per day. For short periods of time during major maintenance periods (every 3 years at the most) additional staff would be based at the plant and therefore some additional domestic water may be required for that period.

14.3.4 Utility Water

Water would be required for maintenance and cleaning of equipment. This includes water required for the periodic gas turbine compressor washing. Other utility water uses include dilution of any pretreatment dosing chemicals and supply for utility hoses for miscellaneous washing, etc. It is estimated that up to 0.8 ML/year required for gas turbine compressor wash, based on 12 washes per year at 7m^3 per wash. An additional 1.5 ML/year has been assumed for utility water supply, which includes some contingency.

Turbine compressor wash water needs to be reasonably high quality (potable water) but some of the other utility water uses may be able to tolerate lower quality water. However it should not be turbid and have low levels of suspended solids. Consideration would be given to potential recycling to supply some of the utility water usage e.g. use of backwash water from water treatment processes and/or rainwater harvesting.

14.3.5 Fire Fighting

Fire fighting water would be stored on site. The required raw water would be stored in two dedicated storage tanks (each tank 1500 m^3) for fire fighting use only. As there is no water supply reticulation system at the Site, the Facility requires dedicated fire storages.

In fire events approximately 1500 m^3 would be necessary for two hours fire fighting for the largest likely fire in a power station. In emergency conditions the dedicated fire storage tanks (2 x 1500 m^3) needs to be refilled in 8 hours. This water would not be required to be of potable water quality. However it would need to contain low levels of suspended solids.

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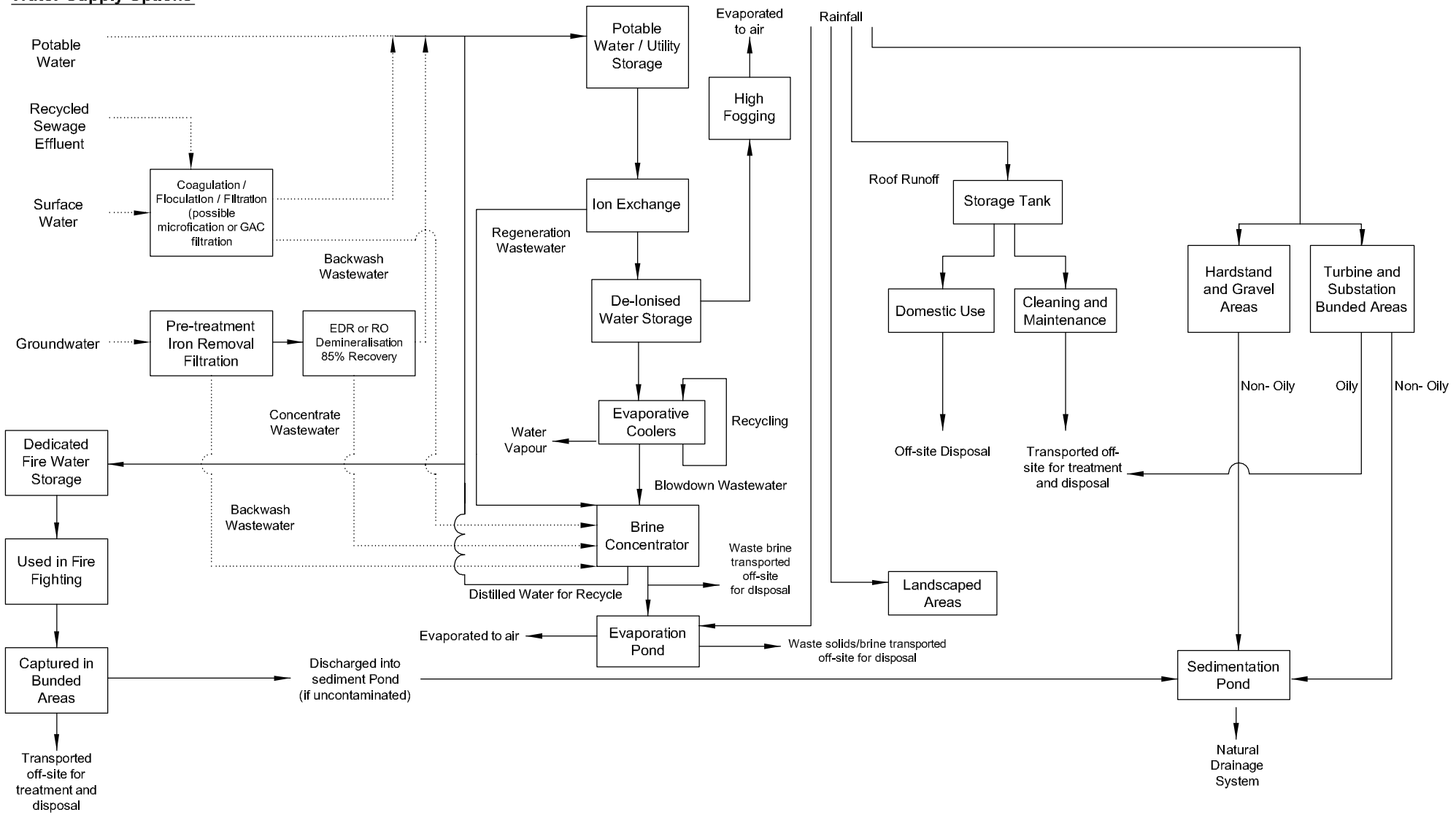
Water Supply Options



Client: AGL ENERGY LIMITED	Project: DALTON POWER PROJECT			Title: INDICATIVE WATER CYCLE STAGE-1	
URS	Designed: AR	Checked:	Date: 17/03/2011	Job No.: 43177661	Figure: 14-2 / Rev. A
	Drawn: AP	Approved:	Status: FINAL	File No.: WaterCycle.dwg	A4

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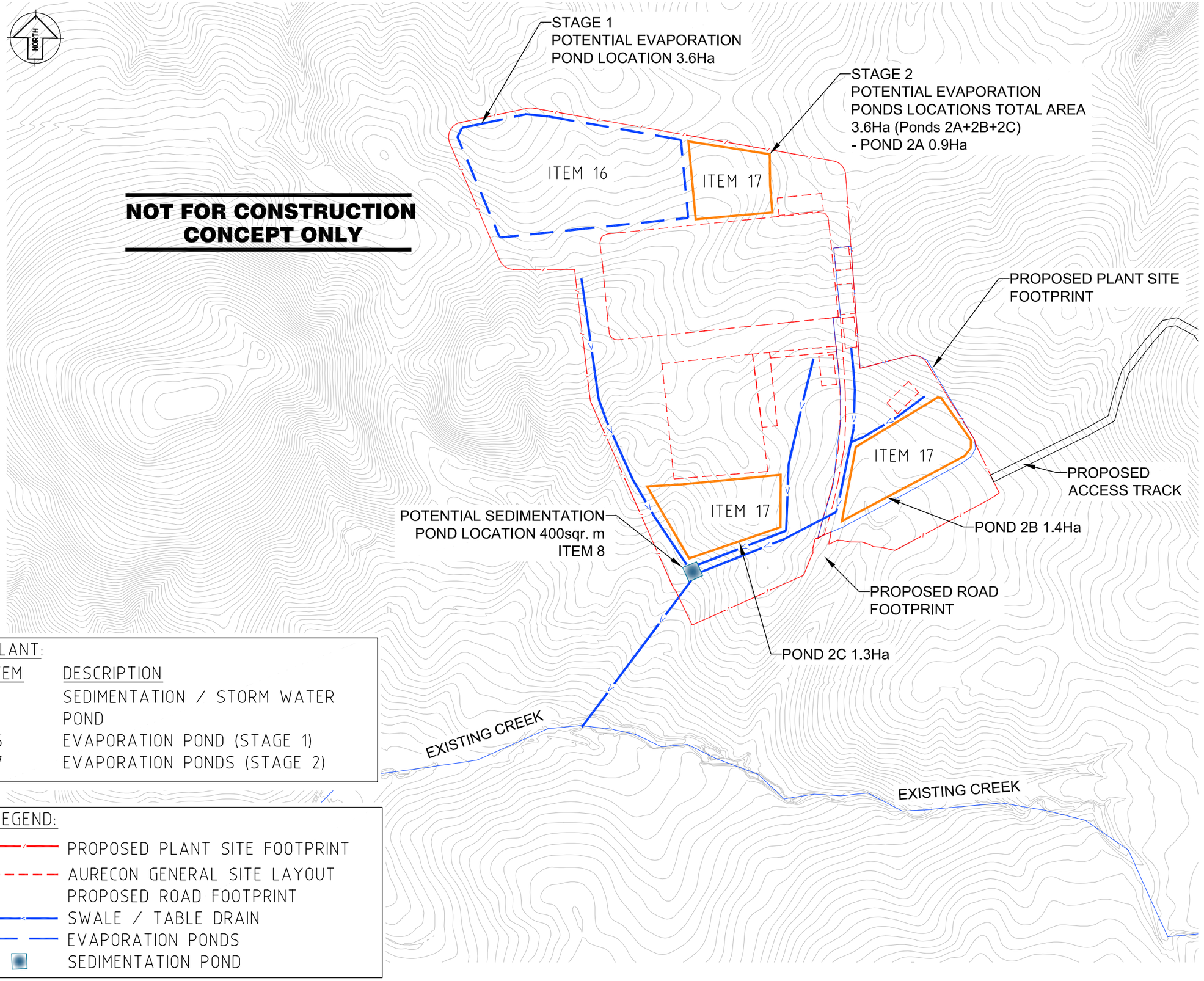

NOT FOR CONSTRUCTION
CONCEPT ONLY

PLANT:

ITEM	DESCRIPTION
8	SEDIMENTATION / STORM WATER POND
16	EVAPORATION POND (STAGE 1)
17	EVAPORATION PONDS (STAGE 2)

LEGEND:

- PROPOSED PLANT SITE FOOTPRINT
- AURECON GENERAL SITE LAYOUT PROPOSED ROAD FOOTPRINT
- SWALE / TABLE DRAIN
- EVAPORATION PONDS
- SEDIMENTATION POND

Source:

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Source:

Designed: CVM	Checked: BKH	Date: 29.06.11
Drawn: CVM	Approved: RV	Status: FINAL
Job No.: 43177661	File No.: 43177661 STM MGMT Rev 3.dwg	

Client

AGL

Project

DALTON POWER PROJECT

Title

PROPOSED SURFACE
WATER FLOW REGIME

Figure: 14-3 | Rev. A | A3

URS

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14.3.6 Landscaping

To minimise the potential for soil erosion and enhance the local ecology, all disturbed areas would be planted at the end of the construction process in accordance with measures outlined in **Chapter 13**. In order to minimise water usage, these areas would be planted with species that are both local to the area and whose water requirements can be supplied by rainfall alone. Some supplementary irrigation water may be required during establishment.

14.4 Potential Water Sources and Water Treatment

A number of potential water sources for the Dalton Power Project have been considered. Approval is sought for each or a combination of:

- water from the existing Upper Lachlan Council water supply. This might be sourced from the:
  - Dalton potable supply;
  - Gunning potable water supply; and
  - Gunning Sewage Treatment Plant
- local groundwater (via bores (and ancillary infrastructure) located within the Development Footprint);
- delivering water to site by truck; and
- harvesting and recycling water on site, such as;
  - harvesting of stormwater runoff;
  - harvesting of roof runoff; and
  - recycling and minimisation of water used on site.

Approval is also sought for a water treatment plant on site to provide the different levels of water quality necessary for the power plant and ancillary purposes including drinking water for the site staff. It should be noted and reiterated that the Facility can operate without water, other than for domestic and utility purposes.

In addition, an option of using surface water from the Lachlan River was considered but discounted given the vulnerability of the river flow to periods of drought, and other, more dependable water source options identified.

Operationally, it is expected that one, or a combination of these sources will be used during the life of the project.

14.4.1 Upper Lachlan Council Water Supplies

There are potentially a number of sources of water from Upper Lachlan Council's existing supply scheme. These are described in the remainder of this section.

Chapter 14 Water Management

AGL has held discussions with the Upper Lachlan Shire Council (ULSC) regarding access to water from Upper Lachlan Water supplies. The ULSC, in its correspondence, indicated the following key points:

- Upper Lachlan Shire is currently planning water supply improvements for both Gunning and Dalton villages.
- It may be possible for Upper Lachlan to supply water for the operation of the power station from the proposed new Gunning water treatment plant. The plant and off river storage could be augmented to cater for a demand of the order of 100kL per day. There are a range of potential water storage options, which would have the effect of improving power station water security, including:
  - ULSC off river storage (as raw water);
  - ULSC Gunning treated water reservoir;
  - ULSC Dalton treated water reservoir; and
  - AGL onsite tanks (also necessary to reduce impacts of peaks in your demand).
- The supply may be arranged on the basis that AGL contributes to the capital expenditure involved (fixed charges) and water purchased from Council under the terms of a negotiated supply agreement (user charges).

Dalton Potable Supply

The town of Dalton is approximately 3 km from the Project site. The existing water supply system comprises a disinfected reticulated water scheme sourced from two groundwater bores. Whilst the Dalton water supply has sufficient capacity to meet the demands of the existing 80 connections, water quality is of a relatively poor standard as drinking water.

Previous water quality assessments indicate that water hardness and total dissolved solids (TDS) uniformly exceed the National Health & Medical Research Council (NH&MRC) Guideline values. The upper limit of acceptable water hardness is >200mg/L $CaCO_3$, and TDS is 500 mg/L. Water hardness and TDS are above the evaporative cooling requirement, and hence would need to be ameliorated. Average pH was found to be 8.4, which is bordering the acceptable upper pH limit for evaporative cooling.

This represents a potentially suitable source for water supply to the Project site providing water quality issues are ameliorated by treatment on site or otherwise and there is sufficient available additional capacity. As mentioned previously, ULSC is proposing to upgrade this water supply system.

As discussed in **Section 14.3**, water from this source may require treatment on site at the water treatment plant including deionising. Some of this deionised water could be shandied with the raw water to produce a lower TDS potable supply.

Gunning Potable Water Supply (via existing Lachlan River Offtake)

The Gunning water supply is sourced directly from the Lachlan River, and Upper Lachlan Council has an existing entitlement of approximately 200 ML/year. The Gunning supply is chlorinated and pumped via a 3.5 km rising main to a 909 kL service reservoir located on the outskirts of the village. Connection to the Gunning water supply was investigated. However, this supply is currently understood to have limitations in terms of water quality and security of supply. However, as previously mentioned, it is understood that plans are underway to augment the village water supply via construction of a water treatment plant and off-stream water storage water facility. These works are expected to be constructed in 2010/11.

Gunning is also known to have hard water. Use of this supply would require treatment online at the water treatment plant to address the water hardness issue.

Gunning Sewage Treatment Plant

Another potential source of water is recycled water from the Sewage Treatment Plant at Gunning. The Gunning sewage treatment plant has a maximum capacity of 250 kL/day (91 ML/year), with approximately half of this water being utilised. If the water quality is suitable and sufficient water quantities are available, this is a viable source to supply a reasonable portion of the overall raw water requirement for process and utility water. While the quality of reuse water is not known, it would require further treatment particularly in relation to the levels of Total Dissolved Solids (salts).

Depending upon the quality, the pretreatment system would likely comprise an appropriate prefiltration system (options including gravity sand filter, multimedia pressure filter, micro-filter or other membrane filter), that would incorporate coagulant and flocculant dosing. This would be followed by ion-exchange (probably with an activated carbon prefilter) or EDI for production of deionised process water.

14.4.2 Direct Lachlan River Off take

A direct take of water from the upper Lachlan River is possible but would require securing a water entitlement from the water market as well as the installation of diversion infrastructure. Given the location of the Site on the catchment boundary, the catchment area upstream of the intake point may not be able to supply water sufficient to meet the water demand without the creation of storage.

Available upper Lachlan River surface water quality data is provided in **Section 14.2.2**. Pretreatment requirements for surface water supplied directly from the Lachlan River would be similar to that discussed in **Section 14.4.1**. This option is presently not being pursued.

14.4.3 Groundwater

Approval is sought to extract and use groundwater for the Dalton Power Project.

Groundwater resources available within the project area, including quality, were discussed in **Section 4.2.3**. The following provides an assessment of the potential bore yields and potential extraction arrangements together with the necessary licencing and infrastructure requirements.

Chapter 14 Water Management

Extraction Arrangements

The Project site is outside the water sharing plan areas under the Water Management Act 2000 and consequently the Water Act 1912 applies.

Licensed extraction of groundwater is administered under the NSW Office of Water. In December 2008, two orders were made which embargo certain new applications for groundwater licences under Part 5 of the Water Act.

The first Order under section 113A of the Water Act gazetted on 19 December 2008 does not apply to the Project site.

However, the second Order also made under 113A of the Water Act and gazetted on 22 December 2008 does apply to the Project site.

Whilst the order is an embargo and operates to prevent any applications for new Part 5 water licences with a water allocation, the embargo does not prevent an application for a licence for a bore to produce water that has been obtained through the transfer of a water allocation.

AGL will therefore be required to:

- purchase a groundwater allocation from an existing licence holder and apply to the Office of Water for the transfer of that allocation to AGL; and
- apply for a Part 5 bore licence to receive the transferred allocation.

In addition, AGL will be required to have purchased the groundwater allocation from an existing licence holder from within the Lachlan Fold Belt GWMA.

AGL proposes to obtain a permanent transfer and has contacted a number of water brokers and has identified numerous water licences with suitable extraction amounts that are for sale. AGL is confident that the purchase of water allocation for the site for the required volume is achievable.

Groundwater Infrastructure

AGL proposes to establish up to approximately six bores within the Development Footprint. In addition, and to convey the water, AGL proposes to construct and operate:

- water pipelines to connect the bores to the site and infrastructure;
- water treatment plant;
- electrical power to the bores, pumps and supporting infrastructure; and
- install header tanks; pumping apparatus and associated infrastructure.

Groundwater Pre-Treatment

The specified TDS of the groundwater is up to 3,500 mg/L making it unsuitable for direct use for any of the nominated water supply categories. Pre-treatment by oxidation (aeration) and filtration and then desalination by reverse osmosis (RO) or electro-dialysis reversal (ERD) were considered for this application. A minimum desalination water recovery of 85 % has been assumed in later estimations of water supply requirements and wastewater streams (and 90 % where a brine concentrator may be applied)

A purified (desalinated) groundwater stream is likely to be of suitable quality for cooling water make-up supply and as potable water following chlorination (or alternate disinfection).

The production of process water for high fogging would require the further deionisation of the desalination water, by ion-exchange or EDI. If the extracted groundwater TDS was at the lower range, then it is likely that that initial desalination could be avoided and the water could be directly deionised. Direct deionisation of water at the upper end of the TDS range is possible, but may be less desirable from an operating cost perspective. In estimating the total site water requirement from a groundwater source (refer to **Section 14.4.7**), a supply TDS of 3500mg/L has been assumed, with initial filtration, desalination followed by deionisation.

Conclusions

The desktop assessment of groundwater as a source of water for the Dalton Power Project concluded the following:

- the primary regional aquifers in the area are basement formation fractured rock systems, with no alluvial aquifer systems in the near vicinity;
- yields from the basement aquifers are highly variable, but reported values are generally less than 2.5 L/sec, and sustainable yields for long term extraction may be much lower than this.;
- groundwater salinity is expected to be within the range of 1,000 (or marginally lower) to 3,500 mg/L (TDS); and
- the site is within the Lachlan Fold Belt GWMA.

14.4.4 Water Delivery by Tanker

Provision has been made in the design for the Project to accept bulk water deliveries by truck, should this be required. Furthermore, it is important to note that the Facility, once operational, can operate without water other than domestic water and a small amount of utility water.

The water delivery option is considered from sources identified above or another source beyond the immediate region.

All of the base site water demand (< 3 ML/a) and all, or a portion, of the projected process water demand, depending upon the development option adopted, could be sustainably supplied by tankering water.

For the purposes of the traffic assessment (refer **Chapter 11**), a maximum of 12.5 ML per annum and no more than 10 truck deliveries per day for each of stage1 and stage 2 of the project (25 ML per annum in total) is assumed. Assuming a standard road tanker of 20 kL, up to approximately 400 kL/d, or 20 truck deliveries per day, could be supplied to the site in any single day. This equates to 40 vehicle movements per day of which it is assumed that 10 % of these movements would occur during the AM peak hour. For the purposes of the traffic assessment, it is assumed that the reminder of water supply is provided by on-site groundwater or via the augmentation of the Dalton or Gunning supply.

Feed tankage would to need be provided to accommodate variable demand. The impact of these deliveries on the traffic network is considered further in **Chapter 11** and **Appendix F**.

Pretreatment requirements for a tankered potable water supply are discussed in **Section 14.4.1**.

14.4.5 Harvested and Recycled Water

Stormwater Runoff Harvesting

Water harvesting of stormwater runoff from on site (and potentially off-site where water flows onto the site) is a potential source of water as the potential site yield (up 80 ML/a in a 90%ile wet year) is sufficiently high to supply some of the Project's water supply requirements. Pretreatment requirements would be similar to those discussed for the Lachlan River water in **Section 14.4.1** and **Section 14.4.2**.

This option is not considered further as the proposed stormwater management system described in **Section 14.6** has been developed to approximately maintain the pre-existing flow regime.

Roof Runoff Harvesting

There would be a number of rooves at the site including administration and control building, workshop and store, security building, generator and transformer buildings and parts of the turbines themselves, some or all of these areas could be connected to rainwater tanks. Rainwater would be of suitable quality for non-potable domestic uses (showers, toilet flushing) and laundry, for the required maintenance activities, for a raw water supply for process water (requiring pretreatment like all of the other potential supply options), and for plant establishment irrigation. The yield would be relatively small compared to the overall site requirements and roof runoff could be harvested to supplement other supplies.

The rainwater collection system would be properly maintained in order to ensure that water entering and stored in these tanks remains of good quality. A first flush system would be installed to ensure water most likely to be contaminated by particles settled on roofs does not enter the tank.

Roof runoff harvesting would be implemented for the Project.

Wastewater Desalination

As discussed in **Section 14.5**, if high fogging is implemented, it is likely that a brine concentrator would be installed to reduce wastewater generation and recycle the recovered distilled water. An explanation of brine concentration technology is provided in **Section 14.3.5**. A brine concentrator may also be considered for an inlet air evaporative cooling only arrangement. Most of the wastewater that is fed to a brine concentrator is recovered as a very high quality distilled water. It would be of suitable quality for direct use in evaporative cooler make-up, but may require further deionisation for high fogging water supply.

Water Use Minimisation and Recycling

- As the selection of the primary site water supply has not yet been determined, the water demand quality and quantity is also not yet confirmed. The detailed selection and design of the water storage and treatment system would be the responsibility of the successful tenderer to construct the plant. There are a wide range of options for reducing water consumption in pretreatment processes, and for recycling (with and without further treatment) wastewater streams. The specific potential wastewater streams are discussed in **Section 14.5**.

14.4.6 Summary of Water Supply Sources

A summary of the water supply options, previously discussed in **Section 14.4.1** to **Section 14.14.5**, is presented in **Table 14-3**.

Table 14-3 Summary of Water Supply Sources

Water Supply Options	Advantages	Disadvantages	Conclusion
Dalton potable water supply (groundwater)	Existing water supply in reasonable proximity to site. Water supply system is proposed to be upgraded.	Likely to be insufficient excess capacity to be the main water supply for the site, although this may change with proposed ULSC upgrades. Marginal water quality as a potable water supply without further treatment (though fine for further treatment to process water)	Option as a supplementary supply but unlikely to be sufficiently available excess capacity to be the main supply, although this may change with proposed ULSC upgrades.
Gunning potable water supply (Lachlan River offtake)	Council extraction entitlement held, which is well in excess of site needs. Water supply system is proposed to be upgraded.	Source is 15 km from the site (if piping). There is a suggestion that there is potential water supply constraints associated with the available water from the river.	Option as a primary water supply source.
Gunning treated sewage effluent (recycle water)	Initial indications are that there may of the order of 40ML of excess effluent, which is sufficient for all of or a reasonable proportion of site needs.	Source is 15 km from the site (if piping). Recycled water quality is not yet clear, but there is likely to be a higher pretreatment requirement. Microbiological quality risks would need to be managed.	Option as a supplementary water supply source.
Direct Lachlan River offtake	River in reasonable proximity to the site.	Suggestions that the supply may be seasonally constrained. Entitlement would need to be acquired. Diversion infrastructure required. Marginal water quality as a potable water supply without further treatment (though fine for further treatment to process water)	Not currently proposed.

Water Supply Options	Advantages	Disadvantages	Conclusion
Groundwater extraction	Groundwater is available in the area. Although, relatively, local aquifers are not high yielding it is reasonably possible that the sufficient groundwater supply could be acquired from a number of bores on or nearby the site.	Entitlement would need to be acquired within the existing cap. Further investigations, including drilling, would be required to locate extraction bores, with no guarantee of success. Groundwater TDS may be higher than other potential supplies.	Option as primary water supply source.
Tankered water (from sources identified above or another source beyond the immediate region)	Water can be sourced and is a guaranteed supply	Base domestic and utility water demands readily met by tankering. Relatively large overall water demand, including process water, to supply by tankering . Therefore large number of trips per year and potentially relatively expensive.	Option as primary water supply source.
Roof runoff harvesting	Reasonably good quality water.	Yield small relative to over water demand	This would be implemented as part of the design to provide supplementary water.
Stormwater runoff harvesting	Available onsite.	Could impact on downstream waterways, which has not been assessed. Objective to retain post development hydrology as close as possible to pre-development.	Not currently proposed.

For the purposes of this Environmental Assessment, it is currently proposed that the initial site water supply may be offsite tankering to meet the essential base domestic and utility water demands, and some or all of the process water demands (depending upon the development option adopted). During operation, other water sources such as on-site groundwater extraction and/or Upper Lachlan Shire Council water supplies may be used to meet the full nominated site water supply requirements.

14.4.7 Overall Water Supply Requirement

As discussed previously, the overall water supply requirement to meet the water demands nominated in **Table 14-1** is a function of the pretreatment requirements of the water supply, and of any wastewater treatment and recycling proposed. The potential levels of pretreatment for different supply options is summarised in **Table 14-4.**

Table 14-4 Summary of Potential Pretreatment Requirements for Water Supply Sources

Indicative Pretreatment Requirement	Water Supply Source			
	Groundwater	Surface Water	Recycled Sewage Effluent	Potable Water
Prefiltration - multimedia pressure filters - gravity sand filters - membrane filters - cartridge filters Possibly after pre-aeration/oxidations and/or coagulant and flocculant dosing	✓	✓	✓ (high level of prefiltration)	
Desalination - reverse osmosis (RO) - elecro-dialysis reversal (EDR)	✓	Possible but unlikely	Possible but unlikely	
Deionisation (for process water supply only) - ion-exchange - electro-deionisation (EDI)	✓	✓	✓	✓

Each of the potential pretreatment processes has an associated wastewater stream. The water supply would therefore need to accommodate these losses to meet the Facility demands nominated in **Table 14-1**. **Table 14-5** presents an indicative total site water supply requirement to meet the demand, accounting for pretreatment losses for nominal 750 MW Power Station Capacity (Stage 1) and nominal 1500 MW Power Station Capacity (Stage 2). Indicative pretreatment requirements for a high fogging and evaporative cooling or evaporative cooling only option assuming a groundwater supply are set out in **Table 14-5**. Due its relatively higher salinity, groundwater has the highest pretreatment requirement and compared to the other options is expected to result in a marginally higher overall water supply requirement. This has therefore been presented as the conservative option.

Table 14-5 Overall Site Water Supply Requirements Assuming Groundwater Water Supply Source

Water Supply Requirement	Assumptions	Groundwater Supply Requirement (ML/a)			
		Stage 1		Stage 2	
		E Class - High Fogging and Evaporative Cooling	F Class - Evaporative Cooling Only	E Class - High Fogging and Evaporative Cooling	F Class - Evaporative Cooling Only
Prefiltration backwash	Assumed 10% backwash loss	4.8 1.4 9	6		2.7
Desalination concentrate	Assumed 90% recovery for high fogging case and 85% recovery for evaporative cooling only case	4.8 2.0 9	6		4.0

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Water Supply Requirement	Assumptions	Groundwater Supply Requirement (ML/a)			
		Stage 1		Stage 2	
		E Class - High Fogging and Evaporative Cooling	F Class - Evaporative Cooling Only	E Class - High Fogging and Evaporative Cooling	F Class - Evaporative Cooling Only
Deionisation plant backwash and regeneration wastewater	Activated carbon prefilter back wash, and ion-exchange resin regeneration – total 6% of feed, and 8% and 10% in the surface water and sewage effluent cases respectively. Deionisation assumed for high fogging option only.	3.1 - 6.2			-
Inlet air evaporative cooling water system blowdown	Assumed 5% of make-up for high fogging option and 20% for evaporative cooling only option.	0.6 2.0 1.2			4.0
Total wastewater streams	13.3		5.4	26.3	10.7
Brine concentrator distilled water recycle	Brine concentrator assumed for high fogging case only	-12.5 -		-25.0	-
Site water demand (corrected to only account for the net evaporative cooling water demand)	52.1		9.6	104.2	18.6
Total water supply requirement		**52.9**	**15.0**	**105.8**	**29.3**

The water supply assumptions and estimates presented in **Tables 14-5** assume no significant implementation of the potential minimisation and recycling measures discussed in **Section 14.4.5**, other than the significant measure of recycling of brine concentrator distillate in the high fogging option (E-Class), which decreases the supply requirement by up to ~30%. They are also only estimates based on stated assumption and the actual supply requirement may vary from this, higher or lower. The overall water supply requirement then, depending upon the water source or combination of sources, (Table 14-4), over and above the nominated demand (Table 14-1), varies from up to 30% for groundwater supply (case presented in Table 14-5) to about 0 % for the potable water supply case (or possibly even marginally less than demand in the potable water supply case where a brine concentrator is employed).

The overall water supply requirement is likely to be in the order of up to:

- **2 to 3 ML / annum** minimum water demand
- **10 to 20 ML / annum** overall for Stage 1 and **20 to 40 ML / annum** overall for Stage 2 for the F-Class case (evap cooling only)

- **50 to 70 ML / annum** overall for Stage 1 and **100 to 140 ML / annum** overall for Stage 2 for the E-Class case (evap cooling and high fogging)

14.5 Wastewater Generation and Management

14.5.1 Introduction

In order to minimize the environmental impact, the proposed water management plan aims to supply the water requirement of the power station, reduce the release of potential pollutants to the natural environment and reuse the water following a cost benefit analysis.

The runoff storm water drains are discharged to a storm water pond for attenuation and treatment prior to release to the environment. Process areas, including bunds, would be directed to the stormwater pond via an oil / sediment interceptor after confirmation that the water is uncontaminated. In the event that this water is identified to be impacted e.g. oil spill, it would be collected by an eductor truck for offsite disposal.

Wastewater from the Facility would be generated by the following operations:

- wastewater from evaporative cooler operation (referred to as blow down water);
- wastewater from water pretreatment operation including:
  - prefiltration backwash wastewater;
  - desalination system concentrate (high TDS reject steam); and
  - ion-exchange plant regeneration wastewater (and activated carbon prefilter backwash, or EDI concentrate.
- wastewater from maintenance activities;
- dome stic wastewater;
- spills; and
- stormwater collected in bunded areas.

These sources are discussed in further detail below.

14.5.2 Process Wastewater

As discussed previously, process wastewater would be generated from water supply pretreatment operations and gas turbine inlet air evaporative cooling blowdown. An indicative estimate of the wastewater volumes for various water supply options is presented in **Table 14-5**. These estimates do not assume the significant implementation of potential minimisation measures discussed in **Section 14.3.5** and are therefore considered to be reasonably conservative. The estimated wastewater generation quantities are:

- Stage 1: ranging from approximately **0.2 ML/annum** for a potable water supply case with a brine concentrator (fogging) compared to **5.4 ML/ annum** for a high TDS groundwater supply case for evaporative cooling.
- Stage 2: ranging from approximately **0.4 ML/ annum** to **10.7 ML/ annum** respectively.

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Process wastewaters, which are characterised by high TDS would be discharged directly to an evaporation pond for volume reduction and periodic offsite tanker disposal, or via a brine concentrator. The wastewater evaporation pond is discussed in **Section 14.5.4**.

14.5.3 Brine Concentrator

In the water supply and demand scenario for a high fogging option, the potential wastewater volume would be such that evaporation ponds alone as the primary wastewater concentration method becomes less attractive. In this context, based on preliminary assumptions of treatment technologies and wastewater volumes, a brine concentrator may be required to concentrate the wastewater and recover water for recycle. The concentrated brine would either be directly tankered offsite or discharged to an evaporation pond.

The wastewater streams that would likely be fed to a brine concentrator are as follows:

- Inlet air evaporative cooler blowdown;
- Ion exchange regeneration and backwash wastewater;
- RO/EDI desalination concentrate; and
- Filter backwash water.

As there is not a continuous source of waste heat on site, an electrically powered brine concentrator would be required. The normal technology employed in this type of plant is a mechanical vapour compression (or vapour compression distillation) brine concentrator. This uses a compressor to apply a vacuum to the system, which reduces the boiling point of water within. Water is 'boiled' off and condensed to produce distilled water, and salt that was present in the water fed to the unit is concentrated to produce a brine wastewater. A falling film type system is often used, which can help control scaling on the heat transfer surfaces. The brine is concentrated to an indicative 200,000 to 250,000 mg/L TDS. Although it is possible to concentrate beyond this, some of the salt minerals start to precipitate, which can impact on the design, operational and maintenance requirements of the concentrator.

14.5.4 Wastewater Evaporation Pond

Process wastewater streams would likely be discharged to an evaporation pond. In the case of the E-Class with a brine concentrator, the estimate volume is relatively small (~770 kL/a) and may be directly tankered off site for disposal at an appropriately licensed facility. Nevertheless, it has been assumed that it will be discharged to an evaporation pond for planning purposes.

It is envisaged that an evaporation pond would be constructed for Stage 1 and additional pond(s) would be constructed to accommodate the additional wastewater load for Stage 2. The indicative pond size and indicative location for Stages 1 and 2 are shown in **Figure 14-3**.

The performance of an evaporation pond is a function of climatic conditions and the wastewater salinity and can therefore vary significantly from year to year. Increasing wastewater salinity has the effect of reducing evaporation rates, which needs to be accounted for in design. The pond also needs to be sized to accommodate the maximum volume of water generated but also to accommodate the generation pattern. More of the wastewater would be expected to be generated in summer when inlet air cooling is typically in greater demand.

The evaporation ponds have been indicatively sized based on a simple water balance. The balance was conducted over a 10 year period assuming wastewater discharge of approximately 0.8 ML/a (refer to **Table 14-5**) of brine concentrate, distributed in accordance with an assumed operational pattern. The balance assumed average climatic conditions (evaporation and rainfall) in all years except for a 90%ile wet year assumed in year two (but could accommodate two wet years and the rest average years in a 10 year period). A relationship between salinity and evaporation rate was incorporated to account for this factor. The indicative sizing is provided in **Table 14-6** and shown in **Figure 14-3**.

Table 14-6 Evaporation Pond Indicative Sizing

Evaporation Pond	Evaporative surface area (m^2) (approx.)	Depth (m) (approx.) (excluding freeboard capacity)	Capacity (ML) (excluding freeboard capacity)
Stage 1	36,000	1.00	36
Stage 2	36,000	1.00	36

The pond sizing is very indicative and would be finalised when Project design is verified. A pond of an indicative 3.6 ha might be required for the E-Class high fogging brine concentrator option for Stage 1, but the evaporative cooling only case(F-Class), with an indicative 5.4 ML/a (i.e. approximately seven times more than the brine concentrator discharge volume) wastewater discharge has an estimated evaporation pond requirement of only 2.4 ha, illustrating the impact of the reduced evaporation rate for much higher salinity water. The evaporative area required for Stage 2 may need to be provided by more than one pond, as shown in **Figure 14-3**, however the water balance assessment determined that the evaporation ponds for Stage 1 and 2 could be accommodated within the Facility footprint.

The evaporation pond would at times contain water with high to very high salinity, as it approaches periodic drying out. The water balance modelling also indicated that dissolved solids / salt build up in the pond would be able to be readily controlled with the annual disposal by tanker (to a licensed facility) of a relatively small volume of wastewater in late summer/early autumn, when the volume in the pond is low and TDS concentration is high. It is anticipated that the annual removal of evaporation pond wastewater would not need to commence for some years after commencement of operation. In the case of brine concentrator discharge, direct disposal of brine would also be considered.

The drying behaviour of the pond is very dependant upon the climatic conditions considered on an annualised basis. Based on the initial modelling, the pond may be dry for a period of one or two months, usually at the end of summer, at least four a times in a decade, depending upon the climatic conditions.

A pond liner would be required to avoid contamination of surface water, soil and groundwater. A composite pond liner is proposed. The liner may consist of a High Density Polyethylene (HDPE) geomembrane placed over 1 m of compacted clay, to achieve a minimum combined permeability of $1x10^{-9}$. This is a preferred choice over a solitary clay liner, to minimise the potential for cracking of the clay liner and to define the boundary between sediment and liner, thus assisting cleaning of sediments. The final liner design would be considered in further design stages, understanding however that it would meet the regulatory permeability requirements. It is expected that the in-situ materials or site-won fill would be structurally adequate for construction of evaporation ponds. However, a synthetic liner (such as high density polyethylene) and an appropriate clay layer would be

used to minimise the risk of the saline blow down water and chemical drains escaping into the natural groundwater system. The option for a protective soil layer would be considered at the detailed design phase.

The pond would be designed to have at least a 1 m freeboard above pond top water level.

Roofed areas of plant and the workshop would also be bunded to ensure that any spills or fire water would not escape into the compound area. Stormwater should not enter these areas. Any liquid contained in these bunds is likely to be contaminated and would be disposed of off-site.

14.6 Stormwater Management

The proposed development alters the rate of progress of water through the cycle, resulting in hydrological and water quality effects. The most effective forms of stormwater management aim to address this disruption during the detailed design phase by minimising impervious area on site. This is to match the pre-development level of runoff to post-development level as closely as possible. Where this is not possible, stormwater effects could be managed by constructed mitigative methods such as stormwater detention ponds and water quality treatment devices such as swales, rain gardens and other low impact devices. These considerations have been applied in developing a conceptual stormwater management regime. This would need to be reviewed as part of detailed plant design.

The pre-development hydrology of the Site is discussed in **Section 14.2.1**. There is effectively a northern and southern catchment, which can be discerned from the contours shown in **Figure 14-3**. The Northern catchment ultimately discharges to the Lachlan River via existing drainage lines, and the southern catchment discharges to the creek to the south of the site, shown in **Figure 14-3**. This creek ultimately discharges to the Lachlan River. The area of the larger Dalton property on which the Facility is located that drains to the Lachlan River would be left as cleared grazing land or revegetated with species indigenous to the area and therefore there would be effectively no change in the quantity of stormwater.

14.6.1 Stormwater Pre-Development

Pre-development peak inflow estimates to the site for the 10 and 100 year ARI (Average Recurrence Interval) storm events were calculated using the Statistical Rational Method recommended in Australian Rainfall and Runoff. These flows are shown in **Table 14-7**.

Table 14-7 Pre-Development Catchment Areas and Design Inflows

Catchment	Area (ha)	Design Inflows	
		Q10 (m^3/s)	Q100 (m^3/s)
North 7.06		0.289	0.635
South 17.43		0.713	1.766
Road 5.16		0.211	0.464

The Facility would alter the quantity and quality of the pre-development stormwater runoff through the introduction of a power station, hardstand areas and associated access roads. All of these developments may affect the quantity, flow paths and timing of stormwater runoff during a rainfall event.

Based on the current site plan (**Figure 14-3**), the Facility site sub-catchment areas would be modified relative to the pre-development sub-catchments areas. As such, a larger sub-catchment discharges towards the south and a smaller sub-catchment discharges towards the north (the northern catchment area has effectively been reduced by the evaporation ponds). Therefore the annual volume of surface water run-off towards each of the receiving surface water bodies would be modified from predevelopment, as shown in **Table 14-8**. The estimated annual surface water run-off were estimated pre and post development applying the MUSIC model, based on 90 percentile rainfall (wet year).

Table 14-8 Pre and Post Development Site Catchment Yields

Stage	Direction to Receiving Surface Water	Estimated Annual Flow (ML)	Catchment Area (ha)	Catchment Area (Ha) Contributing to Discharge
Pre-Development	Northern 42.2		12.25	12.25
	Southern 42.2		12.25	12.25
	Total	84.4 25.0 25.0		
Developed and Treated - Stage 1	Northern	13.4 7.06 3.46		
	Southern 66.4		17.44	17.44
	Total	79.8 24.5 20.9		
Developed and Treated - Stage 2	Northern	11.3 7.06 2.51		
	Southern 60.4		17.44	14.74
	Total	71.7 24.5 17.3		

The overall site discharge in the scenario modelled was reduced by up to about 15 % (84.4 ML/a predevelopment compared to 71.7 ML/a post-Stage 2 development).

14.6.2 Stormwater Post-Development

Approximately 25 ha of land would be disturbed in order to construct the compound, access roads, gas and water pipelines, and electricity supply. Rainfall on these disturbed sites may cause soil erosion and runoff may contain high levels of sediments which could then enter natural waterways.

To minimise potential effects to the receiving environment site stormwater treatment measures have been identified in order to achieve stormwater quantity and quality objectives, based on NSW Stormwater Quality Guideline and Best Stormwater Management Practices.

The following stormwater management practice is proposed for the Project:

- Swale/Ta ble drains:
  - Divert catchment runoff around the site areas and into the sediment pond.
  - Divert and treat runoff from the power station hardstands into the sediment pond.
  - Treat runoff from the access road via swales.
- Sedimentatio n Pond:
  - Treat runoff from the disturbed site areas

An increase in runoff has been estimated based on multiple surface types. The peak stormwater runoff from the constructed site was modelled based on change in surface type from pre to post development (end Stage 2) and the associated footprint area of these surfaces, as summarised in **Table 14-9**.

Table 14-9 Development Catchment Type and Area

Surface Type	Area (ha)
Concrete	4.34
Gravel	2.14
Road 2.91	
Roof 5.41	
Main Access Road	5.16
Evaporation Ponds	7.25

Post-development peak flow estimates, without treatment, to the site for 10 and 100 year ARI were calculated using the Statistical Rational Method recommended in Australian Rainfall and Runoff. These flows are shown in **Table14-10**.

Table 14-10 Developed Catchment Areas and Design Inflows (Stage 2)

Catchment	Area (Ha)	Q10 (m^3/s)	Q100 (m^3/s)
North 7.06		0.103	0.226
South 17.43		1.116	2.421
Road 5.16		0.211	0.464

Sedimentation Pond

Sediment ponds are used to retain coarse sediments from runoff and are important for protecting downstream elements from becoming overloaded or smothered with sediments. They operate by reducing flow velocities and encouraging sediments to settle out of the incoming water stormwater.

Initial assessment estimates the sediment pond volume as 800 kL, 20 m long x 20 m wide x 2 m deep. The permanent pool volume in the sediment pond is 200 kL, which would capture and store settled-out sediments, which periodically would be removed during pond maintenance (normally once per 10 years). The average detention time for the pond would be 48 hours to achieve 85 % removal of suspended solids, some nutrients and metals. The proposed location of the pond is shown in **Figure 14-3**. This pond would discharge to the creek located to the south of the site.

Bunded Transmission Pad

To contain any potential leaks or spillages the bunded area is proposed in accordance with *AS 1940-2004 The storage and handling of flammable and combustible liquids*. The transmission pad would retain 100 % of the oil volume on site, in the incident of a spill, and to have additional capacity to contain incident rainfall for a 100 yr ARI event. In order to achieve this standard requirement, the bunded area has been modelled to retain the 100 year ARI, which would require a minimum bund height around the transmission area footprint of 500 mm, which includes an allowance of 150 mm freeboard. This includes two hours of the peak storm event.

It is expected that the bunded area would have a positive influence on the treatment performance of the sediment pond as it would reduce the peak flow leaving the concrete based sub-catchment.

Bund drainage (manual) would be confirmed clean and pass through an oil/sediment trap prior to discharge to the stormwater system.

Swales Drains

Vegetated swales are also proposed to convey stormwater in lieu of pipes and provide a desirable buffer between receiving waters (e.g. creek or wetland) and impervious areas of a catchment. They use overland flows and mild slopes to slowly convey water downstream. The interaction with vegetation promotes an even distribution and slowing of flows thus encouraging coarse sediments to be retained.

14.6.3 Construction Period

All construction works would be undertaken in a manner to minimise the potential for soil erosion and sedimentation and in accordance with the measures outlined in the *Managing Urban Stormwater – Soils and Construction Volume 1 (*NSW Department of Housing, 2004*)* (commonly referred to as the Blue Book guidelines*)*. Areas which are disturbed would be managed with appropriate erosion and sedimentation control devices installed and maintained in line with the Blue Book guidelines. This may include limiting slope length, the installation of sediment filters and the construction of a sedimentation basin downstream of the plant area. These devices would remain in place until the surface is restored. These devices would also capture any gross pollutants. All works would be designed to minimise the potential for problems associated with salinity.

Containment bunds would be constructed with provision for collection of any spilt material. Waste collection areas would be designated. Appropriate bunding would be installed and appropriated containers would be provided. Waste disposal and collection would be properly undertaken. All vehicle and equipment maintenance would be undertaken offsite. Any vehicle washing on-site would be restricted to specific bunded areas.

Staff facilities would be provided and installed and maintained so that pollutants, including wash water, are not conveyed from the site in stormwater.

During the construction period water may be required for dust suppression. This would be sourced from the existing dams on the site or imported if required.

14.7 Flooding

14.7.1 Potential Impacts

The proposed power station site is located in the upper Lachlan River catchment on a subcatchment boundary between two first order unnamed creeks. The site is undulating and at a significant elevation (~575mAHD) compared with the nearby creeks.

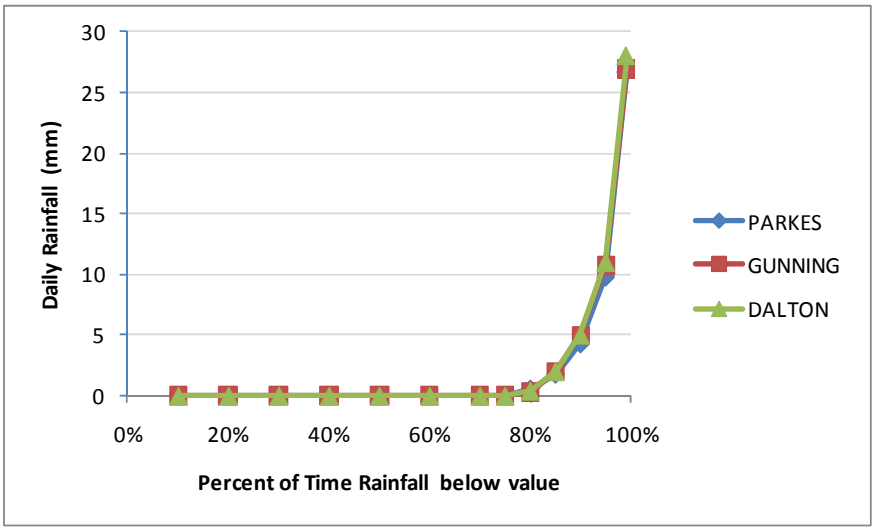
The distance from the southern boundary of the proposed site to the southern creek is ~200m and the site lies at an elevation of ~+15m above that creek. The catchment area of the creek adjacent to the power station site is small at approximately 1.8km^2.

The northern creek rises immediately adjacent to the northern boundary of the proposed power station site falling away sharply to a well defined creek line at an elevation substantially more than 15m below the proposed power station elevation.

No flood studies have been undertaken for the Lachlan River in this area. All flood studies have been undertaken downstream of the site, and are unsuitable for use in this instance.

Rainfall data from Parkes was used to consider the potential for flood inundation. Data from this site has a longer record than Dalton P.O. records. The long term daily rainfall frequency and magnitude from records at Parkes, Gunning and Dalton is similar, although the recorded maximum daily rainfall total for Parkes (149.9 mm) is higher than Gunning (137.2mm) and Parkes (112mm) (comparison provided in Figure 14-4). Adoption of Parkes rainfall is therefore considered conservative for an initial assessment of flood inundation.

Figure 14-4 Comparison of Rainfall Data



Based on the above information it was concluded that peak flows through the southern creek are very unlikely to encroach on the power station site for any event less than at least the 100 year Average Recurrence Interval flood.

Furthermore, due to the topography and location of the northern creek relative to the proposed power stations site, no flooding is expected to occur from the north even the most extreme storm event.

14.7.2 Mitigation Measures

The issue of flooding from the Lachlan River would be considered in the detailed design phase. This would require hydrologic and hydraulic studies to be undertaken and implementation of any mitigation measures to address potential local flooding from the Lachlan River.

14.8 Summary of Mitigation Measures

Table 14-11 presents a summary of mitigation measures related to water management

Table 14-11 Summary of Mitigation Measures

Mitigation Measure	Implementation of mitigation measure		
	Design	Construction	Operation
Soil Erosion			
All construction works would be undertaken in a manner to minimise the potential for soil erosion and sedimentation. Sediment and erosion control measures would be detailed in the CEMP.		✓	
At a minimum the measures outlined in the *Managing Urban Stormwater – Vol 1 Soils and Construction* would be implemented. Measures may include: • limiting slope length, • installation of sediment filters and • the construction of a sedimentation basin downstream of the plant area.		✓	
Soil erosion and sedimentation devices would remain in place until the surface is restored. These devices would also capture any gross pollutants.		✓	
Disturbed areas would be quickly revegetated or covered with a non-erodable surface following construction.		✓	
Spills and site management			
All possible pollutant materials would be stored well clear of site boundaries and stormwater drainage lines and stored in a designated covered area.		✓	✓
Appropriately bunded areas would be included for storage of fuels, oils and chemicals.			✓
Waste collection areas would be designated.	✓	✓	✓
Waste disposal and collection would be undertaken in an appropriate manner.			✓
All major vehicle and equipment maintenance would be undertaken offsite.		✓	✓
Any vehicle washing on-site would be restricted to specific bunded areas.		✓	✓
Staff facilities would be provided, installed and maintained so that pollutants, including wash water are not conveyed from the site in stormwater.		✓	✓
Water for dust suppression would be sourced from the existing dams on the site or imported if required.		✓	✓
Surface water			
Roof runoff would be reused at site and no contaminated effluent would be discharged into waterways.	✓		✓
Water management strategies developed and implemented to maintain zero water discharge from the power plant site except for natural surface flows. Some wastewater may be tankered offsite for disposal at a licensed facility.	✓	✓	✓

Mitigation Measure	Implementation of mitigation measure		
	Design	Construction	Operation
Water from the power plant site would be directed through a sedimentation pond designed to remove any oil and minimise suspended solids to an acceptable level prior to discharge from the Site. Process areas would also pass through an oil/sediment trap prior to entering the stormwater system.	✓		✓
The outlet of the power plant site's stormwater system would be designed to maximize the dispersion of these high flows and spread the flow out over a wider area and thereby minimize their potential to cause soil erosion downstream.	✓		✓
Wastewater Treatment			
Blow down water and other process wastewater would be collected in evaporation ponds lined with a synthetic liner (such as high density polyethylene) and clay to minimise the risk of the saline waste water escaping into the natural groundwater system.	✓		✓
Adequate pond freeboard would be provided to prevent overtopping eg by wave action.	✓		✓
Waste solids, sludge/brine would be removed from site and disposed of by a licensed contractor		✓	✓
Undertake hydrologic and hydraulic studies and implement mitigation measures if required to address local flooding.	✓		
Domestic wastewater would be treated by a zero discharge proprietary treatment system or stored and disposed of offsite by a licensed contractor.	✓	✓	✓
Following confirmation of water supply source(s) and arrangements during the detailed design of the water treatment system, the following would be investigated and implemented following a cost benefit analysis of the following: • Assessment and potential implementation of inlet filter (if any) backwash recycling system; • Maximising recovery of product water in any desalination systems; • Ensuring appropriate pretreatment prior to a deionisation plant to ensure minimal loss of efficiency due to poor feed water quality (physical fouling, ion-exchange resins 'poisoning' due to organics contamination, etc); • Assessment and potential recycling of the evaporative cooling system blowdown (side stream purification and return to the cooling water system or blending with the desalination/deionisation plant feed water possibly after filtration and/or other pretreatment); and • Assessment of a zero liquid discharge option whereby all wastewater streams are thermally desalinated to produce only a solid salt residue, with recovered distillate recycled. This would be an extension of a brine concentrator option, whereby a crystalliser or dryer would further treat a brine to recover solid salt.	✓		✓
Further environmental assessment would be required should AGL seek to supply water to for the Project by water pipeline.	✓		✓

Heritage – Summary of Key Outcomes

The heritage assessment describes the results of the data review, field survey and Aboriginal consultation program conducted for the Project. The assessment provides a significance assessment for the sites identified during the current survey. The Department of Environment, Climate Change and Water's (DECCW) *Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010* have been implemented for the Project. To date letters have been sent to the required groups/authorities, additional letters have been sent to groups identified by OEH, and a public notice has been placed in the Yass Tribune (14 May 2010).

The Dalton gas pipeline study area falls within the boundaries of the Onerwal Local Aboriginal Land Council (OLALC), based at Yass. The Land Council was contacted by phone, email and fax to invite a representative to participate in the field survey of the pipeline easement. However, no response was received from the OLALC.

The assessment addressed previously recorded sites and field surveys of the development footprint. No previously recorded Aboriginal or historical sites are located within the area of the power station footprint or the gas pipeline and access road study areas.

The assessment concluded the following:

- Six sites (Dalton 2, Dalton 3, Dalton 4, Dalton 5, Dalton 7 and DGP3), and two areas of potential archaeological deposits (DPAD1 and DPAD2) would be directly impacted by the plant footprint.
- Sites Dalton 1 and Dalton 6 would not be impacted by the Project.
- DGP4 and DGP5 is within the footprint of the gas pipeline and access road and would be directly impacted by the Project.
- DGP6 is within close proximity of the pipeline and access road footprint.

Where impacts cannot be avoided then the artifacts should be collected or relocated away from the area of impact. The following management strategies would be implemented:

- Disturbance to Aboriginal archaeological sites Dalton 2, Dalton 3, Dalton 4, Dalton 5, Dalton 7 and DGP3 should be avoided if possible. If impact is unavoidable, the artefacts would be collected or relocated away from the area of impact.
- If impact to Aboriginal site Dalton 5 and potential archaeological deposits DPAD1 and DPAD2 cannot be avoided, then a program of archaeological subsurface testing would be conducted to ascertain the presence, extent and integrity of cultural material that may be present in these areas. It is noted that the majority of the identified DPAD 2 area is located external to the Facility boundary, and detailed design will aim to avoid disturbance to the portion which has been identified within the boundary.
- The artefacts exposed at DGP5 should be collected and/or relocated away from the area of impact.

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- A limited program of salvage excavation should be conducted at sites DGP4 and DGP6 with the aim of recording and analysing a larger and more representative sample of artefacts

No further action is required for the DGP1, which is situated outside of the impact area.

The Dalton gas pipeline study area is located within a broad area included in an active Native Title Claim by the Gundungurra Tribal Council Aboriginal Corporation.

No European sites were located as occurring within either the power station footprint, or within the gas pipeline easement area.

15.1 Introduction

An assessment of the cultural heritage impacts of the Project was conducted by Navin Officer Heritage Consultants (Navin Officer).

This chapter provides a summary of the full assessments which are presented in **Appendix I**. The assessments addressed the local and regional archaeology and Aboriginal and European cultural heritage, and were prepared in accordance with the draft *Guidelines for Aboriginal Cultural Heritage Assessment and Community Consultation* (DECCW 2010).

15.2 Methodology

The cultural heritage assessments for both the power station footprint and for the gas pipeline and access road encompassed the following elements:

- *Literature and database review* to determine if known Aboriginal and historical sites were located within the area under investigation, to facilitate site prediction on the basis of known regional and local site patterns, and to place the area within an archaeological and heritage management context;
- *Fieldwork* involved inspection of all areas of ground surface visibility within the study area; and
- *Recording parameters* identifying material evide nce of A boriginal occup ation as reveal ed by surface artefacts and areas of archaeological potential unassociated with surface artefacts.

Based on this methodology the following was provided:

- predictive statements for Aboriginal and European heritage places in the study area;
- results of the desktop analyses and field surveys of the subject site;
- statutory obligations relevant to cultural heritage of the site; and
- recommendations based on the results of the investigation and the impact of the proposed development on the known and potential archaeological resource.

The field survey of the Dalton study conducted in three stages. The first site visit was undertaken in April 2009 to survey the power station footprint, while further site visits were undertaken in March 2010 and January 2011 for the finalised gas pipeline and access road route option. Additional surveys were conducted in June 2011 to investigate a southern extension area of the proposed Facility footprint and communications tower infrastructure (including a proposed access track).

One Aboriginal stakeholder group has an interest in the Dalton study area, the Onerwal Local Aboriginal Land Council (LALC). Arrangements were made for a representative from the group to attend the field surveys. However a representative from the LALC did not attend.

Chapter 15 Heritage

The Dalton gas pipeline study area falls within an active Native Title Claim by the Gundungurra Tribal Council Aboriginal Corporation (details: Gundungurra Tribal Council Aboriginal Corporation #6; Tribunal File No: NC97/7; Federal Court File No: NSD6060/980).

The claim covers a very large area of southeastern NSW from south of Katoomba to Goulburn (approximately 18675 km^2) including the Upper Lachlan Shire.

A desktop review was also undertaken of historical heritage places in the vicinity of the power station footprint and within the vicinity of the gas pipeline easement, and the potential impacts on the heritage significance and visual elements of those places. No historical relics or features had previously been identified in the study area, and none were identified in either the assessment undertaken for the power station footprint, or for the gas pipeline.

15.3 Consultation

Consultation in relation to heritage matters included the following:

- Consultation with the Office of Environment and Heritage (OEH) to obtain information concerning previously recorded Aboriginal archaeological sites and completed archaeological studies.
- Consultation with representatives from the Onerwal Local Aboriginal Land Council.
- The Onerwal Local Aboriginal Land Council was provided with a copy of the draft of the power station assessment (2009) for comment on the cultural significance of the locality and any archaeological objects or areas recorded in the survey.

The Office of Environment and Heritage's (OEH) *Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010* (DECCW, 2010) are being implemented for the Project. To date letters have been sent to the required groups/authorities, additional letters have been sent to groups identified by OEH, and a public notice has been placed in the Yass Tribune (14 May 2010).

Consultation would continue during detailed design with the Onerwal Local Aboriginal Land Council.

15.4 Environmental Context

15.4.1 Landscape

Prior impacts within the study area range from moderate to high. The area as a whole has been subject to vegetation clearance, fencing, grazing and erosion. In particular, the spur crests and upper slopes display very shallow soil profiles that appear to be gravelly lag deposits left behind by erosion. Other impacts include formed roads, associated drainage channels, agricultural dams and services such as overhead power lines and subsurface cables.

15.5 Aboriginal Context

According to Tindale (1974) the Dalton study area is located within the tribal boundaries of the Ngunawal. A search of the AHIMS database revealed no previously recorded sites within the Dalton Power Project study area inclusive of both the facility footprint area and the pipeline corridor. Three sites, Mount Pleasant 1, 2 and 3 are the closest recorded sites to the study area. These sites are located to the north of the study area on the Lachlan River.

There are no previously recorded historical sites in or adjacent the study area, however previous studies modeling the site patterning for the Dalton area identify archaeological potential in the area.

The Aboriginal context of tribal boundaries, traditional groupings and local aboriginal history is discussed in more detail in **Appendix I**. Consultation with the Aboriginal community on cultural values is ongoing. As part of this consultation process, both heritage assessments have been forwarded to Onerwal Local Aboriginal Land Council for comment on the recommendations and any cultural issues relating to the development.

15.6 Historic Overview

The region was first explored by Europeans in 1820 and was then settled throughout the 1820s. John Macarthur settled Taralga in 1822, various Scots arrived in the Braidwood area in the 1830s, and almost 10,000 cattle and sheep were farmed in the open country around Goulburn in 1821. The 1830s saw the whole southern area of the bioregion occupied by squatting runs (NSW NPWS 2003).

The town of Dalton was settled in 1847. The study area is located in land owned in 1905 by John Mitchell and John Hallam. The parish map shows that the current road from Dalton is along the original alignment.

Dalton was part of Gunning Shire which was later amalgamated with Crookwell Shire and parts of Mulwaree, and Yass Shires to form the Upper Lachlan Shire.

There are no heritage listed items within the study area, however unrecorded historical sites and features of heritage significance may occur within the study area.

Structures of historical interest and heritage significance may be standing, ruined, buried, abandoned or still in use.

Chapter 15 Heritage

15.7 Assessment of Potential Impacts

15.7.1 Aboriginal Sites

No Aboriginal sites or objects have been previously identified in the vicinity of the Dalton power plant area or the gas pipeline and access road study area.

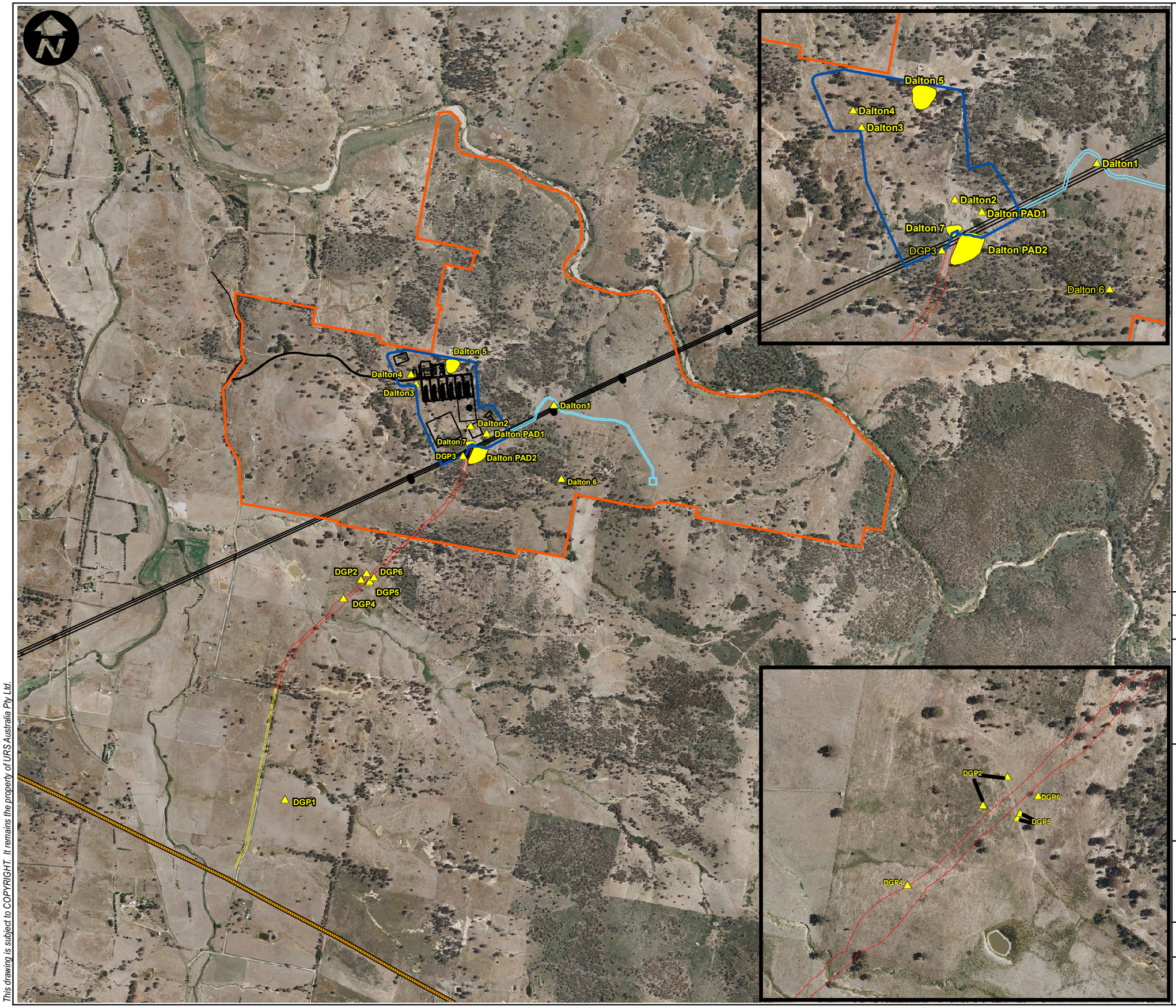
Facility Footprint Study Area

Five Aboriginal sites comprising three isolated finds, one artefact scatter, one artefact scatter with potential archaeological deposit, and two areas of potential archaeological deposits (PAD) were located in or near the Dalton power plant study area during the power plant field survey undertaken in April 2009 and June 2011 to investigate a southern extension area of the proposed Facility footprint and communications tower infrastructure (and associated access track).

The artefacts found in the area (D1 – D4, D6 and D7) are common raw materials and have therefore been assessed as having low archaeological significance. D5 and the potential archaeological deposits (DPAD1 and DPAD2) have a moderate to high likelihood of containing further deposits however the significance of this site/deposit cannot be determined based on available data. These sites are detailed in **Table 15-1** and presented in **Figure 15-1**.

Table 15-1 Site locations of relative to Facility Footprint

Recording Code	Recording Type	Location Relative to Development
Dalton 1 (D1)	isolated find	Outside facility footprint area
Dalton 2 (D2)	artefact scatter	Directly impacted by facility footprint and potentially by gas pipeline and access road easement
Dalton 3 (D3)	isolated find	Directly impacted by facility footprint
Dalton 4 (D4)	isolated find	Directly impacted by facility footprint
Dalton 5 (D5)	artefact scatter and PAD	Directly impacted by facility footprint
Dalton 6 (D6)	artefact scatter	Outside facility footprint area
Dalton 7 (D7)	artefact scatter	Directly impacted by facility footprint
Dalton PAD1 (DPAD1)	potential archaeological deposit	Directly impacted by facility footprint
Dalton PAD2 (DPAD2)	potential archaeological deposit	Directly impacted (in part) by facility footprint



Legend

- AGL Site Boundary
- Plant Footprint
- Gas Pipeline (northern) and Access Road
- Gas Pipeline (southern)
- Communications Tower and Hut Footprint
- Communications Tower Services and Access Track
- Moomba-Sydney Pipeline
- Transmission Line
- Aboriginal Sites
- Aboriginal Sites

0 0.125 0.25 0.5 0.75 1

Kilometres

Source: Aerial Image from AGL

Drawn: AY/SB	Approved: KT	Date: 16/06/2010
Job No.: 43177661	File No.: 43177661.058.mxd	

Client

AGL POWER GENERATION (NSW)

Project

AGL DALTON POWER PROJECT

Title

ABORIGINAL SITES WITHIN STUDY AREA (FACILITY FOOTPRINT AND GAS PIPELINE EASEMENT)

Figure: 15-1

URS

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Gas Pipeline and Access Road Study Area

Six Aboriginal sites comprising one isolated finds and five artefact scatters, and one area of potential archaeological deposit were located in or near the gas pipeline and access road easement. The artefacts within the proposed pipeline corridor have a moderate to low archaeological significance and are unlikely to lead to any further finds due to the level of exposure and erosion of the soil in the area.

The Sites of relevance to the pipeline and access road easement are detailed in **Table 15-2** and presented in **Figure 15-1**.

Table 15-2 Site locations of relative to Gas Pipeline and Access Road Easement

Recording Code	Recording Type	Location Relative to Development
Dalton 2 (D2)	artefact scatter	Directly impacted by power plant facility footprint and potentially by gas pipeline and access road easement
Dalton PAD1 (DPAD1)	potential archaeological deposit	Directly impacted by power plant facility footprint and potentially by gas pipeline and access road easement
Dalton Gas Pipeline 2 (DGP2)	artefact scatter	Outside pipeline and access road easement - no impact
Dalton Gas Pipeline 3 (DGP3)	isolated find	Outside pipeline and access road easement
Dalton Gas Pipeline 4 (DGP4)	artefact scatter	Directly impacted by gas pipeline footprint
Dalton Gas Pipeline 5 (DGP5)	artefact scatter	within close proximity of gas pipeline footprint
Dalton Gas Pipeline 6 (DGP6)	artefact scatter	Located on the south-eastern edge of proposed gas pipeline footprint; would potentially be impacted by construction of the pipeline.

Further definition of the nature of each of the above artefact scatters, isolated finds and potential archaeological deposits is provided in **Appendix I**. The locations of all Aboriginal Sites identified through heritage investigations carried out across the Dalton Power Project study areas are shown in **Figure 15-1**.

15.7.2 European Sites

No historical relics or features were identified within the study area of either the power station footprint or of the gas pipelines easement area during the field surveys.

15.8 Mitigation Measures

15.8.1 Aboriginal Heritage

The proposed construction of the Dalton Power Project would necessitate the substantial disturbance or removal of the current ground surface and associated upper soil profile within the footprint of the Facility, as well as in the gas pipeline and road easement area. This level of impact could destroy, damage or move any archaeological material potentially present within the affected sediments.

Power Station Footprint

Five sites (Dalton 2, Dalton 3, Dalton 4, Dalton 5 and Dalton 7) and areas of potential archaeological deposit (DPAD1 and DPAD2) would be directly impacted by the Project. It is noted that the majority of the identified DPAD 2 area is located external to the Facility boundary, and detailed design will aim to avoid disturbance to the portion which has been identified within the boundary.

Three sites (DGP4, DGP5 and DGP6) have been identified in, or adjacent to, the study area for the proposed pipeline in the context of the current study.

The potential of these sites to extend beyond their current recorded extent is probable, given the constraints of the low ground surface visibility within the study area, and the continuity of the micro-topographic landforms on which they are situated, to either side of the proposed development footprint. The likely subsurface presence of artefacts along these landforms, and their continuity outside of the proposed pipeline easement, means that avoiding impact to Aboriginal objects by minor adjustments to the easement may be problematic. Accordingly, the following mitigation measures are to be implemented:

- If impact to Aboriginal sites Dalton 2, Dalton 3, Dalton 4 Dalton 7 and DGP3 cannot be avoided then the artefacts should be collected or relocated away from the area of impact.
- If impact to Aboriginal site Dalton 5 and potential archaeological deposit DPAD1 and DPAD2 cannot be avoided, then a program of archaeological subsurface testing should be conducted to ascertain the presence, extent and integrity of cultural material that may be present in these areas.
- where practicable, disturbance to Aboriginal archaeological sites DGP4, DGP5 and DGP6 should be avoided;
- if avoidance of sites DGP4, DGP5 and DGP6 is not feasible, then the following management strategies are recommended:

  a. the artefacts exposed at DGP5 should be collected and/or relocated away from the area of impact; and

  b. a limited program of salvage excavation should be conducted at sites DGP4 and DGP6 with the aim of recording and analysing a larger and more representative sample of artefacts.

- If during construction of the pipeline, Aboriginal objects are encountered outside of the DGP4, DGP5 and DGP6 site recordings, then the actions defined in the Unanticipated Discovery Protocol should be followed as described below and in greater detail within **Appendix I**.

A CEMP for the Project would detail management strategies to be followed to mitigate impacts on the identified Aboriginal items as listed above, together with strategies to be followed in the event that an Aboriginal object is uncovered during the construction of the Project.

In the event that an Aboriginal object is uncovered during the construction of the Project the following procedures are to be undertaken:

1) All works would cease in the immediate vicinity of the object.
2) A qualified archaeologist would assess the significance of the object.
3) If artefacts are discovered their location would be recorded using a hand held GPS and mapped, the artefacts would be collected, bagged and given a sequential location number.
4) If midden material is discovered its location would be recorded using a hand held GPS and mapped, a sample of the material is collected, bagged and given a sequential location number.
5) The collected material would be examined in detail by a suitably qualified lithic specialist and the midden material examined and recorded. A report is to be written detailing the findings of this examination.
6) Following completion of the analysis of the assemblage, all the lithic items would be lodged with the Australian Museum, or would be subject to a Care and Control Permit issued by the OEH.

Further detail on the management framework for the discovery of new sites or human skeletal remains during construction is provided in **Appendix I** and would be incorporated into a CEMP for the Project.

15.8.2 European Heritage

No historical relics or features were identified within the study area. However, the following management strategies would be followed and detailed in the CEMP for the Project, in the event that a substantial intact non-aboriginal archaeological relic is unexpectedly discovered:

1) All work would cease in the immediate vicinity of the object.
2) A qualified archaeologist would assess the significance of the relic.
3) The location of any relic would be recorded in accordance with best practices guidelines (as identified by the NSW Heritage Branch).
4) Based on (2) and (3) above, a report would be written by a heritage specialist detailing the outcomes of the assessment of the new discovery, including recommendations as to re-commencement of work in the affected area.

More detail on the management framework for the discovery of new sites or human skeletal remains during construction is provided in **Appendix I** and would be incorporated into a CEMP for the Project.

15.9 Mitigation Measures

Table 15-3 summarises the mitigation measures relating to the heritage assessment.

Table 15-3 Summary of Heritage Mitigation Measures

Mitigation measure	Implementation		
	Planning and design	Construction	Operation
Aboriginal Heritage			
Where practicable, disturbance to Aboriginal archaeological sites D2, D3, D4, D5, D7 and DGP3 should be avoided. If impact is unavoidable, the artefacts should be collected or relocated away from the area of impact.	✓	✓	
If impact to Aboriginal site D5 and potential archaeological deposits DPAD1 and DPAD2 cannot be avoided, then a program of archaeological subsurface testing should be conducted to ascertain the presence, extent and integrity of cultural material that may be present in these areas.	✓	✓	
Where practicable, disturbance to Aboriginal archaeological sites DGP4, DGP5 and DGP6 should be avoided.	✓	✓	
If sites DGP4, DGP5 and DGP6 are unavoidable, then the following management strategies are recommended: • the artefacts exposed at DGP5 would be collected and/or relocated away from the area of impact; and • a limited program of salvage excavation should be conducted at sites DGP4 and DGP6 with the aim of recording and analysing a larger and more representative sample of artefacts.		✓	
The CEMP would be developed and implemented addressing heritage issues. The CEMP would detail management strategies for identified Aboriginal sites together with strategies to be followed in the event that an Aboriginal object is uncovered during construction.		✓	
European Heritage			
The CEMP would be developed and implemented addressing heritage issues including strategies to be followed in the event that a non Aboriginal archaeological relic is uncovered during construction.		✓	

Land Use and Planning – Summary of Key Outcomes

The proposed Development Site is approximately 4 km north of the township of Dalton. Land use immediately surrounding the Development Site is predominantly rural enterprises on large to medium size holdings.

The Development Site is located in an area that is zoned RU2 Rural Landscape, with parts of the Gas Pipeline (northern section) and Access Road, as well as the Gas Pipeline (southern section) zoned RU1 Primary Production. Zoning RU1 Primary Production and RU2 Rural Landscape, provide that "power generation" facilities are permissible with consent.

The proposal would result in changes to the land use of the development footprint itself as it is currently used primarily for agricultural purposes. An area of 183.26 ha (approximately 36 % of the Site) would form part of the Offset Area which would be conserved and managed appropriately (refer to **Chapter 13** for further details). The remainder of the Site would also be managed appropriately (refer to **Chapter 13** for further details). Therefore AGL considers that the land use change would be an overall positive one due to the higher conservation outcomes of the land use change from agricultural use and production to conservation.

Consideration was given to cumulative impacts with other major projects being undertaken or considered in the Upper Lachlan Shire Council area. The current major projects listed on the DoP register of major projects in the Upper Lachlan Shire Council area are all windfarms. The dominance of electricity generation projects is due to the presence of wind resources and infrastructure associated with electricity generation in the region.

These projects are located between 5 km and more than 20 km from the Dalton Power Project. These projects are in a range of stages from consideration of DGRs to operation having commenced. Timing of the projects for construction and operation (for those not having already commenced) is unknown and dependant on the respective proponents. Based on the distance between Dalton Power Project and other windfarm projects, potential differences in timing of construction between projects, and differences in key environmental impacts between gas fired generation and wind generation, there would not be a negative cumulative impact from the Dalton Power Project.

Mitigation measures detailed in this Environmental Assessment relate to the control of the development's impact on noise levels, air and water quality, traffic and transportation, visual amenity and other environmental matters. These mitigation measures would be implemented to ensure that the proposed Project is managed in an effective and efficient manner, with minimal impact on existing or possible future surrounding land uses.

Chapter 16 Land Use and Property Impacts

16.1 Introduction

This chapter describes the land use patterns present in the areas surrounding the proposed Dalton Power Project and assesses the potential impacts of the construction and operation of the proposal on adjoining land uses.

16.2 Existing Land Use – Development Site

The three farm holdings comprising the AGL Site currently operate as rural landholdings with sheep and cattle grazing. **Figure 4-1** shows the existing structures and land uses on the Development Site.

The Development footprint encompasses and traverses land which is zoned RU2 Rural landscape and RU1 Primary Production under the Upper Lachlan Local Environment Plan 2010.

16.3 Existing Land Use – Surrounding Areas

The Development Site is approximately 4 km north of the township of Dalton. Developments immediately surrounding the Development Site are predominantly rural enterprises on medium to large size holdings, with adjoining properties. The existing nine residences which are closest to the Development Site are identified in **Figure 12-1**.

16.4 Land Use Issues Arising From Consultation

Consultation with adjacent landowners as well as with the general community was conducted leading up to and during preparation of this Environmental Assessment as detailed in **Chapter 6** *Consultation*.

Surrounding land users predominantly graze livestock (mostly sheep) and no issues were raised during consultation that effect existing land uses, other than the poor condition of the Elms and Riverview properties regarding noxious weed infestations and the potential for further spread. It is noted that the proponent has commenced a noxious weed eradication program in consultation with Upper Lachlan Shire's Weed Officer and neighbouring property owners. It was also identified that one neighbouring landowner operates an extractive industry from their property and utilises Walshs Road occasionally for that purpose. This was not considered by the proponent or the neighbour to be impacted by the proposed Dalton Power Project.

No surrounding landowners consulted engaged in aerial fertilisation of their property in recent (or generally memorable) history, however this was carried out across part of the "Holmes" property a number of decades ago. This proved uneconomic, and the aerial spraying subsequently ceased..

16.5 Potential Existing Land Use Conflicts

16.5.1 Construction Phase Impacts and Mitigation Measures

The main potential for impacts of construction activities on surrounding land uses include:

- air quality;
- soils and geology;
- traffic flow effects;

- noise impacts; and
- flora and fauna.

The potential impacts of the construction phase of the proposed development on surrounding land uses are discussed in relevant chapters of the EA, including **Chapter 9** *Air Quality*, **Chapter 8** *Soils, Geology and Groundwater*, **Chapter 11***Traffic and Transport*, **Chapter 12** *Noise* and **Chapter 13** *Flora and Fauna*. The potential effects of the proposed construction activities on surrounding land uses are briefly summarised below.

Air Quality

A range of dust suppression measures and erosion and sedimentation controls would be implemented during the construction phase of the proposed power station. These controls would be incorporated in a construction soil and water management plan to be developed as part of the Construction Environmental Management Plan (CEMP).

Soils and Geology

A soil and water management plan would include procedures and controls to ensure that water runoff from construction activities is minimised, contained and disposed of appropriately (if required), and to prevent chemical spillages from construction equipment from entering water channels.

Traffic and Transport

Temporary upgrades or reconfigurations of the local road network may be required to facilitate over mass and over dimensional haulage of plant and equipment to the site during the construction phase. AGL are committed to ongoing consultation with the relevant local authorities regarding these requirements and would contribute financially towards these works as detailed in **Chapter 11**.

Noise

The construction of the proposed development is not expected to have significant noise impacts upon local residents. During the construction phase some localised and temporary noise impacts may occur. A preliminary assessment of noise during the construction phase shows no exceedances at the existing residential receivers. Implementation of noise mitigation measures to be included in a CEMP would minimise construction noise impacts.

Flora and Fauna

A Weed and Pest Management Plan, developed as part of the CEMP for the Site, would minimise the impacts of the development on flora and fauna during construction. The plan would include active control of feral animals (primarily foxes and rabbits). Implementation of these mitigation measures would ensure that the proposed Project would not have any impact on surrounding land use from a flora and fauna perspective.

16.5.2 Operation Phase Impacts and Mitigation Measures

The main potential for environmental impacts associated with the operation of the Project on surrounding land uses include:

- air quality;
- visual impacts;
- traffic flow effects;
- noise impacts;
- flora and fauna;
- water management;
- hazard; and

The potential impacts of the operational phase of the proposed power station on surrounding land uses are briefly summarised below but are discussed in greater detail in relevant chapters of the Environmental Assessment, including **Chapter 8** *Air Quality*, **Chapter 10** *Landscape and Visual*, **Chapter 11** *Traffic and Transport*, **Chapter 12** *Noise*, **Chapter 13** *Flora and fauna*, **Chapter 14** *Water Management* and **Chapter 18** *Preliminary Hazard Analysis.*

The proposal would result in considerable changes to the land use of the site itself as the site is currently used primarily for grazing. Approximately 5% of the Site would be utilised for the Dalton Power Project. Even so, the rural zoning of the site permits some non-rural uses. Land within the AGL Site Boundary is zoned RU2 Rural Landscape, with parts of the Gas Pipeline (northern section) and Access Road, as well as the Gas Pipeline (southern section) zoned RU1 Primary Production. Zoning RU1 Primary Production and RU2 Rural Landscape, provide that “power generation” facilities are permissible with consent.

The Project has a lifespan of 30 operating years. Operation of the Project is not likely to have a significant impact on surrounding land uses due to the operating hours (up to 15 % of the year) of the power station and the large buffer between the proposed plant and surrounding residences.

An area of 183.26 ha (approximately 36 % of the Site) would form part of the Offset Area which would be conserved and managed appropriately (refer to **Chapter 13** for further details). The remainder of the Site would also be managed appropriately (refer to **Chapter 13** for further details). Therefore AGL considers that the land use change would be an overall positive one due to the higher conservation outcomes of the land use change from agricultural use and production to conservation.

Air Quality

The results of the worst case dispersion modelling for local air quality showed that ground level concentrations of NO_2, PM_{10}, CO and SO_2 were below the NSW DECCW criteria; and VOC, including PAH were found to be below the NSW DECCW criteria. In conclusion, the assessment considered that the impacts on local air quality from this development would be minor and adverse impacts are unlikely for surrounding land uses.

Landscape and Visual

The Landscape and Visual Assessment concluded that the Project would have a low visual impact on people in areas surrounding the site due to a range of measures including:

- screening from existing trees and natural landforms;

- restricting the views to the stacks to upper portions of the stack structures;
- using materials and colours to minimise the visual contrast;
- lighting design which would avoid direct line of sight from residences that are located to the east and west of the site; and
- no visible emissions would be discharged from the turbine stacks.

The implementation of the above measures would minimise the impact of the proposed Project on surrounding land uses.

Traffic and Transport

The traffic and transport assessment found that the arterial road network can satisfactorily and safely accept the additional traffic generated by the proposed development during the construction, operational and maintenance phases.

Noise

No exceedances of operational noise have been predicted for the existing six residences. Mitigation measures are proposed that are not considered excessive and are considered to be relatively easily achieved. Further information with respect to design would be provided during the detail design assessment once the final selection of the turbine is complete.

Flora and fauna

Implementation of the offset strategy and mitigation measures for the Project would ensure that the overall biodiversity of the local area would be 'maintained or improved'.

A Weed and Pest Management Plan developed as part of the OEMP for the site would minimise the impacts of the development on flora and fauna during operation. The plan would include active control of feral animals (primarily foxes and rabbits). Implementation of these mitigation measures would ensure that the proposed Project would not have any impact on surrounding land use from a flora and fauna perspective.

Water

Mitigation measures would be employed to minimise the erosion of soils during construction such that discharge from the sedimentation pond would be through an appropriately designed dissipating structure to minimise soil erosion potential. Appropriately bunded areas would be established for storage of fuels, oils and chemicals and areas within the operational plant area would be appropriately drained so that surface runoff would be prevented from infiltrating directly onto the ground and from reaching the groundwater. Implementation of these measures would minimise adverse impacts on surrounding land uses.

Wastewater volumes have been estimated and management strategies developed to maintain zero discharge from the site except for part of natural surface flows and ensure minimal impact on surrounding land uses.

Hazard

Despite the conservativism built into the risk assessment, the results show that the risk associated with this development is very low. The proposed Project complies with the most stringent risk criteria stipulated by the DoP, are adhered to and therefore the Project does not pose issues for the surrounding landholders.

16.6 Potential Future Development

16.6.1 Current Land Use Zoning

Land within the AGL Site Boundary is zoned RU2 Rural Landscape, with parts of the Gas Pipeline (northern section) and Access Road, as well as the Gas Pipeline (southern section) zoned RU1 Primary Production. Zoning RU1 Primary Production and RU2 Rural Landscape, provide that "power generation" facilities are permissible with consent.

The Dalton Power Project falls within the definition of *"electricity generating works"* contained in the Upper Lachlan LEP 2010. Accordingly, the Dalton Power Project falls within the list of permissible uses of the zoning in the Upper Lachlan LEP 2010. The current zoning of surrounding areas permits activities such as agriculture, rural housing and open space.

16.6.2 Summary of Development Planning in the Region

The section provides a summary of the development planning in the region and addresses the following strategies, strategic reviews, and policies in the context of implications for the Project:

- Sydney to Canberra Corridor Regional Strategy 2006 – 2031.
- Upper Lachlan Strategy Plan 2020.

Sydney to Canberra Corridor Regional Strategy 2006 - 2031

The Sydney to Canberra Corridor Regional Strategy applies to all local government areas between the fringe of Sydney through to the Australian Capital Territory, and includes the Upper Lachlan Shire Council, which is where the Dalton Power Project is located.

The current population of the region is approximately 137,000, with both the northern and southern ends of the region experiencing high growth, reflecting their proximity to Sydney and Canberra. The Region's population is projected to be 183,350 by 2031, a growth of 46,350 people, requiring an additional 25,200 dwellings and 27,800 jobs.

The economy of the region is diverse, reflecting the range of agricultural landscapes, the growing population, key national transport links and the influence of Sydney and Canberra on large parts of the region. One of the challenges for the region is to maintain the rural character of the landscape whilst acknowledging other uses of rural land and the strategies contains policies and objectives that seek to achieve this balance.

Encouraging economic development relies on many factors, including industries establishing in the area. Gunning has been identified in the Strategy as a town generally reliant on higher order centres such as Yass or Goulburn for employment opportunities. The Project is consistent with the aim and

objectives of the Strategy and is an example of new industry in the area that would provide employment opportunities for the local workforce during both the construction and operational phases of the Project.

Upper Lachlan Shire 2020 Vision Strategy

The objective of developing the Upper Lachlan Shire 2020 Vision Strategy ("the Strategy") was to guide the ongoing sustainable management of land use decisions to 2020. As part of the research for developing the Strategy, investigations into the suitability and capability for growth in the Upper Lachlan LGA were undertaken. The Strategy will form the basis of planning and land use decisions up until 2020.

The agriculture, forestry and fishery industries are the largest employers in the Upper Lachlan LGA, with nearly a third of the region's population employed in those sectors.

Consultation with local communities identified some ideal future directions for the area. For the Dalton area, the future direction included a need for the "integration of people, population, rezoning and advertising to create a vibrant community heritage town with future sustainable industries". Respondents in the Gunning area asserted that new industries which complement existing businesses should be encouraged to the area. One of the primary drivers behind this is providing employment opportunities within the area. Respondents also emphasised that any proposed industrial sites should be located outside of the town with a buffer zone to protect residential amenity, aesthetics and noise levels.

The Strategy identified a number of planning objectives for the Upper Lachlan Shire. These were Environmental (including water quality, protecting native flora and fauna, weed control and retaining agricultural lands); Social (including providing for a variety of land uses and preserving the rural landscape and character of the area); and Economic (including promoting development in areas of low agricultural value and providing opportunities for employment growth). There was also an emphasis on land use harmony. A suggested solution for conflicting land uses was to use natural and man-made barriers to create buffers between residential development and incompatible land uses.

Population growth is one of the goals for the Upper Lachlan Shire. Key areas that would promote growth, as identified in the Strategy include attracting new industry to the area, and the associated job creation. The proposed development of a gas-fired power station at Dalton is in keeping with these aims. It also does not compromise the goals for the retention of Gunning as rural town centre, as it will not impact on the Village zone.

16.7 Potential Future Land Use Conflicts

AGL is not aware of any future planned land use or zoning changes which may apply to the immediate vicinity of the Project. While a number of effects have been identified as part of this Environmental Assessment, none of them will negatively impact surrounding land owners, nor will they have an effect on those land owners being able to continue using their land for rural purposes.

AGL has committed to implementing mitigating measures identified in this Environmental Assessment.

Chapter 16 Land Use and Property Impacts

16.8 Cumulative Impacts

Consideration was given to other major projects being undertaken or considered in the Upper Lachlan Shire Council area. Projects currently listed (website access 4 March 2011) on the DoP register of major projects are presented in **Table 16-1**.

Table 16-1 Summary of current major projects in the Upper Lachlan Shire Council area

Project	Proponent	Proximity to Dalton Power Project	Status
Epuron Rye Park Windfarm	Epuron	Approximately 5 km west	DGRs issued.
Crookwell 3 Windfarm	Crookwell Development P/L	More than 20 km north east	DGRs issued.
Crookwell II Windfarm	Crookwell Development P/L	More than 20 km north east	Approved 2005.
Gullen Range Windfarm	Gullen Range Windfarm Pty Ltd	More than 10 km north east	Approved 2010.
Cullerin Windfarm	Origin Energy	More than 5 km north east	Approved 2007. Commenced operation 2009.
Bango Windfarm	Bango Windfarm Pty Ltd	More than 20 km north east	DGRs issued.
Rugby Windfarm	Suzlon Energy Australia & Windlab Developments Pty Ltd	More than 20 km north east	DGRs issued.

The current major projects in the Upper Lachlan Shire Council area are all windfarms. The dominance of electricity generation projects is due to the presence of wind resources and infrastructure associated with electricity generation in the region.

These projects are located between 5 km and more than 20 km from the Dalton Power Project. These projects are in a range of stages from consideration of DGRs to operation having commenced. Timing of the projects for construction and operation (for those not having already commenced) is unknown and dependant on the respective proponents.

The cumulative impact of the Dalton Power Project with these projects considered the following:

- C onstruction:
  - Distance between Dalton Power Project and other windfarm projects.
  - Potential differences in timing of construction between projects.
  - Potential for cumulative impacts relating to construction traffic and socio economic depending on the timing of construction of the other projects, and impacts to flora and fauna.
- Operation
  - Differences in key environmental impacts between gas fired generation and wind generation.
  - Potential for cumulative impacts relating to operation noise, visual.

16.8.1 Construction Cumulative Impacts

Traffic

Cumulative construction traffic impacts would depend on the convergence of timing of construction periods for the above projects. Construction traffic to the Rye Park, Crookwell, and Gullen Range windfarms is likely to utilise Hume Highway and then turn off at the relevant local roads. It is assumed traffic for Crookwell and Gullen Range windfarms would leave the Hume Highway before traffic for the Dalton Power Project. It is assumed that traffic for the Rye Park windfarm would continue beyond the turn off for Dalton. The traffic route access for these projects on the local roads would therefore be likely to be different beyond the turnoff from the Hume Highway. Therefore, should the construction timing converge, the cumulative traffic impact of the projects would be along the Hume Highway.

The Hume Highway is classified National Highway 31 and State Highway 2. The Hume Highway is part of the Auslink National Network and is a vital link for road freight transport between Sydney and Melbourne. For approximately 92 % of its length in NSW and in close proximity to Gunning, the Hume Highway consists of a dual carriageway (two lanes in each direction) with a posted speed limit of 110 km / hr.

Therefore it is considered that as the Hume Highway is a vital link for road freight transport that it is designed in a manner that would accommodate traffic for all four projects should construction timing converge.

Flora and Fauna

It is likely development of these projects would all require some level of vegetation clearing. Each Project would be required to consider the local and regional impacts of vegetation clearing to ensure the principles of ‘maintain and improve’ are followed. To minimise the potential impact of the Dalton Power Project, the Flora and Fauna Assessment contains detailed recommended mitigation measures. These measures include management plans for the construction and operational stages of

the project, clearing strategies, habitat replacement plans and rehabilitation and land management strategies. In addition to these measures, in order to offset the potential impact of the Project on Box Gum Woodland and Natural Temperate Grassland, AGL propose to offset the following:

- 77.57 ha of Box Gum Woodland within the AGL owned lands adjoining the development footprint, and
- 80.71 ha of Native Temperate Grassland and 24.97 ha of exotic pasture that has the potential, with appropriate management to meet the criteria for recognition as Natural Temperate Grassland within the AGL owned lands adjoining the development footprint.

Implementation of the offset strategy and mitigation measures for the Project would ensure that the overall biodiversity of the local area would be 'maintained or improved' as per the requirements of the DEC (2005) guidelines. Given that the flora and fauna aspects of the project have been assessed as satisfying the 'maintain or improve test', the project would not produce any negative cumulative impacts with respect to flora and fauna.

Socio-economic

Timing of the projects for construction and operation (for those not having already commenced) is unknown and dependant on the respective proponents.

A high level assessment of employment impacts identified that there was a relatively high proportion of construction workers in both the Upper Lachlan SLA and the South Eastern SD. This means the construction labour required for both stages of the Dalton Power Project should be easily sourced from the local region. It is considered that there may be differing skill sets required between the two types of projects (gas fire generation and wind generation) and the region may be able to service multiple projects should the construction timing converge.

16.8.2 Operation Cumulative Impacts

Noise

The noise assessment for the Dalton Power Project found that the noise criteria can be achieved with no further noise mitigation measures beyond those already proposed by AGL. Consequently, the impacts of the operation of the plant are not expected to degrade the existing acoustic environment nor create annoyance to the community surrounding the facility. Therefore it is considered that the distance to the other Projects and noise profile is such that it would not create additional cumulative impact on the existing acoustic environment with other projects.

Visual

The Visual Assessment concluded that the proposed Dalton Power Project would have a low visual impact on people in areas surrounding the Development Site. This is due to a combination of existing trees and natural landforms, views to the stacks being generally restricted to upper portions of the stack structures, views to the lower sections of the power plant and associated infrastructure mitigated by existing trees and local undulating landform. Therefore it is considered that the siting of the Dalton Power Project is such that it would not create additional cumulative impact on the views within the surrounding region.

16.9 Mitigation Measures

The proposal would result in changes to the land use of the site itself as the site is currently used primarily for grazing. However, the proposed site is located in an area that is zoned rural and development for the purposes of 'generating works' is permissible with development consent. Mitigation measures detailed in this Environmental Assessment relate to the control of noise levels, air and water quality, traffic and transportation, visual amenity and other environmental matters, as detailed in **Chapter 7** through **Chapter 18,** would be implemented to ensure that the proposal is managed in an effective and efficient manner, with minimal impact on existing or possible future surrounding land uses.

Chapter 17 Socio Economic Assessment

17.1 Introduction

Economic impacts have been assessed, focusing on the direct and indirect economic impacts of the Project. Analysis was undertaken on the construction and ongoing operation of the power plant development, and is based on recent socio economic impact analysis for other AGL projects of a comparable scale. The assessment also includes a consideration of the social impact of the Project in terms of the impacts on local population and labour workforce.

As a result of the Project location, the following regions are the likely considered to be impacted by the Project and were the focus of socio-economic analysis:

- Upper Lachlan Statistical Local Area (SLA)
- South Eastern Statistical Division (SD);
- New South Wales; and
- Aus tralia.

Dalton is the nearest population centre to the Project site, and is a small inland country town located in the Upper Lachlan Shire. Dalton is north of the Hume Highway that joins Sydney and Melbourne, and is located between Goulburn and Yass in south western New South Wales. Nearby towns are Cullerin, Gundaroo, Gunning, Yass, and Murrumbateman.

Economic impact analysis has been used to assess the effect of the proposal on the Australian economy level, which encompasses all local, state and national impacts. Economic impact analysis measures the total economic contribution of a project, infrastructure facility, business operation or industry on an economy. In this analysis, the total economic impact of the proposed plant development has been assessed at the construction and ongoing operations stages of development.

17.2 Existing Regional Socio-economic Conditions

The existing socio-economy environment of the Project area is examined in the following section. An understanding of the current situation provides a comparative basis for project impacts as it forms the basis for a 'without' proposed development scenario, which is supplemented by a 'with' development scenario addressed in later sections of this chapter.

17.2.1 Demography

Population

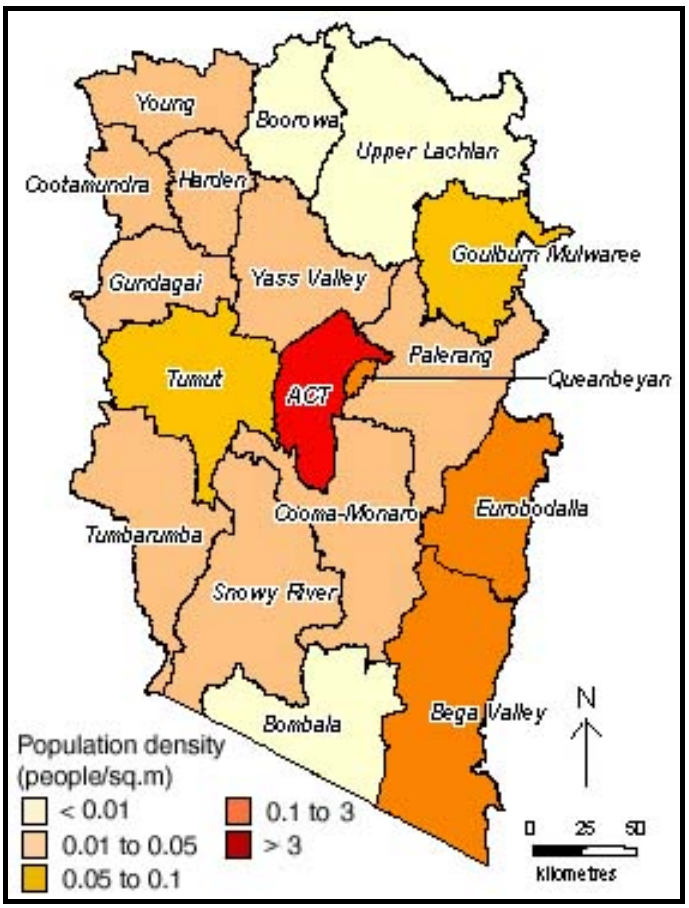
Local, regional, state and national population counts and projections for the areas surrounding the proposed Dalton Power Project are shown in **Table 17-1**. The populations for all regions are characterised by a projected pattern of growth continuing until 2026. The population projections for the Upper Lachlan Statistical Local Area (SLA) indicate a compound annual growth rate (CAGR) of 0.93% from 2001 to 2026. This is slightly lower than both the regional and state growth rates, of 1.09% and 1.07% respectively, and significantly lower than the national growth rate of 1.67%.

Table 17-1 Population and Projections

Area	2001 Actual	2006 Actual	2011 Forecast	2016 Forecast	2021 Forecast	2026 Forecast	CAGR
Upper Lachlan SLA	6,749	6,840	7,154	7,608	8,058	8,499	0.93%
South Eastern SD	200,000	211,190	220,900	234,900	248,800	262,400	1.09%
New South Wales	6,371,745	6,585,732	7,187,000	7,559,600	7,939,800	8,322,800	1.07%
Australia 18,97	2,350	20,061,651	22,447,400	24,422,700	26,571,820	28,723,000	1.67%

Source: ABS Statistics and Projections, NSW Planning Department Population Projections, URS Analysis

Population density



Source: SoE report 2004 Upper Lachlan

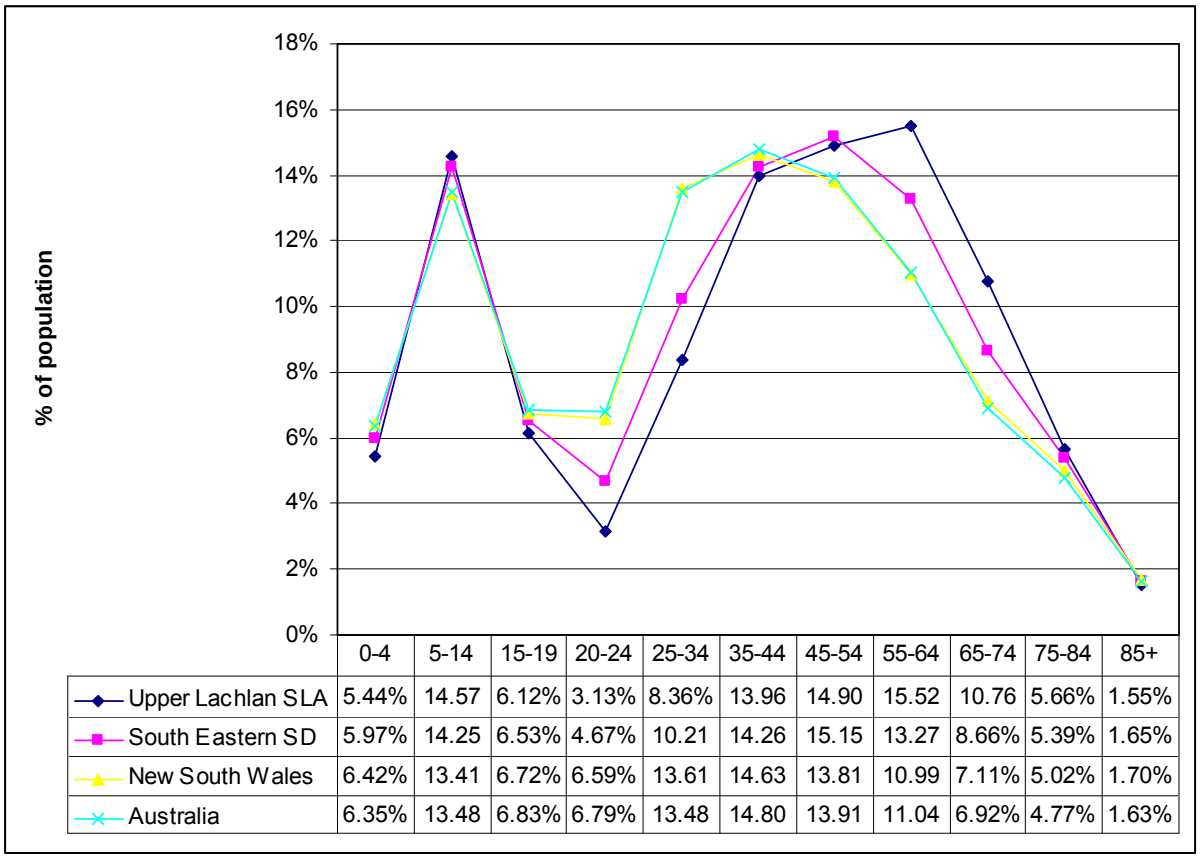
As expected for a rural council area with few townships, Upper Lachlan council area is sparsely populated. Preliminary estimated residential population at June 2004 was 7,621. Based on those land uses in the council area that are most likely to be populated (urban and agriculture), the calculated population density is around 0.01 persons per hectare (or one person for every 88.59 hectares) (SoE 2004).

Age Structure

The age structure of the Upper Lachlan SLA based on the 2006 ABS Census is shown in **Figure 17-1**. The largest proportion of the population is 'working age', between 15 - 64 years, with 62.01% of the population in Upper Lachlan being of working age. NSW and Australia respectively have 66.34 % and 66.85% of their population being of working age, which is slightly higher than in Upper Lachlan.

The Upper Lachlan SLA has a relatively higher proportion of residents above the age of 65, with 17.96% (compared to 13.83% in NSW and 13.32% in Australia). Also, the proportion of residents between the ages of 20 and 34 is significantly lower in Upper Lachlan, 11.5%, when compared to the state and national figures of 20.2% and 20.27%. This is indicative of young people moving away from rural areas, a common trend throughout Australia.

Figure 17-1 Age Structure (2006 Census)



	0-4	5-14	15-19	20-24	25-34	35-44	45-54	55-64	65-74	75-84	85+
Upper Lachlan SLA	5.44%	14.57	6.12%	3.13%	8.36%	13.96	14.90	15.52	10.76	5.66%	1.55%
South Eastern SD	5.97%	14.25	6.53%	4.67%	10.21	14.26	15.15	13.27	8.66%	5.39%	1.65%
New South Wales	6.42%	13.41	6.72%	6.59%	13.61	14.63	13.81	10.99	7.11%	5.02%	1.70%
Australia	6.35%	13.48	6.83%	6.79%	13.48	14.80	13.91	11.04	6.92%	4.77%	1.63%

Source: ABS Basic Community Profiles 2006, URS Analysis

17.2.2 Labour Force

In addition to the age structure discussed above, further analysis of the existing labour force situation is detailed in the following section.

Labour Force Status

The Upper Lachlan SLA has a labour force of 3,343 which is approximately 0.11% of NSW's total labour force. The Upper Lachlan SLA unemployment rate is 3.88%. This unemployment level is significantly lower than the state and national levels of 6.30% and 5.53% respectively. The unemployment rate in the projects greater region, South Eastern Statistical Division (SD), is 5.44%.

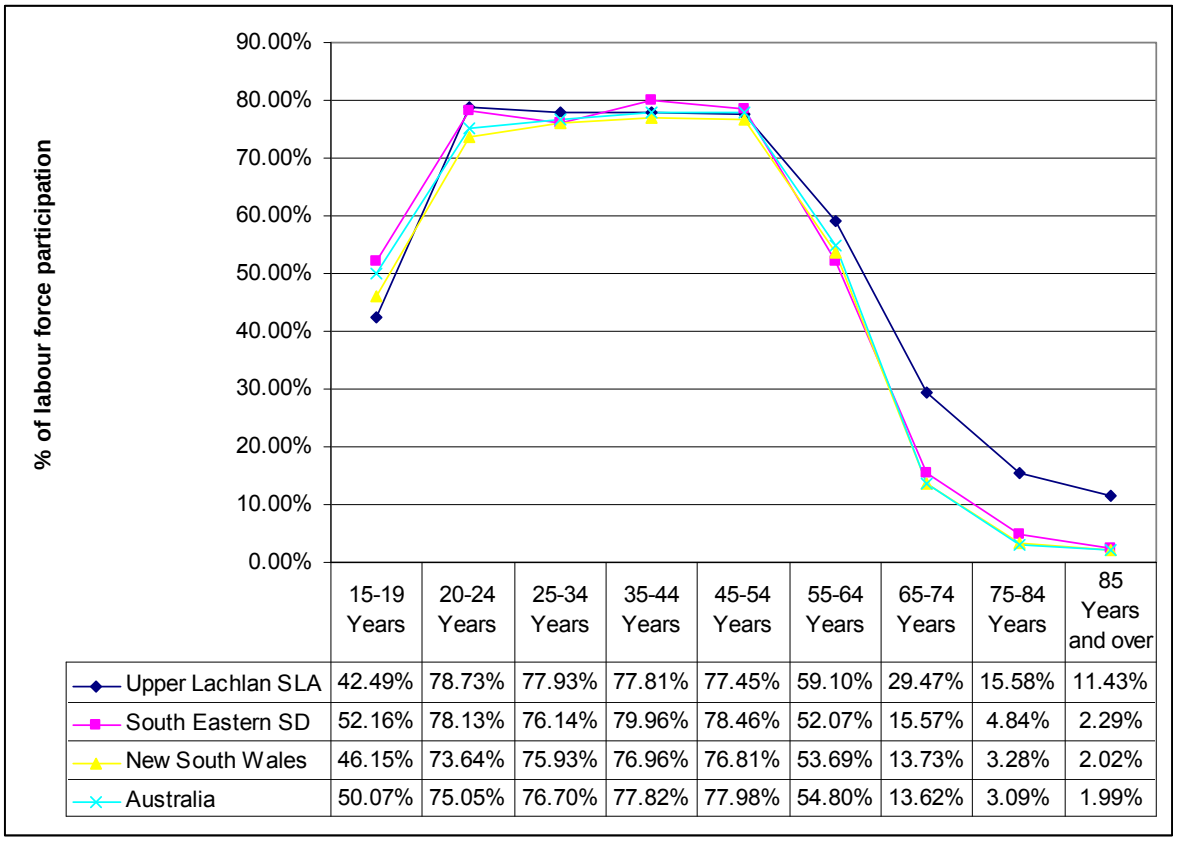
Table 17-2 Labour Force Status (2006 Census)

		Upper Lachlan SLA	South Eastern SD	New South Wales	Australia
Employed:	**Full-time**	2,091 54,53	5	1,879,628 5,827,4	33
	Part-Time	922 27,19	2	842,713	2,685,197
	Employed Away From Work	124	3,640 103,5	25 337,9	89
	Hours Of Work Not Stated	81 2,256		83,578	253,566
	Total	3,218 87,62	3	2,909,444 9,104,1	85
Unemployed, looking for:	**Full-time work**	81	3,132 115,1	65 310,5	81
	Part-Time work	44 1,634		67,994	193,221
	Total	125	4,766 183,1	59 503,8	02
	Unemployment Rate	3.88% 5.44%	6.30% 5.53%		
Total Labour Force		3,343 92,38	9	3,092,603 9,607,9	87

Source: ABS Basic Community Profiles 2006, URS Analysis

Figure 17-2 shows the proportion of labour force participation based on the age of residents in each of the assessed regions. This diagrammatic representation indicates that on a local, state and national basis the project areas follow a similar trend in terms of the proportion of each age group in the labour force. The Upper Lachlan SLA has a significantly larger proportion of 'post working age' participants in the labour force than the regions that encompass it.

Figure 17-2 Proportion of Labour Force Participation by Age (2006 Census)



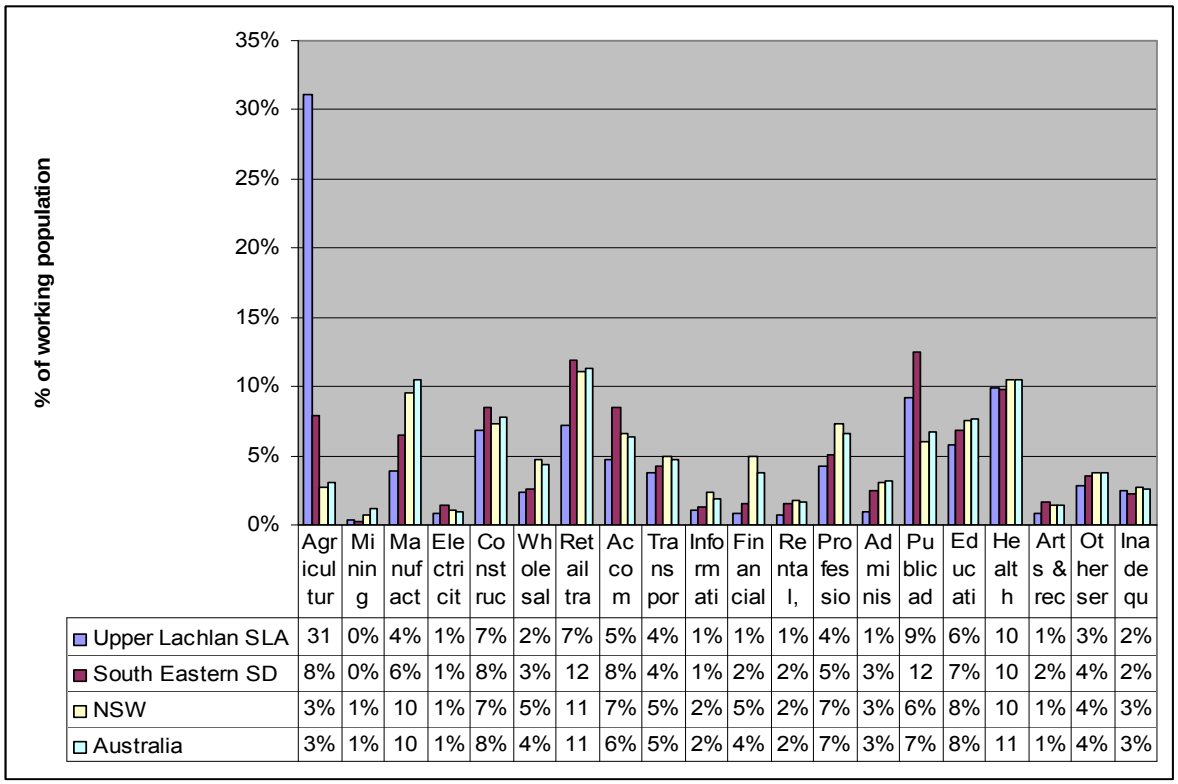
	15-19 Years	20-24 Years	25-34 Years	35-44 Years	45-54 Years	55-64 Years	65-74 Years	75-84 Years	85 Years and over
Upper Lachlan SLA	42.49%	78.73%	77.93%	77.81%	77.45%	59.10%	29.47%	15.58%	11.43%
South Eastern SD	52.16%	78.13%	76.14%	79.96%	78.46%	52.07%	15.57%	4.84%	2.29%
New South Wales	46.15%	73.64%	75.93%	76.96%	76.81%	53.69%	13.73%	3.28%	2.02%
Australia	50.07%	75.05%	76.70%	77.82%	77.98%	54.80%	13.62%	3.09%	1.99%

Source: ABS Basic Community Profiles 2006, URS Analysis

Industry Employment

The major industries in terms of the proportion of the working population employed in different industries are shown in **Figure 17-3** for Upper Lachlan SLA, South Eastern SD, NSW and Australia. The three major industries in the Upper Lachlan SLA are agriculture (31%), healthcare (10%) and public administration and safety (9%). A relatively high level of construction workers in both Upper Lachlan (7%) and the South Eastern SD (8%) could mean that labour for the construction phase of the Project could be sourced almost entirely from the local region. The three major industries in both NSW and Australia as a whole are Retail Trade, Health Care and Social Assistance and Manufacturing.

Figure 17-3 Industry of Employment (2006 Census)

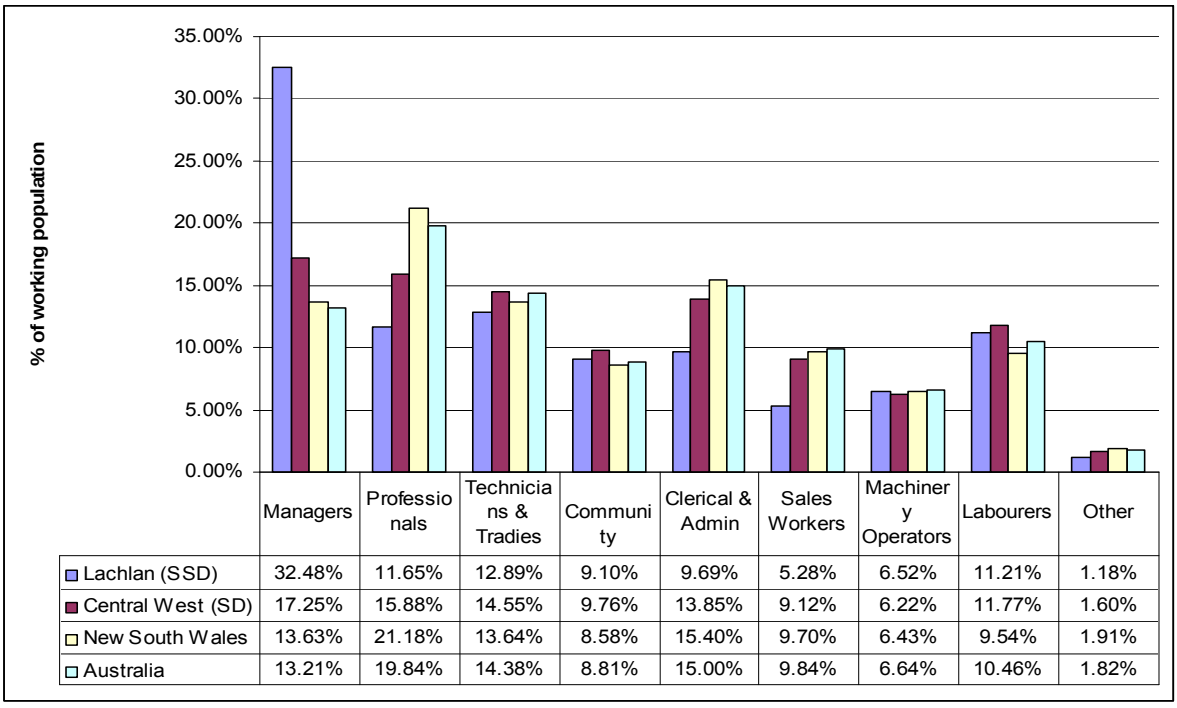


	Agriculture	Mining	Manufact	Electricit	Construc	Wholesal	Retail tra	Accom	Transpor	Informati	Financial	Rental,	Professio	Administ	Publicad	Educati	Health	Arts & rec	Other ser	Inadequ
Upper Lachlan SLA	31	0%	4%	1%	7%	2%	7%	5%	4%	1%	1%	1%	4%	1%	9%	6%	10	1%	3%	2%
South Eastern SD	8%	0%	6%	1%	8%	3%	12	8%	4%	1%	2%	2%	5%	3%	12	7%	10	2%	4%	2%
NSW	3%	1%	10	1%	7%	5%	11	7%	5%	2%	5%	2%	7%	3%	6%	8%	10	1%	4%	3%
Australia	3%	1%	10	1%	8%	4%	11	6%	5%	2%	4%	2%	7%	3%	7%	8%	11	1%	4%	3%

Source: ABS Basic Community Profiles 2006, URS Analysis

Further examination of the current labour force in the Project area is shown in **Figure 17-4**, which presents the proportion of the working population in a range of occupation categories. This figure indicates that in the Upper Lachlan SLA, the two major occupation categories are managers (32.48%), and technicians and trades workers (12.89%). There is a significantly higher proportion of managers than in NSW or nationally, reflecting the dominance of the agricultural sector within the Upper Lachlan SLA. The proportion of professionals is significantly less in the Upper Lachlan than in the wider region, NSW and Australia. In comparison to the local project area, NSW has a comparatively higher number of professional workers, which is likely to reflect the influence of Sydney as a capital city.

Figure 17-4 Occupation of Labour Force Participants (2006 Census)



	Managers	Professionals	Technicians & Tradies	Community	Clerical & Admin	Sales Workers	Machinery Operators	Labourers	Other
Lachlan (SSD)	32.48%	11.65%	12.89%	9.10%	9.69%	5.28%	6.52%	11.21%	1.18%
Central West (SD)	17.25%	15.88%	14.55%	9.76%	13.85%	9.12%	6.22%	11.77%	1.60%
New South Wales	13.63%	21.18%	13.64%	8.58%	15.40%	9.70%	6.43%	9.54%	1.91%
Australia	13.21%	19.84%	14.38%	8.81%	15.00%	9.84%	6.64%	10.46%	1.82%

Source: ABS Basic Community Profiles 2006 and URS Analysis

17.3 Social Impacts

This section presents the potential social impacts of the Project, with a particular emphasis on localised impacts. The main social impacts relating to the Project include impacts on local employment and environmental amenity.

17.3.1 Employment Impacts

The Project is to be completed in two stages, with each stage of construction taking approximately 24 months to complete and requiring up to approximately 250 construction workers. AGL would endeavour to source as much of this construction labour from the local region, in particular from Goulbourn, the largest major town within close proximity to the Project site. Once operational, the facility would require approximately 5-10 full time employees, and AGL would seek local workers to operate the Dalton facility wherever possible.

Table 17-3 Labour Requirements

	Construction Stage 1	Construction Stage 2	Operational Stage
Labour Requirements	**250**	**250**	**7**

As also discussed in **Section 16.8.1**, a high level assessment of employment impacts carried out for the Project has identified a relatively high proportion of construction workers in both the Upper Lachlan SLA and the South Eastern SD. It is reasonably assumed that construction labour requirements for both stages of the Dalton Power Project could easily be sourced from the local region.

Given the size and significant cost of the Project, sourcing local employees for the construction and operational phases of the Project would generate positive social impacts for the local Dalton population, as well as the wider population within the Upper Lachlan LGA as well as neighbouring council areas.

17.3.2 Localised Amenity Impacts

Localised amenity impacts, during the construction and operational phases of the Project, were been assessed individually and are discussed in detail throughout this Environmental Assessment. Specialist studies have been undertaken taking into account the Projects impacts on a number of key areas, including:

- traffic and transportation
- noise
- air quality; and
- visual impacts.

The results of these studies have indicated that while some impacts would be generated during the construction phase of the Project, these impacts can be effectively ameliorated and are short term in nature. Longer, operational impacts were also assessed, with the specialist studies finding that these impacts are acceptable in terms of overall local environmental amenity. AGL has gone through a thorough site selection process to ensure that the Project would result in minimum amenity impacts for the local population. Overall, amenity impacts resulting from the Project are considered to be acceptable and would not have an adverse impact on the local population.

17.4 Economic Impact Analysis

Economic impact analysis is typically carried out to determine the impact of a project on economic activity, employment and trade in both the private and public sector. Such studies are useful where the impact of a project needs to be quantified.

To broadly quantify the estimated economic impacts of the Dalton Power Project, the economic analysis that was undertaken on behalf of AGL for the recently approved Leafs Gully Power Project was used.

The Leafs Gully Project, while smaller than Dalton, is nevertheless comparable, as it provides a basis for demonstrating the overall economic benefits of a similar gas fired peaking facility, albeit with a maximum generating capacity of 300 MW. Despite this, the size of the Leafs Gully Power Project is similar in scale to the first stage of the Dalton Power Project. The overall economic benefits of the Leafs Gully Power Project are presented below.

Table 17-4 Economic Benefits - Leafs Gully Power Project

Economic Benefit	Amount ($)
Value added GDP effects during construction	50.9 million
Value added GDP effects during operation	29.7 million
Effects on household income during construction	15.8 million
Effects on household income during operation	0.7 million

The purpose of the economic analysis is to contribute to the overall socio economic assessment for the Dalton Project. The intention is to provide a broad quantification of estimated economic impacts. Accordingly, the economic benefits expected to arise from the DoPI approved Leafs Gully Power Project (as determined through a robust economic assessment) have been scaled to provide an approximate value of the likely benefits that may be expected from the Dalton Power Project.

17.5 Estimated Economic Impact of the Project

The Dalton Power Project would have an economic impact on the Australian economy in two phases, the construction phase and the on going operational phase. Economic impact is typically measured in terms of four key indicators. These include output, value added, household income and employment.

Stage 1 impacts depend on the how many turbines are constructed. Stage 1 may involve the construction of between two and four turbines with a total generating capacity between 250MW and 780MW. Estimated economic impacts for Stage 1 would comparable to Leafs Gully if only 250MW of generating capacity is provided, given that Leafs Gully had a total capacity of only 300MW. If Stage 1 results in 780MW of generating capacity being provided on site, the estimated economic impacts are outlined below.

Table 17-5 Estimated Economic Benefits - Dalton Power Project Stage 1

Economic Benefit	Amount ($)
Value added GDP effects during construction	152.7 million
Value added GDP effects during operation	89.1 million
Effects on household income during construction	47.4 million
Effects on household income during operation	2.1 million

Economic impacts for the entire Project, that is, up to 1500MW of generating capacity, are also outlined in the table below.

Table 17-6 Total Estimated Economic Benefits for the Dalton Power Project

Economic Benefit	Amount ($)
Value added GDP effects during construction	254.5 million
Value added GDP effects during operation	148.5 million
Effects on household income during construction	79 million
Effects on household income during operation	3.5 million

17.6 Summary of Economic Impacts

The estimated economic impacts for the Project show positive economic and social benefits at a national level in terms of contribution to GDP, income and employment resulting from the plant construction and operation. It is believed however, that a large proportion of the benefits from the Project would eventuate in the local or state regions. Some of the local impacts likely to be generated by the Project include:

- labour is likely to come from the Upper Lachlan and Goulburn-Mulwaree region, as the construction and manufacturing industries are both strong in terms of the proportion of the workforce employed in these industries, and the local region has a comparative advantage to the rest of NSW in the number of tradespersons working in the area; and
- the local population is not expected to be impacted by the Project as the employment numbers during operation are not significant.

17.7 Mitigation Measures

Where practicable, local contractors and supply companies would be utilised for the provision of labour and services during the construction phase and subsequent operation and maintenance of the plant.

The mitigation measures for social impact broadly relate to the mitigation measures detailed in this Environmental Assessment relating to the control of noise levels, air and water quality, traffic and transportation, visual amenity and other environmental matters. These measures are detailed in **Chapter 7** through **Chapter 18,** and would be implemented to ensure that the Dalton Power Project is managed in an effective and efficient manner, with minimal impact on existing surrounding land uses.

AGL has an active community engagement philosophy that involves support of particular community initiatives. Examples of this are:

- Project Pelican at the AGL owned and operated Torrens Island Power Station (TIPS). This project looks after and rehabilitates injured seabirds. This project has been ongoing for many years;
- Hallett community fund supporting community activities;
- AGL support of the Audax Alpine classic Cycle Ride;
- AGL Support for the Panda enclosure at the Adelaide Zoo;
- AGL support for the reburial of the Kaurna Aboriginal Ancestral Remains that had been held at the South Australian Museum in the Torrens Island Conservation Park; and
- AGL's Warmth in Winter program that support Homeless shelters by contributing to paying for some their winter heating bills.

AGL commits to examining potential involvement in community engagement initiatives within the local communities in which it would operate the Dalton Power Project.

Preliminary Hazard Analysis – Summary of Key Outcomes

The preliminary hazard analysis (PHA) assessment has been carried out in accordance with the Department of Planning's Hazardous Industry Planning Advisory Paper (HIPAP) No. 6 (*Guidelines for Hazard Analysis*) and HIPAP No. 4 (*Risk Criteria for Land Use Planning*). The main hazard associated with the proposed Project is associated with the handling of natural gas (predominantly composed of methane gas), which is a flammable gas held under pressure.

As the design of the power plant and associated gas supply pipeline is in the preliminary stage, detailed plant information was not available for review. In situations where such information could impact on the PHA, assumptions were made. These assumptions are intentionally conservative and have been stated in the assessment.

Despite the fact that many of the assumptions in the PHA are highly conservative, the results show that the risk associated with this development is very low. The most stringent risk criteria, as required by the Department of Planning, are adhered to.

The risk assessment carried out in this study assumed that the Facility would be operated with appropriate consideration to safety and safety management at all stages.

Chapter 18 Preliminary Hazard Analysis

18.1 Introduction

The Department of Planning's *Multi Level Risk Assessment Guidelines*, aim to provide a guide to the level of assessment necessary for an operation being studied. In accordance with these guidelines and as part of the Environmental Assessment, a quantitative Preliminary Hazard Assessment (PHA) was prepared for the Dalton Power Project. The following sections summarise the results of the PHA undertaken by Planager Risk Management Consulting for the proposed power plant. The full report is presented in **Appendix J**.

The assessment has been carried out in accordance with the Department of Planning's HIPAP No 6 (*Guidelines for Hazard Analysis*) and HIPAP No 4 (*Risk Criteria for Land Use Planning*). These documents describe the methodology and the criteria to be used in PHAs, as required by the Department of Planning for major "potentially hazardous" development.

In accordance with Department of Planning's HIPAP No. 3 *(Environmental Risk Impact Assessment Guidelines),* the safety assessment process would continue throughout the design, construction and commissioning of a potentially hazardous facility to refine and update the outcome of the development approval / environmental risk process.

18.2 Methodology

The objective of this PHA is to present the hazards and risks associated with the proposed peaking power plant and the lateral gas supply pipeline.

Through the evaluation of likelihood and consequence of the major hazards, the risks to the community associated with proposed power plant are estimated and compared to NSW Department of Planning risk criteria.

The process for PHA follows a number of steps which provide assurances that risks imposed by a development upon surrounding land uses would be within acceptable limits and that this would continue to be the case throughout the life of the development.

The aim of the PHA is to:

- identify and analyse the hazards and risks associated with all processes involved with the handling and transporting of potentially hazardous material which form part of the new development;
- assess the findings against the risk criteria currently in use by NSW Department of Planning; and
- identify opportunities for risk reduction, and make recommendations as appropriate.

The risk assessment has quantitatively determined the risk of fatality and injury to the public associated with the handling and processing of potentially hazardous material at the proposed development.

The PHA notes that there are five stages in risk assessment, each of which is described below.

- Stage 1 - Hazard Identification - The tasks involved in the hazard identification of the proposed facility included a review of all relevant data and information to highlight specific areas of potential concern and points of discussion, including drafting up of a preliminary hazard identification word diagram. The hazard identification word diagram is then reviewed and completed in a workshop which included people with operational, engineering and risk assessment expertise. The review takes into account both random and systematic errors, and gives emphasis not only to technical requirements, but also to the management of the safety activities and the competence of people involved in them.
- Stage 2 - Consequence and Effect Analysis - The consequences of identified hazards are assessed using current techniques for risk assessment. Well established and recognised correlations between exposure and effect on people are used to calculate impacts.
- Stage 3 - Frequency Analysis - For incidents with significant effects, whether on people, property or the biophysical environment, the incident frequency are estimated, based on historical data. A probabilistic approach to the failure of vessels and pipes is used to develop frequency data on potentially hazardous incidents.
- Stage 4 - Quantitative Risk Analysis - The combination of the probability of an outcome, such as injury or death, combined with the frequency of an event gives the risk from the event. In order to assess the merit of the proposal, it is necessary to calculate the risk at a number of locations so that the overall impact can be assessed.
- Stage 5 - Risk reduction - Where possible, risk reduction measures are identified throughout the course of the study in the form of recommendations.

Stage 4 (Quantitative Risk Analysis) calculates the risk for each incident according to:

Risk = Consequence x Frequency

Total risk is obtained by adding together the results from the risk calculations for each incident, i.e. the total risk is the sum of the risk calculated for each scenario.

The results of the risk analysis are presented in three forms discussed below.

Individual Fatality Risk

Individual Fatality Risk, is the likelihood (or frequency) of fatality to notional individuals at locations around the site, as a result of any of the postulated fire and explosion events. The units for individual risk are probability (of fatality) per million per year. Typically, the result of individual risk calculations is shown in the form of risk contours overlaid on a map of the development area. For pipelines (as for other transport activities), the individual risk contours are best represented as risk transects, showing the risk as a function of the distance from the pipeline.

Injury and irritation risk

Injury and irritation risk, i.e. the likelihood of injury to individuals at locations around the site as a result of the same scenarios used to calculate individual fatality risk.

Societal risk

Societal risk takes into account the number of people exposed to risk. Whereas individual risk is concerned with the risk of fatality to a (notional) person at a particular location (person 'most at risk', i.e. outdoors), societal risk considers the likelihood of actual fatalities among any of the people exposed to the hazard. Societal risk is presented as so called *f-N curves*, showing the frequency of events (f) resulting in N or more fatalities. To determine societal risk, it is necessary to quantify the population within each zone of risk surrounding a facility. By combining the risk results with the population data, a societal risk curve can be produced.

The risk results are assessed against the guidelines adopted by the NSW Department of Planning.

18.3 Risk Criteria

18.3.1 Individual Risk Criteria

The individual fatality risk is the probability of fatality to a person or a facility at a particular point. It is usually expressed as chances per million per year (pmpy). It is assumed that the person would be at the point of interest 24 hours per day for the whole year. By convention in NSW, no mitigation is allowed, i.e. any possible evasive action that could be taken by a person exposed to a hazardous event, e.g. by walking out of a toxic cloud or a heat radiation. The assessment of fatality, incident propagation and injury risk should include all components contributing to the total risk, i.e. fire and explosion.

The Department of Planning uses a set of guidelines on acceptable levels or individual risk which are in line with the criteria used elsewhere in the world. These guidelines are published in the HIPAP No. 4 (*Risk Criteria for Land Use Safety Planning)*.

18.3.2 Societal Risk Criteria

Societal risk is concerned with the potential for an incident to coincide in time and space with a human population. Societal risk takes into account the potential for an incident to cause multiple fatalities. Therefore, two components are relevant, namely:

- the number of people exposed in an incident; and
- the frequency of exposing a particular number of people.

The societal risk criteria specify levels of societal risk which must not be exceeded by a particular activity. The same criteria are currently used for existing and new developments. Two societal risk criteria are used, defining acceptable and unacceptable levels of risk due to a particular activity. The criteria are represented on the societal risk (f-N) curve as two parallel lines. Three zones are thus defined:

1) Above the unacceptable / intolerable limit the societal risk is not acceptable whatever the perceived benefits of the development.
2) The area between the unacceptable and the acceptable limits is known as the ALARP (as low as reasonably possible) region. Risk reduction may be required for potential incidents in this area.

3) Below the acceptable limit, the societal risk level is negligible regardless of the perceived value of the activity.

18.4 Potential for Hazard Incidents and Mitigation Measures

18.4.1 Summary of Hazard Identification Process

The main hazard associated with the proposed development is related to a leak of flammable natural gas.

This would generally only have the potential to cause injury or damage if there was ignition, which resulted in a fire or explosion incident. The factors involved are:

- failure must occur causing a release. There are several possible causes of failure, with the main ones being corrosion and damage to the equipment by external agencies;
- the released material must come into contact with a source of ignition. In some cases this may be heat or sparks generated by mechanical damage while in others, the possible ignition source could include non-flame proof equipment, vehicles, or flames some distance from the release;
- depending on the release conditions, including the mass of material involved and how rapidly it is ignited, the results may be a localised fire (for example a so called jet fire), a flash fire or an explosion of the vapour cloud formed through the release; and
- finally, for there to be a risk, people must be present within the harmful range (consequence distance) of the fire or explosion. How close the people are will determine whether any injuries or fatalities result.

Natural gas is a buoyant, flammable gas which is lighter than air (relative density of 0.6). On release into the open, the non-ignited gas tends to disperse rapidly at altitude. Ignition at the point of release is possible, in which case the gas would burn as a jet (or torch) flame. On release in an enclosed area (for example within the gas turbine housing) an explosion or a flash fire is possible.

The gas is non-toxic, posing only an asphyxiation hazard. Due to its buoyancy, any release of credible proportions from operations of this scale, in the open, would not present an asphyxiation hazard. With standard confined space entry procedures and appropriate security arrangements to prevent unauthorised access to any of the facilities the risk associated with asphyxiation from natural gas should be minimal.

Locally, the pressure of the compressed gas may be hazardous in case of an uncontrolled release. These hazards, while of importance for people working at the site, do not have implications beyond the immediate location of the release unless the released gas is ignited. Therefore, the risk associated with non-ignited compressed gas does not form part of the scope of the present risk assessment. This potential risk would however need to be closely managed through job safety analysis (JSA) and / or other risk assessment practices used by management and operators of the facility in accordance with NSW *Occupational Health and Safety Act 2000* and its associated regulations.

Other potential hazards are associated with the handling and use of diesel and other combustible liquids (i.e. the oils used for pumps, compressors, turbines etc.). Minor quantities of flammable acetone (used for cleaning) would also introduce a potential fire hazard.

Chapter 18 Preliminary Hazard Analysis

A total of 16 hazards were identified for the Project, as listed in **Table 18-1** below.

Table 18-1 Summary of Identified Hazards

Number	Hazardous Event Potential	Offsite Impact Potential
1	Leak of natural gas to atmosphere from gas pipes on-site (outside the turbine housing)	Yes
2	Operational error of the pipeline causes leak	Yes
3	Venting of gas from process	No
4	Explosion within piping or inside a vessel	No
5	Leak of natural gas to inside the turbine housing from damage to pipe, corrosion, sabotage, etc.	Yes
6	Leak of natural gas to inside the turbine housing due to projectile.	No
7	Release of carbon dioxide (or of other fire quenching material to be used for fire protection)	No
8	Loss of containment of flammable or combustible liquid (including diesel, oils and acetone)	No
9	Fire at transformers	No
10 F	looding	No
11 Earthqu	ake	No
12	Land subsidence due to mining activity	No
13	Aircraft crash on Power Station site	No
14	Terrorist activity or vandalism to natural gas installation	No
15	Transport of potentially hazardous material to the site (diesel, acetone)	No
16	Leak of natural gas from the gas supply pipelines	Yes

Table 18-1 above shows that 16 hazards were identified during the assessment. The PHA (refer to **Appendix J**) presents a hazard identification word diagram representing the hazardous incidents and their associated mitigating features. This assessment determined that 12 events had no potential for offsite effects. The remaining four hazards (natural gas leak from pipeline, leak from pipeline caused by operational error, leak of natural gas to inside the turbine housing, and leak of natural gas from the gas supply pipelines) were assessed in more detail. The detailed risk assessment is presented in **Appendix J**.

The Preliminary Hazard Analysis has considered that further assessment is not required to address fire as there are adequate design controls such as fire protection (fire extinguishers, hose reel requirements, separation distances etc) as per AS1940, design of ventilation of building as per AS1940 Section 4.4 with regards to flammable vapours, control of ignition sources as per AS1940 Section 9.7.6. Notwithstanding this, AGL commits to undertaking further assessment of:

- the impact of bushfires on the power station; and
- the bushfire ignition threats from the power station.

18.4.2 Risk Assessment

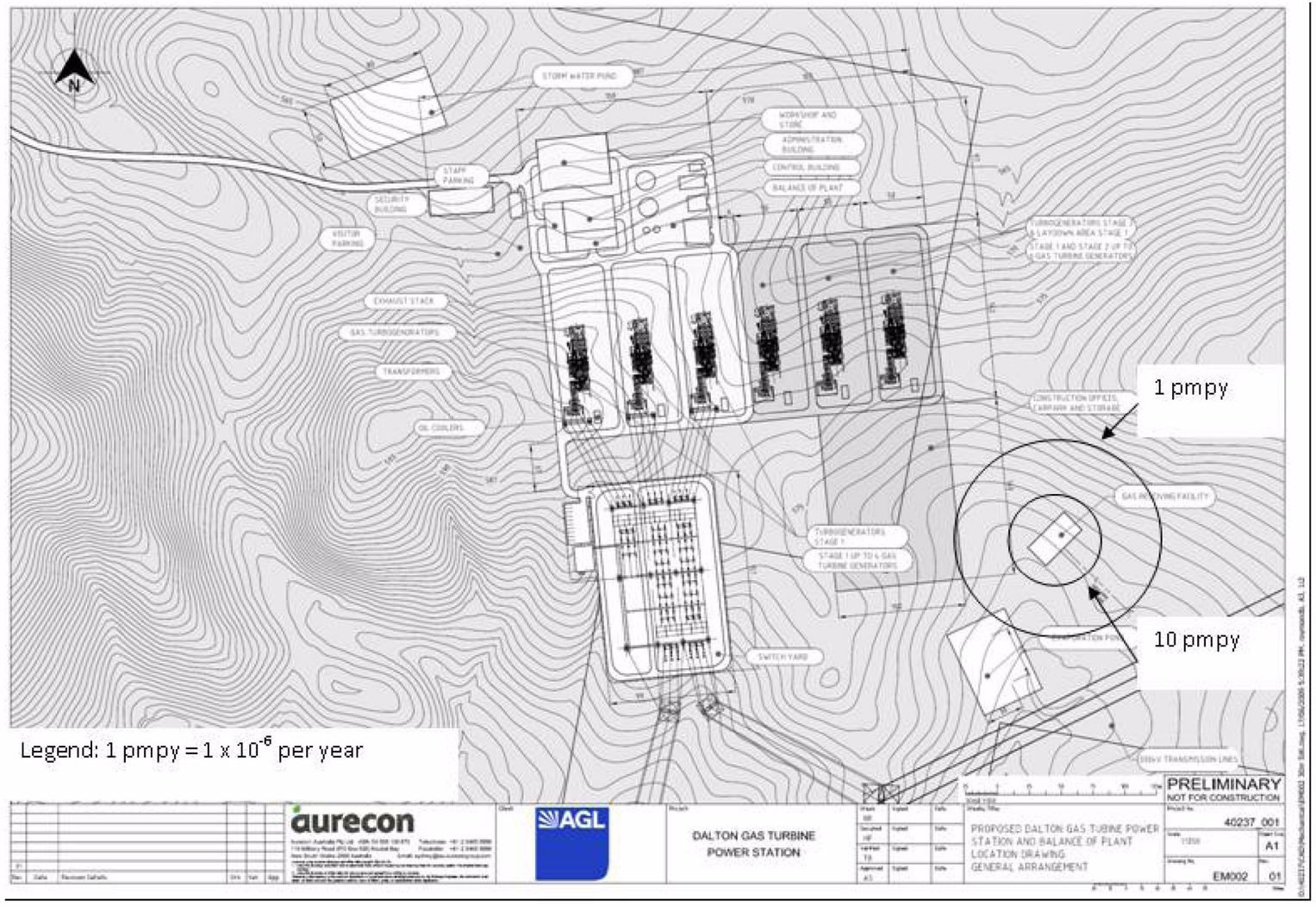
The risk assessment used the ISORIS computer software tool to determine the cumulative risk from all identified hazards. The tool calculates the leak rate for each identified incident type, using standard orifice flow equations for vapour or liquid, as appropriate. This program is designed to take consequence and frequency information and determine risk levels to individuals at all locations within a user-defined grid. Based on the modelling, risk contours can be determined drawn.

Natural Gas

Risk contours for the site are shown in **Figure 18-1**, which shows the individual fatality contours for risk associated with the Power Plant. Further to this, **Figure 18-2** presents a risk transect for individual fatality at the natural gas supply pipeline (from the off take at the Moomba to Sydney Gas Pipeline) up to the boundary of the Facility.

Fatality, injury and propagation risk contours are contained well away from surrounding residences. In this study the risk of fatality of 1 per million per year does not extend to surrounding residences. The concept of societal risk is therefore not applicable for the proposed development.

The individual risk of fatality associated with the gas supply pipeline is a maximum of 2 per million per year up to a distance of about 18 m from the centre line of the pipeline. The 1 per million per year risk contour, relevant for residential development, reaches up to a distance of 22 m from the centre line of the pipeline.



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Client

AGL

Project

DALTON POWER PROJECT

Title

INDIVIDUAL FATALITY RISK CONTOURS

Figure: **18-1**

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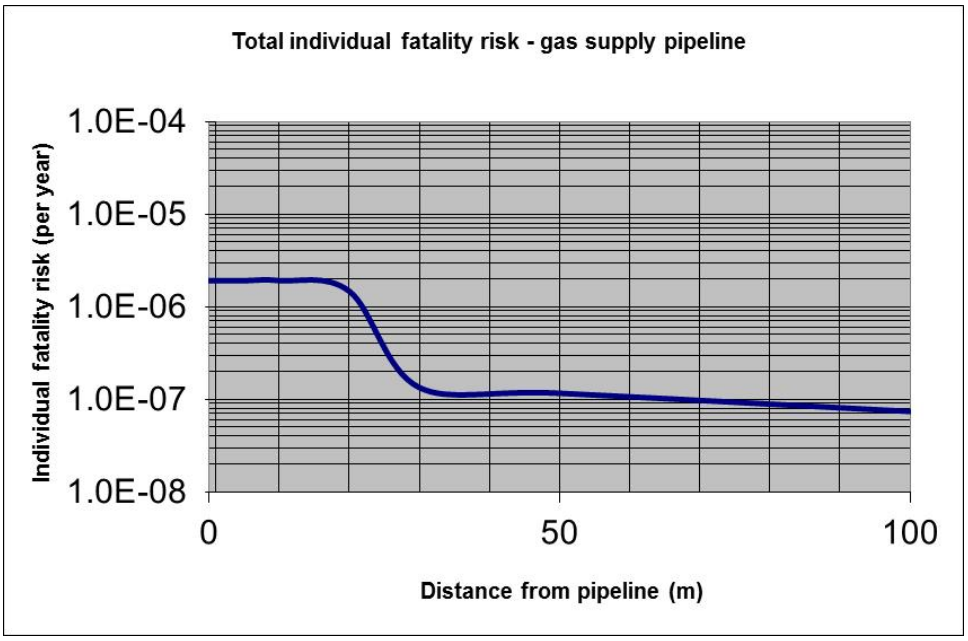
Figure 18-2 Individual Fatality Risk Transect for gas supply pipeline



Risk of Natural Gas Explosion in Turbine Housing

The likelihood of a confined explosion inside the turbine housing was estimated taking into account that the basis of safety would likely include:

- highly reliable ventilation fan system;
- gas detection linked to automatic emergency shut down system;
- prevention of ignition sources within the housing;
- explosion panel (to minimise effect of confinement) and fire quenching (e.g., carbon dioxide); and
- separation distances to nearby turbines and pressure piping.

With six turbines, the total frequency of explosion inside the turbine housing was determined as being very low.

A confined explosion may generate high over pressures which could damage neighbouring equipment and turbines. It is, however, understood that the housings would be designed with explosions vents (and / or panels) which would blow out in case of a pressure event, thereby reducing the effect of the confinement. Further, the turbines would be separated from each other by a buffer zone.

With proper design it is unlikely that an explosion at one turbine would have a serious effect a neighbouring turbine.

Transport Risk

Once the site has been built and is operational, the frequency of road transportation to the site of dangerous goods and potentially hazardous material would be minimal. It is expected that one delivery (up to a maximum of three deliveries) per year would be sufficient for the operation of the site, consisting of the occasional diesel and oil top up and possibly the transport of some other material used for maintenance or cleaning (e.g. acetone). Note that oil and diesel would be transported to the site in relatively small quantities. Diesel is used only occasionally in the stand-by emergency generator (in case of a power failure, diesel is the fuel for the generator used to run the UPS - *Uninterrupted Power Supply*). Oils are used to top up the gear boxes of the turbines, pumps, air compressors etc.

Road transportation would use Walshs Road and a purpose built access road up to the site. The access road to the site is to be of adequate construction for the use and to be maintained and repaired as required. General transport risks of these materials are handled by transport companies' internal safety requirements. Clean up and incident management would be as per the transport company's procedures.

The quantities and transport movement of potentially hazardous materials for this site are well below those listed in the *Transportation Screening Threshold* table as defined by the Department of Planning.

The review of road transport risks concludes that the risk associated with the transport of dangerous goods and potentially hazardous material to the site is negligible.

18.4.3 Risk Results

The quantitative analysis showed that:

- Individual Risk of Fatality: The risk of fatality at the nearest residential area is well below the criterion for new installations of one chance in a million per year (1×10^{-6}/yr). The 1×10^{-6}/yr individual fatality risk for the Facility is contained well within the site boundaries. It follows that the risk of fatality at the nearest open space and the nearest industrial area are also well below the criterion of ten and fifty chances per million years respectively (10×10^{-6}/yr and 50×10^{-6}/yr) and contained within side boundaries.
- It should however be noted that the maximum tolerable risk for residential developments is exceeded for a distance of 22 m of either side of the centreline of the gas supply pipeline for a pipeline designed to AS2885 requirements for rural development. The 1×10^{-6}/yr individual fatality risk for the gas supply pipeline does not extend into any residential areas.
- Injury Risk: The 50×10^{-6}/yr risk contour is contained within the site boundary. The risk of injury at the nearest residential area is well below the criterion for new installations of fifty chances per million years (50×10^{-6}/yr).
- Propagation Risk: The 50×10^{-6}/yr risk contour is contained within the site boundary. The risk of propagation of an incident at the power station does not encroach into any other industrial areas.
- Societal Risk: The risk of fatality does not extend anywhere close to any residential area and is well within the criteria for business / industrial areas. It is therefore considered that the current installation does not have a significant impact on societal risk.

- Transport Risk: The risk associated with transport of potentially hazardous materials is low for this development.

The detailed design has not been completed as yet for this development. A set of very conservative assumptions as to the design and operation of the plant have been made, including a 100 % on-line operation of the plant (as a worst case assumption, with appropriate fire proof isolation valves separating the plant from pressurised gas supplies).

Despite the conservatism built into the risk assessment, the results show that the risk associated with this development is very low. The most stringent risk criteria, as required by the Department of Planning, are adhered to.

The results show that the 1 x 10^{-6} per year individual risk contour does not extend beyond the site boundary for the power station.

This risk contour does extend by 22 m in either direction of the centreline of the pipeline, implying that future residential developments (if ever an option) would be restricted within this buffer.

18.5 Mitigating Measures

A summary of the mitigation measures in terms of hazard is provided **Table 18-2**.

Table 18-2 Summary of Hazard Mitigation Measures

Mitigation Measures	Implementation of mitigation measures		
	Design	Construction	Operation
Implement a safety management system for use at the site, specifically as it applies to the proposed hazardous materials handling, pipelining and storages.			✓
High and low pressures of the natural gas pipe are to be monitored during (and, if applicable, outside) operation of the Power Plant. These conditions would need to be associated with an automatic trip / shut down of the pipeline at the metering station in case of a major failure of the natural gas pipeline within the site boundary (as assumed in the PHA).			✓
Use of fusible tubing around high risk natural gas piping to be investigated – such tubing would be linked to automatic shut down of the fuel source.			✓
The detailed design of the turbine housing and associated equipments should clearly outline the safety measures used to ensure that explosive situations do not arise (the risk is rendered negligible). Reference should be made to European ATEX Directive and the UK HSE PM84 or other guidance / regulation of equivalent safety.	✓		
Fire protection inside the turbine housing to be determined, including use of explosion panels and use of fire retardant material where appropriate.	✓		
A system implemented to ensure that any removal of critical safety functions (e.g. for repair or exchange) is subject to careful scrutiny by plant management (decisions on whether to shut down plant or a turbine if a critical safety function is removed need to be canvassed).	✓		✓

Chapter 18 Preliminary Hazard Analysis

Mitigation Measures	Implementation of mitigation measures		
	Design	Construction	Operation
Rotating machines to be designed such that risk associated with projectile is minimised (gas pipelines protected or not in probable line of projectile, people protected etc.)	✓		
Loud alarm and visual indication (e.g. strobe light) to be installed within the turbine housing, alerting any persons within these housings of the pending discharge of asphyxiants and allowing escape.	✓		✓
Further assessment of the impact of bushfires on the power station and bushfire ignition threats from the power station.	✓		
A safety assessment process would continue throughout the design, construction and commissioning of a potentially hazardous facility to refine and update the outcome of the development approval / environmental risk process.	✓	✓	✓

Draft Statement of Commitments - Summary of Key Outcomes

The Draft Statement of Commitments has been prepared in accordance with section 75F (6) of the EP&A Act. The inclusion of appropriate environmental management measures into the detailed design and construction of the Project would minimise adverse impacts on the environment. The proposed adoption of the relevant measures identified in the Draft Statement of Commitments into a Construction Environmental Management Plan (CEMP) and Operation Environmental Management Plan (OEMP) would be an important component of the Project and reiterate the commitment of AGL and its contractors to mitigation of environmental impacts identified in this assessment.

The Draft Statement of Commitments describes the environmental management and monitoring to be undertaken during the construction and operation of the Dalton Power Project.

Chapter 19 Draft Statement of Commitments

19.1 Introduction

This chapter details the Draft Statement of Commitments in accordance with section 75F (6) of the EP&A Act. The inclusion of appropriate environmental management measures into the detailed design and construction of the project would minimise adverse impacts on the environment. The proposed adoption of the relevant measures identified in the Draft Statement of Commitments into a Construction Environmental Management Plan (CEMP) and Operation Environmental Management Plan (OEMP) would be an important component of the Project and reiterate the commitment of AGL and its contractors to mitigation of environmental impacts identified in this assessment.

The Draft Statement of Commitments describes the environmental management and monitoring to be undertaken during the construction and operation of the Dalton Power Project.

19.2 Environmental Management

19.2.1 Construction Environmental Management Plan

Environmental management during the construction phase of the proposed project would be undertaken in compliance with the requirements of a CEMP. The CEMP is an administrative tool outlining environmental management practises, safeguard measures to be implemented, timing of their implementation, and management and monitoring of the process and procedures. The CEMP must be adhered to during the construction of Dalton Power Project.

The key objectives of the CEMP would include:

- ensuring that works are carried out in accordance with appropriate environmental statutory requirements, the conditions of approval for the project, relevant guidelines and existing environmental management systems and procedures at the site;
- ensuring that works are carried out in accordance with the goals and requirements presented in the Environmental Assessment;
- ensuring that works are carried out in such a way as to minimise the likelihood of environmental degradation occurring;
- ensuring that works are carried out in such a way as to manage the impact of the works on neighbouring land uses;
- ensuring that all workers engaged in the works comply with the terms and conditions of the CEMP;
- providing clear procedures for management of environmental impact including corrective actions; and
- identifying management responsibilities and reporting requirements to demonstrate compliance with the CEMP.

The CEMP would serve as a working document to be used during the implementation of the proposal.

Generally the Construction EMP would include:

- establishment of environmental goals and objectives;
- conditions of project approval;
- lists of actions, timing and responsibilities;
- identification of areas of responsibility for environmental management of the Project;
- statutory requirements – licences and approvals required;
- a structured reporting system detailing all relevant matters on a regular basis;
- procedures and forms for documentation and reporting of issues;
- training obligations of personnel in relation to environmental awareness;
- guidelines for emergencies, contact names and corrective actions for non-conformance and notifications to appropriate authorities and affected parties;
- auditing requirements during implementation of the CEMP;
- review procedures and protocols for modification of the CEMP;
- definition of the complaint handling procedure;
- site management and control procedures; and
- monitori ng procedures.

Specifically, the CEMP would provide management actions in relation to:

- erosion and sediment control;
- surfa ce water management;
- waste generation and disposal;
- flora and fauna management;
- Aboriginal cultural heritage management;
- the control of atmospheric emissions;
- the control of construction traffic movements; and
- the control of noise emissions.

19.2.2 Operational Environmental Management Plan

An OEMP would be prepared for the proposed Project, and would address key ongoing monitoring requirements. The OEMP for the operational phase of the Project would include information on:

- the proposed maintenance and monitoring programs for the Project;
- responsibility for maintenance and monitoring;
- repo rting requirements;
- permits, approvals and consents issued under the approval process;
- community liaison requirements such as complaints registers and a 24-hour hotline;
- the appropriate standards and protocols for the necessary controls, monitoring and remediation measures;
- auditing procedures;
- response plans for contingency events;
- properly established operating procedures;
- requirements for environmental training and education for Project staff at all levels;
- definition of the proposed monitoring system for review of plans and establishing progress toward achieving objectives and goals;
- non-co mpliance handling procedures;
- environmental quality controls; and
- plant closure and rehabilitation plan.

19.3 Environmental Safeguards

A number of environmental safeguards and mitigations measures to prevent or minimise environmental impacts that may be generated by the construction and operation of the Dalton Power Project are discussed throughout this Environmental Assessment. These measures would be incorporated in both the OEMP and CEMP and implemented throughout the life of the Project.

Table 19-1 summarises these measures and sets out the timeframe for their implementation (i.e during the design, construction and/or operation phase).

Table 19-1 Summary of Mitigation Measures and Commitments

Item	Mitigation Measures / Commitments	Design	Construction	Operation
	General			
A1	The Proponent would carry out construction and operation in accordance with the: • Project Application; and Agreed Statement of Commitments.		✓	✓
A2	Monitoring would be undertaken in accordance with the Environmental Protection Licence.		✓	✓
	Environmental Management			
B1	The construction and operation would be undertaken in accordance with an Environmental Management System(s) (EMS) to the standard of ISO 14001 or equivalent.		✓	✓
B2	The EMS would provide an overarching system to achieve the environmental management objectives for the Project and address commitments in the statement. This would also include the Minister's Conditions of Approval and any environmental due diligence requirements identified by the Proponents and/or contractor.		✓	✓
B3	Prepare and implement: • a CEMP; and an OEMP. These would include the specific measures outlined in the following sections of this table.		✓	✓
B4	An Environmental Management Representative would be appointed for the construction stage of the proposed Project.		✓	
	Consultation			
C1	Consultation would continue with stakeholders during the planning, detailed design, construction and operation of the Project.	✓	✓	✓
C2	Adjoining landowners and the Dalton community would be notified when construction is likely to be initiated.		✓	
	Soils			
D1	Further geotechnical and groundwater assessments would undertaken to inform the detailed design.	✓		
D2	A Construction Soil and Water Management Plan would be developed and implemented for the construction works to ensure effective management of potential soil erosion issues.		✓	

Item	Mitigation Measures / Commitments	Design	Construction	Operation
D3	At a minimum the measures outlined in the *Managing Urban Stormwater – Vol 1 Soils and Construction* would be implemented. Measures may include: • limiting slope length, installation of sediment filters and the construction of a sedimentation basin downstream of the plant area.		✓	
D4	Construction would be planned to minimise the time that disturbed land is exposed.		✓	
D5	Disturbed areas would be quickly revegetated or covered with a non-erodable surface following construction.		✓	
D6	During the construction period water may be required for dust suppression.		✓	
D7	Discharge from the sedimentation pond would be through an appropriately designed dissipating structure to minimise soil erosion potential.			✓
D8	Appropriately bunded areas would be included for storage of fuels, oils and chemicals.		✓	✓
D9	Areas within the operational plant area would be appropriately drained so that surface runoff would be prevented from infiltrating directly onto the ground and from reaching the groundwater.			✓
	Air Quality			
E1	As part of the detailed design of the development, the assumptions and emission estimates used in this assessment would be reviewed and should the expected emission rates or stack details increase over the values used here, the modelling would be revised to ensure that OEH air quality standards and goals would be met through appropriate design.	✓		
E2	Liaise with CASA to address the issue of potential aviation hazard of the plant.	✓		
E3	Any emissions of dust particulates during construction would be specifically controlled through the implementation of mitigation measures, which would be incorporated into a Construction Environment Management Plan (CEMP).	✓	✓	

Item	Mitigation Measures / Commitments	Design	Construction	Operation
E4	The CEMP would consider the most appropriate dust mitigation method suited to the activity and circumstances. This may include: • watering, spraying or covering earthworks during excavation and handling and on exposed surfaces and stockpiles; • scheduling activities for more favourable meteorological conditions; • ceasing earthmoving activities when wind speeds exceed 30 km/hr; • covering or limiting truck soil loads; • reducing speed limits on unsealed surfaces; • cleaning soil off the undercarriage and wheels of trucks • any long-term soil stockpiles would be stabilised using measures such as fast seeding grass or synthetic cover spray.		✓	
E5	Monitoring of air emissions during operation would be undertaken in accordance with the Environment Protection Licence.			✓
	Greenhouse Gas			
	Install plant that achieves a thermal efficiency that is consistent with Best Available Technology (BAT) as defined in the Generator Efficiency Standards (AGO,2006).	✓	✓	
	Conduct efficiency audits in accordance with both AGL's internal directives, and regulatory requirements under the *Energy Efficiency Opportunities Act 2006* (EEO - as amended), conducting environmental audits to ensure that plant is being operated efficiently, and to identify opportunities to improve efficiency and reduce emissions intensity e.g.: • restoring the plant to design condition – e.g. replacing filters and removing fouling; • changing operational settings – e.g. ensuring control systems are operating correctly; • investigating and implementing retrofit improvements, and other mitigation options – e.g. turbine blades capable of withstanding higher combustion temperatures, CCS and waste heat brine concentration, where it is cost effective to do so.		✓	✓
	Landscape and Visual			
F1	Materials utilised in the construction of the power station and valve station would be generally dark in tone and where possible non reflective.	✓	✓	✓
F2	Lighting would avoid direct line of sight towards homesteads beyond the site.	✓	✓	✓

Chapter 19 Draft Statement of Commitments

Item	Mitigation Measures / Commitments	Design	Construction	Operation
F3	Top of the stacks would not have lighting unless required for aviation safety.	✓	✓	✓
F4	Large floodlights not to be used other than for emergency lighting.			✓
F5	Security lighting would not spill onto neighbouring residences. This would be achieved through the use of down lights and motion sensor lighting.			✓
	Traffic and Transportation			
G1	AGL would continue liaison with the relevant regulatory authorities about over-mass, over-dimension transport requirements throughout the detailed design phase.	✓		
G2	Once details are confirmed about widening and re-grading works required to facilitate the movement of over-mass, over-dimension vehicles, AGL commits to implementing or paying for temporary improvements, pending project approval.	✓	✓	
G3	Development of detailed Transport Plan (including obtaining approvals) for the transportation of turbine and tower components and equipment.	✓	✓	
G4	Development of detailed Traffic Management Plan for the construction phase.	✓		
G5	Undertake a detailed pavement and structure analysis on all affected sections of road prior to, and following construction. Provide Upper Lachlan Shire Council with a copy of the assessment.		✓	
G6	Undertake an analysis of the horizontal and vertical alignment to determine the adequacy of the affected public road network for all expect traffic types prior to construction. Provide Upper Lachlan Shire Council with a copy of the assessment.		✓	
G7	Development of a Traffic Management Plan for the operational phase if required.			✓
G8	Transport of over-mass and over- dimensional loads to be undertaken under RTA and NSW Police permit conditions and approved routes.		✓	
	Noise			
H1	A Construction Noise Management Plan is to be developed as part of the CEMP to confirm assumptions made in the assessment and to investigate reasonable and feasible noise mitigation measures if necessary.		✓	
H2	Carrying out all noisy construction works during the standard daytime construction hours.		✓	

Item	Mitigation Measures / Commitments	Design	Construction	Operation
H3	Scheduling construction to minimise multiple use of the noisiest equipment or plant items near noise sensitive receptors.		✓	
H4	Strategic positioning of plant items to reduce the noise emission to noise sensitive receptors, where possible.	✓	✓	
H5	Carrying out maintenance work away from noise sensitive receptors, where practicable.		✓	
H6	Ensuring engine covers are closed, maintenance of silencers and mechanical condition. Regular maintenance and noise testing for major items of construction equipment that are significant contributors to construction noise levels.		✓	
H7	Awareness training for staff and contractors in environmental noise issues including.		✓	
H8	Minimising the use of horn signals and maintaining to a low volume. Alternative methods of communication will be considered.		✓	
H9	Avoiding any unnecessary noise when carrying out manual operations and when operating plant.		✓	
H10	Switching off any equipment not in use for extended periods during construction work.		✓	
H11	Minimising heavy vehicles' entry to site and departure from site outside the nominated construction hours.	✓	✓	
H12	Where noise level exceedances cannot be avoided during construction, consideration will be given to applying time restrictions and/or providing quiet periods for nearby residents.		✓	
H13	Community consultation with local residents and building owners to assist in the alleviation of community concerns.		✓	
H14	Maintaining a suitable complaint register. Should noise complaints be received, undertake noise monitoring at the locations concerned. Reasonable and feasible measures would need to be implemented to reduce noise impacts.		✓	
H15	Noise emissions from the plant operation to be verified during commissioning stage to confirm assumptions made regarding noise attenuation and compliance with the project noise criteria.			✓
H16	The exhaust stack is required to be designed to comply with the INP requirements.	✓		✓
H17	AGL will commence discussions with receptors B, C and D regarding the low frequency noise assessment as consistent with other developments.	✓		

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Item	Mitigation Measures / Commitments	Design	Construction	Operation
	Flora and Fauna			
I1	A Flora and Fauna Management Plan (FFMP) would be developed and implemented as part of the CEMP and include measures for the minimisation or avoidance of impacts on threatened as well as common native flora and fauna.		✓	
I2	A Vegetation Clearing Strategy for the development footprint would be developed and implemented to ensure clearing only occurs where necessary.		✓	
I3	A Pre Clearing Survey Strategy would be developed and implemented to detail pre-clearance ecology surveys to be undertaken within all areas planned for vegetation clearance. Surveys would be carried out by qualified ecologists prior to all clearing activities. Surveys would target potentially present threatened flora and fauna and threatened fauna species habitat. OEH/SEWPaC would be consulted regarding requirements for further action.		✓	
I4	A Two-Stage Clearing Strategy would be developed and implemented for areas identified as containing habitat trees (trees with hollows and other habitat features such as nests, drays etc).		✓	
I5	A Habitat Replacement Strategy would be developed and implemented to provide effective delivery of replacement habitat in the adjoining proposed offset area in order to compensate for all EPBC Act vegetation habitat removed. AGL estimates that these works would require site establishment costs of around $15,000 for exclusion fencing, as well as an average cost of rehabilitation of around $24,000 per annum over a 20 year period. These costs are likely to be higher in the first 5 to 10 years than in the second 10 years of rehabilitation works.		✓	
I6	A Habitat Corridor and Connectivity Plan would be developed and implemented with the objective that any planned remediation works would aim to increase the value of the Site in regards to connectivity with other remnants in the landscape, through the revegetation of habitat corridors within the offset area.		✓	✓

Item	Mitigation Measures / Commitments	Design	Construction	Operation
I7	The Site Management Plan would include commitment to: • Maintain low vehicle speed limits on Site and in the surrounding locality to reduce fauna road fatalities; • Restrict all vehicular and personnel entry into retained vegetation through exclusion fencing, signage, locating access roads and paths to avoid habitat damage; • Educate workers as to the appearance and location of all threatened species and ecological communities as well as noxious weeds present or likely to be present within the Site, and mark their locations onto site plans; • Employ down-lights and motion sensor lighting in order to reduce light spill and the associated secondary impact on nocturnal fauna species potentially using the adjoining vegetation. All lighting will be directed inwards so as to minimise any spill outside the areas of activity; and • Areas identified for clearing will be clearly marked prior to construction using highly visible flagging tape or spray paint to prevent unnecessary clearing		✓	✓
I8	A Grazing Management Plan would be developed and implemented to exclude grazing by cattle and sheep to improve the habitat value and floristic diversity of retained vegetation.		✓	✓
I9	An Edge Effect Strategy would be developed to manage and reduce possible edge effects and fragmentation from the Project.		✓	✓
I10	All waterway crossings would be designed and constructed in accordance with the I&I NSW Policy and Guidelines for Fish Friendly Waterway Crossings and Why Do Fish Need to Cross the Road? (Fairfull, S. and Witheridge, 2003 and NSW DPI, 2004) and DWE's Guidelines for Controlled Activitied – Watercourse Crossings (DWE, February, 2008).	✓	✓	
I11	A Weed and Pest Management plan would be developed and implemented.		✓	✓
I12	A Complementary Planting and Rehabilitation Plan would be developed and implemented. This would include strategies to utilise plant species to replicate Box Gum Woodland and Natural Temperate Grassland floristic composition. Planting of local provenance seed, propagules, or saplings would be undertaken where possible and utilise best practice bush regeneration techniques.			✓

Item	Mitigation Measures / Commitments	Design	Construction	Operation
I13	AGL would implement a Biodiversity Offset Strategy (in consultation with OEH and SEWPaC) to compensate for clearing associated with the Project and in line with the requirements of the offsetting policies of those bodies to provide management the offset area for environmental purposes in perpetuity.			✓
I14	Golden Sun Moth surveys will be undertaken in Spring by a qualified biologist prior to determination.	✓		
	Heritage			
	Aboriginal Heritage			
J1	Where practicable, disturbance to Aboriginal archaeological sites D2, D3, D4, D5, D7 and DGP3 should be avoided. If impact is unavoidable, the artefacts should be collected or relocated away from the area of impact.	✓	✓	
J2	If impact to Aboriginal site D5 and potential archaeological deposits DPAD1 and DPAD2 cannot be avoided, then a program of archaeological subsurface testing should be conducted to ascertain the presence, extent and integrity of cultural material that may be present in these areas.	✓	✓	
J3	Where practicable, disturbance to Aboriginal archaeological sites DGP4, DGP5 and DGP6 will be avoided.	✓	✓	
J4	If sites DGP4, DGP5 and DGP6 are unavoidable, then the following management strategies are recommended: • the artefacts exposed at DGP5 would be collected and/or relocated away from the area of impact; and • a limited program of salvage excavation will be conducted at sites DGP4 and DGP6 with the aim of recording and analysing a larger and more representative sample of artefacts.		✓	
J5	The CEMP would be developed and implemented addressing heritage issues. The CEMP would detail management strategies for identified Aboriginal sites together with strategies to be followed in the event that an Aboriginal object is uncovered during construction.		✓	
	European Heritage			
K1	The CEMP would be developed and implemented addressing heritage issues including strategies to be followed in the event that a non Aboriginal archaeological relic is uncovered during construction.		✓	

Item	Mitigation Measures / Commitments	Design	Construction	Operation
	Socio-Economic			
L1	Where practicable, local contractors and supply companies would be utilised for the provision of labour and services during the construction phase and subsequent operation and maintenance of the plant.		✓	✓
L2	AGL commits to examining how to continue its active community engagement philosophy whereby AGL supports particular community initiatives.		✓	
	Water Management			
	Soil Erosion			
M1	All construction works would be undertaken in a manner to minimise the potential for soil erosion and sedimentation. Sediment and erosion control measures would be detailed in the CEMP.		✓	
M2	At a minimum the measures outlined in the *Managing Urban Stormwater – Vol 1 Soils and Construction* would be implemented. Measures may include: • limiting slope length, • installation of sediment filters, and • the construction of a sedimentation basin downstream of the plant area.		✓	
M3	Soil erosion and sedimentation devices would remain in place until the surface is restored. These devices would also capture any gross pollutants.		✓	
M4	Disturbed areas would be quickly revegetated or covered with a non-erodable surface following construction.		✓	
	Spills and site management			
M5	All possible pollutant materials would be stored well clear of site boundaries and stormwater drainage lines and stored in a designated covered area.		✓	✓
M6	Appropriately bunded areas would be included for storage of fuels, oils and chemicals.			✓
M7	Waste collection areas would be designated.	✓	✓	✓
M8	Waste disposal and collection would be undertaken in an appropriate manner.			✓
M9	All major vehicle and equipment maintenance would be undertaken offsite.		✓	✓
M10	Any vehicle washing on-site (if not restricted by Sydney Water from time to time) would be restricted to specific bunded areas.		✓	✓

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Item	Mitigation Measures / Commitments	Design	Construction	Operation
M11	Staff facilities would be provided, installed and maintained so that pollutants, including wash water are not conveyed from the site in stormwater.		✓	✓
M12	Water for dust suppression would be sourced from the existing dams on the site or imported if required.		✓	✓
	Surface water			
M13	Roof runoff would be reused at site and no contaminated effluent would be discharged into waterways.	✓		✓
M14	Water management strategies developed and implemented to maintain zero water discharge from the power plant site except for natural surface flows. Some wastewater may be tankered offsite for disposal at a licensed facility.	✓	✓	✓
M15	Water from the power plant site would be directed through a sedimentation pond designed to remove any oil and minimise suspended solids to an acceptable level prior to discharge from the Site. Process areas would also pass through an oil/sediment trap prior to entering the stormwater system.	✓		✓
M16	The outlet of the power plant site's stormwater system would be designed to maximize the dispersion of these high flows and spread the flow out over a wider area and thereby minimize their potential to cause soil erosion downstream.	✓		✓
	Wastewater Treatment			
M17	Blow down water and other process wastewater would be collected in evaporation ponds lined with a synthetic liner (such as high density polyethylene) and clay to minimise the risk of the saline waste water escaping into the natural groundwater system.	✓		✓
M18	Adequate pond freeboard would be provided to prevent overtopping eg by wave action.	✓		✓
M19	Waste solids, sludge/brine would be removed from site and disposed of by a licensed contractor		✓	✓
M20	Undertake hydrologic and hydraulic studies and implement mitigation measures if required to address local flooding.	✓		
M21	Domestic wastewater would be treated by a zero discharge proprietary treatment system or stored and disposed of offsite by a licensed contractor.	✓	✓	✓

Item	Mitigation Measures / Commitments	Design	Construction	Operation
M22	Following confirmation of water supply source(s) and arrangements during the detailed design of the water treatment system, the following would be investigated and implemented following a cost benefit analysis of the following: • Assessment and potential implementation of inlet filter (if any) backwash recycling system; • Maximising recovery of product water in any desalination systems; • Ensuring appropriate pretreatment prior to a deionisation plant to ensure minimal loss of efficiency due to poor feed water quality (physical fouling, ion-exchange resins 'poisoning' due to organics contamination, etc); • Assessment and potential recycling of the evaporative cooling system blowdown (side stream purification and return to the cooling water system or blending with the desalination/deionisation plant feed water possibly after filtration and/or other pretreatment); and • Assessment of a zero liquid discharge option whereby all wastewater streams are thermally desalinated to produce only a solid salt residue, with recovered distillate recycled. This would be an extension of a brine concentrator option, whereby a crystalliser or dryer would further treat a brine to recover solid salt.	✓		✓
M23	Further environmental assessment would be required should AGL seek to supply water to for the Project by water pipeline.	✓		✓
	Waste Management			
N1	All solid and liquid wastes would be contained on-site and where possible separated into recyclable and non-recyclable materials. All waste would be classified and disposed of by a licensed contractor in accordance with the *EPA's Environmental Guidelines: Assessment, Classification & Management of Liquid and Non-Liquid Wastes* (1999).		✓	✓
N2	Prepare Waste Management Plans as part of the CEMP and OEMP addressing the management of wastes during these stages.		✓	✓
	Preliminary Hazard Analysis			
O1	Implement a safety management system for use at the site, specifically as it applies to the proposed hazardous materials handling, pipelining and storages.			✓

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Item	Mitigation Measures / Commitments	Design	Construction	Operation
O2	High and low pressures of the natural gas pipe are to be monitored during (and, if applicable, outside) operation of the Power Plant. These conditions would need to be associated with an automatic trip / shut down of the pipeline at the metering station in case of a major failure of the natural gas pipeline within the site boundary (as assumed in the PHA).			✓
O3	Use of fusible tubing around high risk natural gas piping to be investigated – such tubing would be linked to automatic shut down of the fuel source.			✓
O4	The detailed design of the turbine housing and associated equipments will clearly outline the safety measures used to ensure that explosive situations do not arise (the risk is rendered negligible). Reference will be made to European ATEX Directive and the UK HSE PM84 or other guidance / regulation of equivalent safety.	✓		
O5	Fire protection inside the turbine housing to be determined, including use of explosion panels and use of fire retardant material where appropriate.	✓		
O6	A system implemented to ensure that any removal of critical safety functions (e.g. for repair or exchange) is subject to careful scrutiny by plant management (decisions on whether to shut down plant or a turbine if a critical safety function is removed need to be canvassed).	✓		✓
O7	Rotating machines to be designed such that risk associated with projectile is minimised (gas pipelines protected or not in probable line of projectile, people protected etc.)	✓		
O8	Loud alarm and visual indication (e.g. strobe light) to be installed within the turbine housing, alerting any persons within these housings of the pending discharge of asphyxiants and allowing escape.	✓		✓
O9	Further assessment of the impact of bushfires on the power station and bushfire ignition threats from the power station.	✓		
O10	A safety assessment process would continue throughout the design, construction and commissioning of a potentially hazardous facility to refine and update the outcome of the development approval / environmental risk process.	✓	✓	✓

20.1 Ecologically Sustainable Development

The *Environmental Planning and Assessment Regulation 2000* requires that an Environmental Assessment include:

> *"The reasons justifying the carrying out of the development or activity in the manner proposed having regard to biophysical, economic and social considerations and the principles of ecologically sustainable development."*

The principles of Ecologically Sustainable Development, as listed in the Regulation, are as follows:

> *"The precautionary principle - namely, that if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.*
>
> *Inter-generational equity - namely, that the present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations.*
>
> *Conservation of biological diversity and ecological integrity.*
>
> *Improved valuation and pricing of environmental resources."*

20.1.1 The Precautionary Principle

AGL's precautionary approach is demonstrated by the design and management controls to be implemented as part of the Project. The controls proposed specifically address the threat of serious or irreversible damage from:

- land use change;
- air emissions;
- noise emissions;
- surface water discharges;
- soil and groundwater contamination;
- impacts on flora and fauna;
- visual impacts;
- damage to cultural artefacts;
- wastewater disposal; and
- potential hazards.

Monitoring of these aspects would be carried out in accordance with regulatory and licence requirements. Through appropriate monitoring, the lack of full scientific certainty regarding any potential environmental impacts can be addressed and the precautionary principle appropriately applied. Where deviations from expected conditions are recorded, the matter would be investigated immediately and appropriate action taken as necessary, to prevent any adverse environmental impact as required by the Environmental Management Plans (Construction and Operation) for the proposed Project.

The Project would utilise modern technology with known consequences and effects. The technology proposed represents the best industry standard for modern power plants and is used throughout the world by the leading electricity generating companies.

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20.1.2 Inter-Generational Equity

The type of power plant proposed, has been designed to aid in the longevity and improved quality of the environment for future generations and thereby meet the principles of inter-generational equity in the following ways:

- the use of gas fired technology which has less environmental impacts than traditional coal fired technology, through the elimination of a need to mine, transport and store coal as a fuel source;
- the use of open cycle gas turbine technology which represents industry best practice, in meeting peak load demand; and
- throughout the lifespan of the proposed Project, opportunities to minimise resources and maximise recycling and reuse of materials would be continually identified. This would be effected through the implementation of a waste management policy and associated plan, which would influence the design and management of both the construction and operational phases.

20.1.3 Conservation of Biological Diversity and Maintenance of Ecological Integrity

The proposed Project, in combination with proposed mitigation measures and biodiversity offset strategy, has been assessed as meeting the maintain or improve benchmark for of relevant species and communities.

Two EECs were found to occur within the development footprint; *White Box – Yellow Box – Blakely's Red Gum Woodland* referred to as Box Gum Woodland, listed under the TSC Act and *Natural Temperate Grassland of the southern Tablelands of NSW and the ACT* referred to as Natural Temperate Grasslands, listed under the EPBC Act. The proposed works would involve the clearing of approximately 5.94 ha of Box Gum Woodland as listed under the TSC Act and 9.07 ha of Natural Temperate Grassland listed under the EPBC Act.

Surveys have determined that Commonwealth listed Box Gum Woodland would not be impacted by the Project. A revised Commonwealth Significant Impact Criteria assessment suggests that there would only be a significant impact on the EEC Natural Temperate Grassland.

The results of the NSW Assessments of Significance indicate that the Project has the potential to result in a significant impact to the TSC Act listed EEC Box Gum Woodland, but would not result in a significant impact to any other threatened species or populations listed under the TSC Act assessed within the Flora and Fauna Assessment.

Mitigation measures would be implemented during both the construction and operational phases of the Project to address and manage potential impacts. In addition to these measures, in order to offset the potential impact of the Project on Box Gum Woodland and Natural Temperate Grassland, AGL has proposed a biodiversity offset strategy to ensure the existing ecological integrity is maintained or improved.

Implementation of the offset strategy and mitigation measures would ensure that the overall biodiversity of the local area would be 'maintained or improved'.

20.1.4 Improved Valuation and Pricing of Environmental Resources

It is difficult to assign a monetary value to the environment of the locality, given the lack of precedence and guidelines in the valuation of environmental resources not considered for commercial use. The approach taken would be to manage any environmental impacts by identifying appropriate mitigation measures to minimise adverse environmental impacts and including the cost of these safeguards in the total project cost.

AGL would invest approximately $1.5 billion for the construction and commissioning of the Project. The cost of implementing these mitigation measures would be included in the overall cost of providing electricity to consumers hence improving the pricing of environmental resources. This approach would allow the value and price of environmental resource protection to be more accurately quantified.

20.2 Consistency with Objects of EP&A Act

An evaluation of the consistency of the Project with the objects of the EP&A Act is presented in **Table 20-1**.

Table 20-1 Consistency of the Project with objects of the EP&A Act

Object	Consistency of proposed Project with object
To encourage the proper management, development and conservation of natural and artificial resources, including agricultural land, natural areas, forests, minerals, water, cities, towns and villages for the purpose of promoting the social and economic welfare of the community and a better environment.	The use of natural gas for the Project results in efficient use of resources for electricity generation as electricity production with gas is at a lower greenhouse intensity than the NSW average. Natural gas is a clean burning fuel and has comparatively low greenhouse gas emissions. In terms of alternate power generation technologies, open cycle gas turbines present the best balance of outcomes between the imperatives of climate change mitigation and meeting peak electricity demand while managing the price of electricity for end use consumers. As part of this Project, AGL propose to offset the following: 77.57 ha of Box Gum Woodland within the AGL owned lands adjoining the development footprint, and 80.71 ha of Native Temperate Grassland and 24.97 ha of exotic pasture which has the potential if managed to become Natural Temperate Grassland within the AGL owned lands adjoining the development footprint. Full details of the proposed management regime for this offset would be included in a management plan that would be prepared in consultation with OEH and or SEWPAC. While the Facility can run without water during times of shortage or restriction, process water for the Project can be soured from a number of options. Water saving options would be considered to meet potential process water needs. The existing socio-economic conditions of the area along with the possible impacts of the proposed development have been examined qualitatively. The Project is expected to have positive economic and social impacts during both construction and operation phases with potential for a positive effect on the regional economy through contribution to GDP, income and employment.
To encourage the promotion and co-ordination of the orderly and economic use and development of land.	The development footprint of the proposed development traverses land zoned as RU2 Rural Landscape and RU1 Primary Production, where the proposed development is permissible with consent under the provisions of the Upper Lachlan LEP 2010..

Chapter 20 Conclusions

Object	Consistency of proposed Project with object
To encourage the protection, provision and co-ordination of communication and utility services.	The Project would contribute to the supply of electricity across NSW, which meets the object of providing utility services. AGL proposes to construct the electricity generating facility on one site, consisting of open cycle gas turbines. This type of generating system can supply electricity to the grid at short notice and is therefore well suited to providing electricity in peak demand periods. Gas turbines are known to be one of the most effective options to provide electricity for short term demand.
To encourage the provision of land for public purposes.	The Project would be used for the supply of electricity to the National Electricity Market.
To encourage the provision and co-ordination of community services and facilities.	The Project benefits broader community services through the supply of electricity to the state of NSW and the National Electricity Market.
To encourage the protection of the environment, including the protection and conservation of native animals and plants, including threatened species, populations and ecological communities, and their habitats.	As part of this Project, AGL has committed to conserving 77.58 ha of Box Gum Woodland within the AGL owned lands adjoining the development footprint, 80.71 ha of Native Temperate Grassland and 24.97 ha of exotic pasture that has the potential if managed appropriately to meet the criteria for recognition as the EEC Natural Temperate Grassland. The offset areas is within the AGL owned lands adjoining the development footprint (refer also to the response to object one above). This Environmental Assessment includes mitigation measures for reducing impact on native animals and plants as described in **Chapter 13**.
To encourage ecologically sustainable development.	Having regard to the Environmental Assessment findings and the principles of ESD, the justification for carrying out the development in the manner proposed is as follows: - environmental issues associated with the proposed development of the Project have been fully considered; - potential impacts identified are capable of being mitigated and the proposed development does not represent a threat of serious or irreversible environmental damage; and - biological diversity and ecological integrity of the area would not be affected by the proposed development.
To encourage the provision and maintenance of affordable housing.	Not applicable.
To promote the sharing of the responsibility for environmental planning between the different levels of government in the State.	Approval is being sought for this Project under Part 3A of the EP&A Act. Involvement of different levels of government in the State is being coordinated by the Department of Planning and Infrastructure.
To provide increased opportunity for public involvement and participation in environmental planning and assessment.	A consultation strategy was developed to initiate and maintain open communication with key stakeholders and to provide a forum to proactively respond and work with key community and key statutory and public authority stakeholders. AGL have committed to provide all relevant information to the community for their consideration and response. A consultation plan would be developed as part of the CEMP / OEMP to outline a coordinated, jointly managed consultation process for the Project.

20.3 Environmental Assessment Findings

A brief summary of the main findings of the Environmental Assessment is presented below. Detailed descriptions of each aspect are presented in the separate sections of the Environmental Assessment. Details of environmental management and monitoring techniques and the commitments made by AGL which would be implemented for the proposed Project are presented in **Chapter 19**.

20.3.1 Bio-physical Environment

The main findings of the biological and physical environment assessment are summarised below.

Air Quality

Modelling showed that the predicted impacts on ground level concentrations of NO_2, PM_{10}, CO and SO_2, when added to peak background concentrations, were within the OEH regulatory criteria. In addition, the predicted incremental concentrations of formaldehyde were found to be within OEH criteria.

The plume rise assessment showed that under the worst case scenario, the Obstacle Limitation Surface (OLS) may be exceeded during a significant proportion of the year. Whilst this assessment is considered conservative with respect to the modelled operating times and operating conditions, consideration should be given for the plant to be designated a hazard to aircraft operators in the area. Ongoing consultation with CASA is required to ensure aviation safety.

The greenhouse gas production from the Project was estimated to be in the range of 0.41-0.90% and 0.11-0.25% of the state and national inventories, respectively. In addition, emissions from the project were estimated to be in the range of 0.85-1.85% and 0.23-0.49% of stationary energy emissions from the state and national inventories, respectively.

Soils and Geology

At present the Development Site is unmined. In the past the area around Gunning has been mined for gold, however the last recorded mining activity was in 1956. Therefore it is deemed unlikely that mine subsidence would affect the site. However, Commissioners Gold hold an exploration permit over the area. No issues were raised by Commissioners Gold during consultation with them. The mitigation measures and safeguards would ensure that soils and groundwater are satisfactorily managed using suitable design, construction and management. Accordingly any impacts on soils and groundwater resulting from the construction and operation of the proposed Dalton Power Project are likely to be negligible.

Landscape and Visual

The Visual Assessment concluded that the Project would have a low visual impact on people in areas surrounding the Site. This is due to a combination of existing trees and natural landforms, views to the stacks being generally restricted to upper portions of the stack structures, views to the lower sections of the power plant and associated infrastructure mitigated by existing trees and local undulating landform. Distant views toward the communications tower are likely to be influenced by atmospheric conditions which will tend to reduce the visibility of the tower.

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Sympathetic colouring of power plant structures minimising the visual contrast between the power plant structures and, tree planting on the site and careful lighting design would further mitigate the visual impact of the proposal.

Traffic and transport

Access to the Site would be via a new access road to be developed from Walshs Road where the road takes a 90 degree turn to the west. The road would be built to comply with requirements for the purposes of constructing and operating the proposed power plant.

The traffic and transport assessment found that the arterial road network can satisfactorily and safely accept the additional traffic generated by the development during the construction, operational and maintenance phases.

Noise

The noise assessment on the whole has found that relevant noise criteria can be achieved with no further noise mitigation measures beyond those already proposed by AGL. Consequently, the impacts of the proposed construction and operation of the plant are not expected to degrade the existing acoustic environment nor create annoyance to the community surrounding the facility.

The noise assessment indicated that low frequency noise may exceed the INP Low Frequency Noise criteria at three residences. An alternative assessment of low frequency and tonal noise impacts undertaken in line with an alternative assessment model (the application of which is supported by international research), suggests that the predicted low frequency noise would not be at a level to cause annoyance to any residential receptors. Given the requirement however for assessment under the INP, AGL will commence discussions with receptors B, C and D regarding this assessment, with a view to reaching agreement with them on noise management for the project consistent with other developments.

Flora and Fauna

Two EECs were found to occur within the development footprint; *White Box – Yellow Box – Blakely's Red Gum Woodland* referred to as Box Gum Woodland, listed under the TSC Act and *Natural Temperate Grassland of the southern Tablelands of NSW and the ACT* referred to as Natural Temperate Grasslands, listed under the EPBC Act. The proposed works would involve the clearing of approximately 5.94 ha of Box Gum Woodland as listed under the TSC Act and 9.07 ha of Natural Temperate Grassland listed under the EPBC Act.

Surveys have determined that Commonwealth listed Box Gum Woodland would not be impacted by the Project. A revised Commonwealth Significant Impact Criteria assessment suggests that there would only be a significant impact on the EEC Natural Temperate Grassland.

The results of the NSW Assessments of Significance indicate that the Project has the potential to result in a significant impact to the TSC Act listed EEC Box Gum Woodland, but would not result in a significant impact to any other threatened species or populations listed under the TSC Act assessed within the Flora and Fauna Assessment.

However, mitigation measures would be implemented during both the construction and operational phases of the Project. In addition to these measures, in order to offset the potential impact of the

Project on Box Gum Woodland and Natural Temperate Grassland, AGL has proposed a biodiversity offset strategy to ensure the existing ecological integrity of the site is maintained or improved.

Water Management

While the proposed Facility can run without water during times of shortage or restriction, process water for the Project can be sourced through a number of options. Different water saving options has been considered to meet potential process water needs. Further investigations would be undertaken to confirm the final water supply arrangement.

The main water demand for the Facility is process water, for supply of gas turbine inlet air evaporative cooling and, if installed, high fogging systems. Deionised water is required for the high fogging demand, and deionised water or high quality (low salinity) potable water can be used to supply the evaporative coolers, A process water treatment plant would be expected to be required on site, regardless of the water supply source, although the level of complexity would change depending upon the source(s) water quality. A potable water supply would be required for domestic purpose, as well as a utility water supply for miscellaneous plant uses. Fire fighting water requires dedicated storage tanks. Landscaping water would be sourced from rainwater, although this may need to be supplemented during flora establishment. There would be provision on site for the delivery of bulk water via tanker trucks.

Process wastewater is generated at the Facility by the process of blow down from evaporative air inlet coolers and wastewater streams arising from process water pretreatment. The process water treatment plant would be designed to minimise the generation of wastewater following a cost benefit analysis.

Clean rainwater collected from the Facility catchment area would be directed to a sedimentation pond. The outlet of the stormwater system would be designed to maximize the dispersion of these high flows and thereby minimise their potential to cause soil erosion downstream.

Surface water from potentially impacted process areas and bunded areas would discharge to the sedimentation pond via a sediment and oil trap. Bunds would only be drained (manually) after confirmation that the contents are uncontaminated. In the event of contamination, the bund contents would be educted and transported offsite to a licensed disposal facility.

All construction works for the Project would be undertaken in a manner to minimise the potential for soil erosion and sedimentation. Wastewater volumes have been estimated and management strategies developed to maintain zero discharge from the site except for natural surface flows.

Heritage

The field survey for the power station identified that five sites (Dalton 2, Dalton 3, Dalton 4, Dalton 5, Dalton 7), and two areas of potential archaeological deposits (DPAD1 and DPAD2) would be directly impacted by the plant footprint.

One site, DGP4 is within the footprint of the gas pipeline and access road and would be directly impacted by the Project. Another site (DGP5) is within close proximity of the pipeline and access road footprint.

Chapter 20 Conclusions

Where possible, disturbance to Aboriginal archaeological sites would be avoided, however if impacts to the Aboriginal sites cannot be avoided, then the artifacts would be collected or relocated away from the area of impact.

No European sites were located as occurring within either the power station footprint, or within the gas pipeline easement area.

Land use and property impacts

Mitigation measures detailed in this Environmental Assessment relating to the control of noise levels, air and water quality, traffic and transportation, visual amenity and other environmental matters, would be implemented to ensure that the proposal is managed in an effective and efficient manner, with minimal impact on surrounding land uses during construction or operation.

Land use in the immediate surrounds of the Site is predominantly rural enterprises on medium size holdings and smaller rural home sites. Land within the AGL Site Boundary is zoned RU2 Rural Landscape, with parts of the Gas Pipeline (northern section) and Access Road, as well as the Gas Pipeline (southern section) zoned RU1 Primary Production. Zoning RU1 Primary Production and RU2 Rural Landscape, provide that “power generation” facilities are permissible with consent.

The Dalton Power Project falls within the definition of *“electricity generating works”* contained in the Upper Lachlan LEP 2010. Accordingly, the Dalton Power Project falls within the list of permissible uses of the zoning in the Upper Lachlan LEP 2010. The current zoning of surrounding areas permits activities such as agriculture, rural housing and open space.

Socio Economic

The analysis shows positive economic and social benefits at a national level in terms of contribution to Gross Domestic Product, income and employment resulting from the plant construction and operation. It is believed, that a large proportion of the benefits from the Project would eventuate in the local or state regions.

Preliminary Hazard Analysis

The results of the PHA show that the risk associated with this development is very low using mostly highly conservative assumptions. The most stringent risk criteria, as required by the Department of Planning, are adhered to.

20.4 Conclusion

Project Approval under Part 3A of the EP&A Act is being sought by AGL for the construction and operation of a gas fired power plant at Dalton near Gunning, NSW. The power plant would use natural gas as its primary fuel and have a total generating capacity of approximately 1500 MW.

The Dalton Power Project would be constructed over two stages, resulting in a maximum installation of six turbines with a nominal generating capacity of 1500 MW at the completion of both stages. The power plant would operate in open cycle mode during times of peak electricity demand and it is expected that the plant would be required to operate for up to 15 % of the year with any exceedances of this capacity to be approved by the relevant authorities.

Mitigation measures to ensure impacts to both the bio-physical and socio-cultural environment remain at an acceptable level throughout the planned lifespan of the proposed power plant have been factored in to the proposal in the following ways:

- proposed generation technology;
- specific power plant design and site layout; and
- adherence to Environmental Management Plans (EMP) including a Construction EMP and Operation EMP, which would dictate the specific environmental policies and management plans that the site would operate in accordance with.

The Environmental Assessment has been produced to ensure that the following regulatory and community requirements have been addressed:

- Environmental Planning and Assessment Act 1979;
- State Environmental Planning Policies and Regional Environmental Plans;
- specific requirements identified by the Department of Planning Director – General; and
- local residents and businesses.

Having regard to the Environmental Assessment findings and the principles of ESD, the reasons justifying the carrying out of the development in the manner proposed are as follows:

- environmental issues associated with the proposed development of the power plant have been fully considered;
- where modelling of impacts was carried out it was on the basis of the worst case scenario, considered cumulative impacts with other known facilities or major projects being considered in the same local government area, and utilised conservative assumptions; and
- potential impacts identified are capable of being mitigated and the proposed development does not represent a threat of serious or irreversible environmental damage; and

The Environmental Assessment provides a comprehensive assessment of the Project and includes investigations regarding all relevant environmental issues.

Potential adverse impacts have been assessed and strategies to avoid, minimise and mitigate those impacts form a key part of the Environmental Assessment. The Project includes a number of commitments to manage environmental impacts during its construction and operation.

This Environmental Assessment has highlighted a range of issues which would be addressed through the careful design and operation of the Project.

On the basis of the studies detailed within the Environmental Assessment, and with the implementation of the recommended mitigation measures, the Project is justified.

Study Team

AGL Energy Limited – Project Management Team

Neil Cooke	Manager, Power Development

URS Australia Pty Ltd – Environmental Assessment Study Team

Nicole Brewer	Project Manager
Kathryn Tinker	Project Consultant
Michael Chilcott	Principal in Charge

Specialist Studies

Air Quality Assessment and Plume Rise Assessment	James Grieve, Air Quality Engineer, URS Australia
Noise Impact Assessment	Arnold Cho, Associate Acoustic Engineer, URS Australia
Greenhouse Gas Assessment	James Grieve, Air Quality Engineer, URS Australia
Cultural Heritage Assessment	Navin Officer Heritage Consultants
Ecological Assessment	Kathryn Chesnut, Project Ecologist, URS Jane Webster, Associate Ecologist, URS Lauren Branson, Senior Ecologist, URS
Preliminary Hazard Assessment	Planager Pty Ltd
Transportation Impact Assessment	Nicole Vukic, Senior Traffic Engineer URS Australia Alex Iljin, Principal Traffic Engineer, URS Australia
Landscape and Visual Assessment	Green Bean Design Pty Ltd