NSW GOVERNMENT
Department of Planning

MAJOR PROJECT ASSESSMENT: Bamarang Gas-Fired Power Station, Bamarang

Director-General's
Environmental Assessment Report
Section 75I of the
Environmental Planning and Assessment Act 1979

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EXECUTIVE SUMMARY

Delta Electricity (the Proponent) proposes to construct a 300 megawatt open-cycle gas turbine facility, electricity transmission infrastructure and a gas pipeline which would connect the facility to the existing Eastern Gas pipeline. The gas turbine facility would operate as a peak-load power station by providing electricity at short notice during periods of peak demand. Stage 2 of the project would see the facility converted into a 400 megawatt combined cycle facility which would operate continuously and provide base load electricity to the grid. It is anticipated that the project (including stage 2 conversion to combined cycle) would cost $456 million and once operational would employ up to 8 staff as an open cycle facility with up to a further 10 people being employed as a combined cycle facility. Construction employment for the first stage of the project would peak at up to 150 jobs with a peak of up to 300 jobs expected for stage 2.

The site is described as Lot 1 DP 127482 located at 651 Yalwal Road, Bamarang and is the site of a disused abattoir. It is located approximately seven kilometres to the west of Nowra, approximately 160 kilometres south of Sydney. Land immediately surrounding the site consists of Bamarang Nature Reserve and Yalwal Road to the north, and bushland to the south, east and west. Bushland in most of these areas is largely undisturbed. Other land uses within the vicinity of the site and transmission line include the Bamarang Reservoir located to the east of the site, Triplarina Nature Reserve, public utilities and infrastructure such as the Eastern Gas Pipeline, a tourist/ accommodation facility, residential areas, farm land and an education facility. The nearest residential dwelling is situated approximately 750 meters to the north.

The Minister authorised the submission of a concept plan on 7 December 2005 pursuant to section 75M of the Act. This approach was sought by the Proponent because details of the water supply component of stage 2 of the project would not be known until detailed design for that stage had been completed. For this reason, the Proponent split the project into two distinct components for the purposes of concept approval assessment. The first component or stage is for the construction and operation of an open cycle gas turbine facility, including electricity transmission and gas supply infrastructure. The Proponent is seeking project approval for this component. The second stage is for the conversion of the open cycle facility into a combined cycle facility, including water supply infrastructure.

The potential environmental planning implications of the project are several due to the environmental impacts typically associated with electricity generation and the close proximity of the site to residential areas. Concern was primarily raised by the community in relation to air quality, noise, visual amenity and water supply for stage 2. The Proponent prepared a detailed Submissions Report to address each of these issues in turn and in the instance of noise, ecology, air quality and visual amenity impacts, the Proponent undertook additional studies to further demonstrate an acceptable level of environmental performance in these areas.

Key issues raised by Government agencies included potential adverse impacts on endangered and vulnerable species (Department of Environment and Conservation (DEC)) and potential air safety impacts (Commonwealth Department of Defence (DoD)). The DEC was concerned that the proposal would require the removal of some 12.8 hectares of potential habitat for threatened species as well as the clearing of Nowra Heath Myrtle individuals. Nowra Heath Myrtle is listed as endangered under both State and Commonwealth threatened species acts (TSC Act and EPBC Act) and is unique to the Nowra region. Both of these issues have since been resolved through discussions held between the Proponent and the DEC. The Department has recommended conditions that would require: a compensatory habitat package to be developed and implemented to offset the loss of 12.8 hectares of significant vegetation; and a series of measures to ensure the ongoing monitoring and management of the Nowra Heath Myrtle individuals, whilst specifically prohibiting their removal.

The DoD was concerned that the proposal would result in an aircraft hazard that may damage aircraft and/ or limit the operations of their nearby Navy airbase, the HMAS *Albatross*. The proposed site is situated within HMAS *Albatross* airspace and under Defence Regulations DoD controls the height of structures and the purposes for which they may be used within a 15 kilometre radius of the airfield. The air plume assessment conducted by the Proponent identified that an infringement into DoD airspace would occur and that this infringement would exceed air safety criteria. After discussions with DoD and additional modelling, the Proponent proposed design changes to minimise the infringement, however despite the proposed changes an infringement is still predicted and

therefore the potential for air hazards remains. The DoD, in acknowledging the importance of electricity generation to the State of New South Wales, has committed to modifying their flight documentation and operations accordingly such that aircraft would be alerted to the hazards associated with passing through the area affected by the power station exhaust plume. The Department has recommended conditions which would ensure that these arrangements are in place prior to the commencement of the commissioning phase of the project.

On balance, the Department considers that the proposed Bamarang Gas-Fired Power Station is a project that would be of benefit to the State of New South Wales. This is because the project would increase electricity supply during periods of peak use, plus, it would provide the Proponent (subject to further environmental impact assessment) the option to convert the facility to a combined cycle plant such that it could then assist in reducing predicted shortfalls in base load generation. It is the opinion of the Department that the environmental impacts identified by the Proponent and through Council, community and Government agency consultation can be effectively managed through the recommended conditions of approval.

Overall, the proposed Bamarang Gas-Fired Power Station project could be approved subject to the effective implementation of the Proponent's Statement of Commitments and the Department's recommended conditions of approval.

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1. BACKGROUND

Delta Electricity (the Proponent) proposes to construct and operate a gas-fired power station at Bamarang located approximately seven kilometres to the west of Nowra, approximately 160 kilometres south of Sydney. The site is located within the Shoalhaven local government area at 651 Yalwal Road and is Lot 1 DP127482 (Figure 1).

The gas-fired power station project consists of two stages. The first stage involves the construction and operation of an open cycle gas turbine facility, transmission line and natural gas pipeline. Stage two involves converting the open cycle facility to a combined cycle facility and requires the construction and operation of a water pipeline.

1.1 Existing Site

The site for the gas-fired power station is located on land currently owned by the Proponent. The land upon which the power station is proposed is zoned 1(d) Rural "D" (General Rural) in the *Shoalhaven Local Environmental Plan 1985.* The site was originally developed for the purposes of an abattoir. The abattoir was never operational and now a number of abandoned buildings are located on the site. Adjacent to these areas are undisturbed woodland areas to the east and north, with disturbed woodland also located immediately to the south.

The route for the transmission line lies largely outside the Proponent's site and consists of land zoned 1(d), 1(f) Rural "F" (Forest) Zone and 7(d1) (Environment Protection "D1" (Scenic) Zone) as well as unzoned land. The majority of the land to be used for the proposed transmission line would be within an existing transmission corridor and road easement (Yalwal Road). Some Crown and private land would also be affected. This land is currently woodland.

The route for the proposed pipeline is located on land zoned 1(d) and extends beyond the Proponent's site to connect with the Eastern Gas Pipeline. This land is also currently undisturbed woodland.

The route for the proposed water pipeline has not been identified as the water source for stage 2 has not been finalised. Land uses of the potential water pipeline would vary significantly depending on the final source selected.

1.2 Surrounding Land Use

The land immediately surrounding the site of the proposed facility consists of Bamarang Nature Reserve and Yalwal Road to the north, and bushland to the south, east and west. Yalwal Road connects the site to Nowra.

The nearest residential dwelling is approximately 750 metres to the north at a mudbrick manufacturing business. Other nearby residential dwellings consist of dwellings 1.25 kilometres to the north along Bamarang Road and rural residential dwellings located two kilometres to the east.

Other land uses within the vicinity of the site and transmission line include the Bamarang Reservoir located 350 metres to the east of the site, Triplarina Nature Reserve, public utilities and infrastructure such as the Eastern Gas Pipeline, a tourism / accommodation facility, farm land and an education facility.

Shoalhaven City Council has prepared and exhibited a draft structure plan for the Nowra-Bomaderry area. The draft plan indicates new living areas to the east of the proposed power station site between the site and the existing subdivision at Cabbage Tree Lane.

Figure 1 - Site Location (Reproduced from the Proponent's Environmental Assessment).

2. PROPOSED DEVELOPMENT

2.1 Project Description

The Proponent proposes to construct and operate a gas-fired power station. The project has been separated into two stages. Stage one consists of the construction and operation of an open cycle gas power station for peak demand power generation. Stage two involves the conversion of this plant into a combined cycle gas power station for base load power generation.

Stage one of the project would involve the construction and operation of an open cycle gas turbine plant consisting of two gas turbines capable of producing an approximate combined nominal output of 300 megawatts. This plant would only operate to generate peak electricity supply and for up to approximately 440 hours in any given twelve month period.

The turbine plant would generate electricity by the gas turbine drawing in cool air through a compressor where it would then be mixed with natural gas and injected at high pressure into a combustion chamber. The combustion reaction would then produce hot exhaust gases which would be used to drive an electrical generator, which in turn would produce electricity. The hot gases would then be vented to the atmosphere.

Further infrastructure proposed for stage one of the project includes the construction and operation of a natural gas pipeline and electricity transmission line. The gas pipeline would be located underground within a 10-metre easement connecting the facility to the Eastern Gas Pipeline located 600 metres to the east of the site.

The proposed electricity transmission line would connect the site to the Shoalhaven Terminal Station. It would consist of both aboveground and underground components. The aboveground component would run through an existing electricity transmission line corridor and along the Yalwal Road corridor, running underground east of Flat Rock Creek. The existing 11 kilovolt transmission line structures would be removed and this line would be attached to the proposed transmission line.

Stage two of the project consists of the conversion of the stage one plant to a combined cycle gas turbine configuration capable of generating an approximate nominal output of 400 megawatts. This plant would operate as a base load electricity generator providing constant electricity supply to the network. Stage two would see the open cycle facility converted to a combined cycle facility through the installation of two heat recovery steam generators and a steam turbine. The combined cycle facility takes advantage of the waste heat gases produced from the open cycle process, using the heat and additional water to produce steam which drives a generator, which in turn generates electricity.

Additional infrastructure associated with stage two would involve the construction and operation of a water treatment plant, water cooled condenser, cooling tower and a water supply pipeline. The water source, pipeline route and design are yet to be finalised. In the event that an adequate water supply is not able to be sourced, then an alternate cooling technology may be needed thereby significantly reducing the water demand of stage two operation.

Unlike stage one of the project, where full project approval to construct and operate the project is being sought, stage two of the project seeks concept approval only. This means that the Proponent would be required to seek full project approval for the stage two components at a later date, once detailed design and environmental information is available. Commencement of stage two would not occur until a separate project approval for stage two is granted by the Minister. A full description of the recommended nature of the approval for both stage one and stage two of this project is detailed in section 3.5 of this report.

2.2 Project Need

The purpose of the open cycle gas-fired power station is to provide additional electricity supply during periods of peak demand. The NSW Government discussion paper entitled *Energy Directions Green Paper* (2004) identifies the need for additional electricity supply, particularly in the supply of peak electricity demand. Peak electricity demand is growing at a rate of 4% per year and is expected to result in peak electricity shortfalls by 2008/09.

Peak demand typically occurs when a large number of users demand electricity at the same time, for example, when a large number of homes use air-conditioning during periods of high temperatures.

The *Energy Directions Green Paper* identifies peak energy demand plants such as gas-fired power stations to be a highly effective measure for meeting peak demand. This is because they have a relatively low capital cost, can be constructed in a relatively short time span, and have notable environmental benefits when compared with alternatives like coal fired generators.

The *Energy Directions Green Paper* also identifies a need for new base load generation capacity in 2012/13. The paper acknowledges that managing and meeting this demand will occur through a combination of measures which includes the construction of gas generation facilities. Conversion of the facility to a combined cycle gas fired power station in stage two would allow the facility to provide base load electricity and meet this anticipated electricity need. Base load generation requires continual operation and therefore requires high efficiency levels. In this respect, conversion to a combined cycle gas fired power facility provides the plant with the required efficiency level for base load generation.

While renewable energy sources and demand management measures are also identified as key measures for meeting this demand in the *Energy Directions Green Paper*, it is acknowledged that these approaches are more likely to have a role in future generation, as cost efficiencies are improved. In light of this, gas fired power generation is generally viewed to be a suitably efficient approach for meeting the immediate electricity generation needs.

3. STATUTORY CONTEXT

3.1 Major Project

The project is declared to be a Major Project under *State Environmental Planning Policy (Major Projects) 2005* because it is development for the purpose of an electricity generation facility for gas fired generation that has a capital investment value of more than $30 million (clause 24(a)). The project will therefore be assessed and determined by the Minister for Planning under Part 3A of the *Environmental Planning and Assessment Act 1979*.

3.2 Permissibility

The site for the gas-fired power station is located within land currently owned by the Proponent. The land upon which power station is proposed is zoned 1(d) Rural "D" (General Rural) in the *Shoalhaven Local Environmental Plan 1985* (Shoalhaven LEP). The proposed facility is an innominate permissible use in the zone.

The route for the proposed transmission line consists of land zoned 1(d), 1(f) Rural "F" (Forest) Zone and 7(d1) (Environment Protection "D1" (Scenic) Zone) as well as unzoned land. Utility installations are permissible with consent in zones 1(f) and 7(d1). Irrespective of this, clause 54D of the LEP permits the carrying out of development by a public authority for the purpose of electricity transmission lines or public utility undertakings. The transmission line is therefore permissible without development consent.

The route for the proposed gas pipeline is located on land zoned 1(d), in which it is an innominate permissible use.

3.3 Environmental Planning Instruments

There are no environmental planning instruments that substantially govern the carrying out of the proposal. The Department highlights that other than in relation to zoning and permissibility, the *Shoalhaven Local Environmental Plan 1985* includes no particular provisions that substantially relate to the proposal.

3.4 Minister's Approval Power

The application and environmental assessment were placed on public exhibition from 19 May 2006 to 19 June 2006 and submissions invited in accordance with Section 75H of the Act. The Department has met all its legal obligations so that the Minister can make a determination regarding the project.

It is also noted that the Environmental Assessment submitted in support of the subject application adequately addresses the Director-General's requirements.

3.5 Nature of the Recommended Approval

On application from the Proponent, the Minister has authorised the submission of a concept plan for the project. At the time of making this decision, the Proponent was considering a number of possible routes for the gas pipeline and transmission infrastructure. Secondly, the Proponent did not have the necessary detailed design information to determine exact wastewater quantities or water supply locations for stage two of the proposal. Hence, there was an insufficient level of detail to enable a full project approval (as opposed to a concept approval) to be granted for some aspects of the development.

Since that time, the Proponent has managed to complete a detailed environmental impact assessment of the proposed open cycle gas fired power station (stage 1), including defined routes for both the natural gas pipeline and the transmission line. This information was included in the Environmental Assessment submitted in support of the application. The Department considers that the Proponent has provided sufficient information such that an adequate level of assessment of stage one of the project could be undertaken, and consequently recommends that the Minister form the view that no further environmental assessment of the work proposed in stage one is necessary.

The Department, on review of the information included in the Environmental Assessment of the proposal is of the opinion that further information and assessment is required in relation to stage two of the project. In this instance,

it is recommended that further assessment be undertaken under Part 3A of the Act because the outstanding issues such as water supply and possible water pipeline routes relate to matters of State or regional environmental planning significance and therefore require further Ministerial involvement in the assessment and approval process. In particular, the Department considers that issues of State or regional environmental planning significance arise with respect to: demand for base load electricity generation; impacts on listed endangered ecological communities; and the significance of water management and conservation.

The Department therefore recommends that the Minister exercise his power under the *Environmental Planning and Assessment Act 1979* to:

1. grant concept approval to the proposal in its entirety;
2. grant project approval for stage one of the project; and
3. require further assessment and approval of stage two of the project under Part 3A.

To reflect this approach, the Department has drafted two recommended instruments of approval. An instrument of concept approval has been created which grants approval to the proposal in its entirety and describes the subsequent assessment and approval requirements for stage two of the proposal.

An instrument of project approval has also been created. This instrument grants full project approval to stage one of the project and details conditions that establish stringent environmental standards, mitigation measures, environmental controls and monitoring requirements for the facility.

4. CONSULTATION AND ISSUES RAISED

4.1 Introduction

The Department received 78 submissions during the exhibition of the application. Of these, 61 or 78.2% were a form-type submission that listed identical issues (visual amenity, land use conflicts) and stated objection to the proposal. A further 17 unique submissions were received from the public, organisations and Government agencies. In total, 65 or 83.3 % of submissions objected to the proposal. Consideration of the issues identified in submissions and assessment of the environmental impacts of this proposal are provided in section 5 of this report.

4.2 Submissions from the Public, Private Companies and Organisations

A total of 11 unique submissions were received from the public, organisations and private companies. Of these submissions, four or 36.4 % objected to the proposal with the remaining submissions stating concerns without express objection to the proposal. The key issues identified in submissions from organisations and the public included:

1. Visual amenity impacts
   - power station will give the area an industrial landscape;
   - building height and plume height will decrease local visual amenity; and
   - light pollution from the facility at night will decrease visual amenity in the local area.

2. Land-use conflicts
   - will decrease land value;
   - adversely impact on local tourism;
   - increases hazard (gas explosion risk) to nearby residents;
   - inadequate assessment of future land use impacts in area earmarked for future residential development; and
   - facility is more suited for an industrial or urban area.

3. Air quality impacts
   - seeking confirmation of composition of emissions and effects on local water quality;
   - will result in adverse health impact on local plants, animals and residents;
   - if design changes proposed how will this affect air pollutant levels; and
   - inadequate air quality modelling and analysis.

4. Noise impacts
   - noise generated will have a negative impact on local residents and business, especially holiday retreat style businesses;
   - noise emission limits must comply with noise standards;
   - inadequate noise modelling, needs to be undertaken at certain locations and distances; and
   - project needs regular noise monitoring.

5. Bushfire hazards
   - impact of bushfires on the facility and the potential for a significant incident to occur;
   - mitigation measures to be used to manage bushfires;
   - site access during bushfires; and
   - personnel responsibilities in relation to bushfires.

6. Water impacts
   - insufficient consideration given to water sourcing for stage two as water requirements are not feasible;
   - if water sourced from Bamarang Reservoir a plant incident could result in reservoir (drinking water) contamination;

- measurements of groundwater flow needs to be undertaken as there may be potential impacts on Bamarang Reservoir, especially in instances where the groundwater table may rise near the site; and
- water extraction from the Shoalhaven River may seriously impact on local water supply.

4.3 Submissions from Government

Five submissions were received from Government agencies: the Department of Environment and Conservation; Department of Natural Resources; Commonwealth Department of Defence; NSW Rural Fire Service; and the Commonwealth Civil Aviation Safety Authority. None of the agencies objected to the proposal, but raised a number of key issues for further consideration. Issues identified included: air quality impacts; flora and fauna impacts; water sourcing and consumption; land-use conflicts; and bushfire management. Comments made by each agency are summarised below.

Department of Environment and Conservation (DEC)

- ensure plant is a peak-load facility only, limited to 440 hours operation per year;
- ensure natural gas is the only fuel source;
- pollutant impacts appear to be unlikely to occur at sensitive receptors;
- flora and fauna mitigation measures not adequate, Proponent to conduct further assessment and a more thorough consideration of mitigation measures as part of the Proponent's Submission Report;
- supports noise assessment and concurs with noise limits;
- supports recommendations of the aboriginal cultural heritage assessment;
- invites further discussions with the DEC regarding habitat off-sets; and
- seeks further confirmation regarding impact of transmission line on National Parks in the local area.

Department of Natural Resources (DNR)

- require further assessment of potential adverse land-use impacts, specifically in relation to future residential requirements. This should be addressed as part of the Proponent's Submission Report;
- there are potential impacts on adjacent riparian corridors;
- supports proposal to use recycled water; and
- points for consideration when undertaking future detailed water supply investigations.

Commonwealth Department of Defence (DoD)

- air plume impact assessment does not adequately quantify the potential risk to aircraft active in the area. Further assessment of the air plume impact should be conducted as part of the Proponent's Submission Report.

NSW Rural Fire Service

- supports the findings and recommendations of the Bushfire Risk Assessment in the Environmental Assessment.

Civil Aviation Safety Authority (CASA)

- site falls within Commonwealth Department of Defence aerodrome area and therefore lies outside CASA's area of control.

4.4 Submissions from Local Government

Two submissions were received from Shoalhaven City Council, with neither expressly stating support nor objection to the proposal. Council did, however, raise a number of matters that it considered should be carefully considered as part of the assessment of the proposal. The key matters are as follows:

1. Future land use impacts
   - proposal situated close to proposed long term new living areas; and
   - impacts on new living areas not assessed.

2. Section 94 contributions
   - Proponent needs to discuss with Council contributions towards local infrastructure.

3. Traffic and access impacts
   - management of construction traffic;
   - site access; and
   - impacts on local road network / infrastructure.

4. Ecological impacts
   - surveying conducted is insufficient and not conducted at the ideal time;
   - detailed additional surveying techniques to be included as part of the studies for the Submissions Report; and
   - mitigation measures outlined need inclusion in development consent.

5. Water impacts
   - further assessment of proposed water sources, requiring detailed information; and
   - impacts on local potable water quality not discussed.

4.5 Submissions Report

On review of the issues identified in submissions, the Department required the Proponent to prepare a Submissions Report to address each of the issues raised in those submissions. As part of this process, the Proponent conducted additional air, ecology, noise and visual amenity impact assessments. Further discussion was also held with the DEC in relation to the provision of habitat off-sets.

The Submissions Report was submitted to the Department and provided to the Department, DEC, Commonwealth Department of Defence and DNR for consideration and comment. Comment was received from these agencies and this has been summarised below.

The Submissions Report contained a detailed response to submission issues and the findings and recommendations of the additional impact assessments. Some minor changes to the Statement of Commitments were made to more thoroughly address issues raised by the DEC. The revised Statement of Commitments is attached to this report as Appendix C.

Additional Air Impact Studies (Plume Assessment)

The additional air assessment was conducted to specifically examine the potential hazard that exhaust fumes from the facility may create for aviation within the region. The assessment compared worst case plume rise as well as the heights and frequency of exceedance of the critical vertical velocity for both stage 1 and stage 2 plumes. Results predicted the maximum plume height (where the vertical velocity reduces to 4.3 ms^{-1}) for stage 1 would be 1040 metres above ground level and 388 metres above ground level for stage 2. The minimum and average plume height at which the average plume vertical velocity would exceed the critical vertical velocity was found to be 63 metres and 112 metres respectively for stage 1 and 53 metres and 70 metres respectively for stage 2. Noting these results, the assessment supported the conclusion presented in the Environmental Assessment – that while exceedances were predicted, the combined probability of an aircraft flying within the plume influence area and of the vertical velocity being greater than that permitted would be sufficiently minimal so as to not represent a potential hazard to aviation.

The assessment recommended a third party aviation expert undertake analysis to determine the likelihood of aircraft flying through the plume influence area within the range of heights that would be potentially affected by the plume. This would then be combined with the probability of plume exceedance of the critical vertical velocity to determine whether the potential hazard is acceptable in terms of CASA risk criterion.

Additional Ecology Impact Studies

The additional ecological impact studies involved further field surveys (including a targeted survey for the Giant Burrowing Frog); mapping of potential habitat; mammal trapping (including stagwatching and spotlighting); hollow-bearing tree counts; and aquatic habitat assessment.

The assessment concluded that potential habitat for ground dwelling mammals would need to be removed for the proposal. The assessment suggested that because this clearing is predominantly on the edge of more extensive bushland areas, species would be able to relocate. It was argued in the report that while some family groups may be lost, it is unlikely that this would put the local population at risk of extinction.

Loss of hollow-bearing trees under the worst-case vegetation clearing scenario would involve the removal of approximately 15 hollow-bearing trees (33% of all hollow-bearing trees on site). This, the assessment concluded, is not anticipated to greatly reduce the number of potential roosting / nesting sites given the variety of types and sizes of hollow-bearing trees conserved on site. Furthermore, the assessment stated that the majority of hollow-bearing trees within the asset protection zone could be conserved.

Field surveys identified a further 60 Nowra Heath Myrtle individuals located within the existing road reserved proposed for carrying the transmission line. The assessment concluded that given that there are only five known populations, removal of these species would be considered significant if offsets were not provided and specific mitigations measures for managing indirect impacts were not implemented. Mitigation measures discussed in the assessment include measures to prevent impacts from run-off, sedimentation and weed invasion, fencing of bushland during construction work and minimisation of clearing.

Additional Noise Assessment

The additional noise assessment examined anticipated noise levels associated with stage one of the proposal. The assessment identified a correction to one of the anticipated noise levels described in the original noise assessment, demonstrating that the project is anticipated to meet noise limits for stage one. Typical mitigation measures that could be used to ensure that noise generated from the proposal meets project noise limits were also described.

Additional Visual Amenity Assessment

The additional visual amenity assessment examined views of the proposed facility from the Nowra Hill lookout, Cabbage Tree Lane and from the proposed site entrance at Yalwal Road. The study concluded that visual amenity impacts would be minimal.

4.6 Agency Review of the Submissions Report

The response of the DEC, DNR and Department of Defence to the Submissions Report and proposed modifications to the proposal are detailed as follows:

Department of Environment and Conservation

- operation should be restricted to 440 hours of operation within any 12 month period;
- the DEC opposes the removal of Nowra Heath Myrtle but believes that it can co-exist with the proposed transmission line;
- DEC acknowledges that easement vegetation maintenance would be required within the proposed transmission line easement and as such permits the slashing of Nowra Heath Myrtle at time intervals and to vegetation heights as permitted by the DEC;
- no slashing of Nowra Heath Myrtle is to occur without prior consultation with the DEC;
- Statement of Commitments does not adequately address impacts of the proposal on threatened flora and fauna as it does not clearly seek to maintain the existing biodiversity value of the area. The DEC therefore requires that habitat off-sets be provided to ensure that biodiversity levels area maintained in the local area; and
- survey findings are questionable because they were not undertaken at the optimal survey period.

Department of Natural Resources

- notes that the submissions report has not provided more information regarding water supply, rather restates the Proponent's intention to assess these matters in detail if and when stage 2 is required;
- DNR reiterates its concern that water access and sustainability issues be appropriately considered and that the Department of Planning be satisfied with the analysis of these issues prior to determination;

- if recycled water was unavailable and the water was to be sourced from the Shoalhaven River, the proposed extraction rate would represent a reasonable size addition to the current extraction levels;
- Tallowa Dam water releases will change in the near future, thereby altering existing downstream pumping regimes and license conditions, particularly in low flow periods, thereby potentially affecting this proposal; and
- consideration of environmental issues must be undertaken within the broader context of the potential growth of Nowra.

Commonwealth Department of Defence

- plume rise assessments need to assess the potential hazards to aviation created by the vertical velocity from gas efflux which can result in aircraft damage or affect handling characteristics of craft in flight;
- hazardous gaseous efflux is defined as being the vertical and horizontal limits of the exhaust plume at which the vertical velocity reduces to a value of 4.3 m/s;
- Defence notes that the maximum plume height, where the vertical velocity reduces to 4.3 m/s, for stage 1 will be 1040 m above ground level and 388 m above ground level for stage 2;
- Defence notes that these heights exceed the obstruction clearance surfaces for the Nowra RAN base (HMAS *Albatross*) and that the frequency of exceedance would be 100 % for stage 1 and 70 % for stage 2; and
- Defence objects to the construction of the power station at the proposed site.

4.7 Design Change Air Impact Studies

The Proponent undertook a further iteration of the air plume assessment in response to DoD's assessment of the plume impact assessment presented in the Submissions Report. DoD was not satisfied with the exceedance and therefore objected to the proposal.

In response to this, the Proponent investigated a series of measures that the project could potentially employ to assist in mitigating the air plume such that it satisfied the air safety concerns identified by DoD. The plume management measures proposed were engineering design changes. These changes were then modelled by the Proponent and a design change air impact study was produced. The design change air impact study stated that it investigated possible changes to stack height, stack diameter and stack exit temperature to reduce the impact of the air plume; concluding that changes to stack height and diameter were feasible. The Proponent proposed to decrease the stage 1 stack height from 40 m to 25 m and to increase stack diameter from 5.6 m to 6.7 m (a 43 % increase in stack area). For stage 2, stack height would be increased to 40 metres (a combined cycle design limit) and stack diameter would increase from 5.6 to 6.7 m as per that proposed for stage 1.

The Proponent undertook modelling of both stage 1 and stage 2 to firstly examine the plume rise impacts incorporating the design changes and found the maximum plume height where the critical vertical velocity is exceeded to have decreased from 1040 metres to 887 metres for stage 1 and to have decreased from 388 metres to 308 metres for stage 2. The assessment also found the frequency of exceedance of the OCS to be reduced from 100 % to 40 % for stage 1 and from 70 % to 30 % for stage 2. This study was submitted to the Department and DoD for review.

The second component of the design change air impact study was to examine the potential impact that the design changes could have on local air quality. Changes to design parameters will change the results of air impact modelling and for this reason it was important that the Proponent demonstrated that the project (with the proposed changes) would still comply with the relevant DEC air quality criteria. The study concluded that the plant with the new design changes would comply with the DEC air quality criteria. This study was submitted to the Department and DEC for review.

The responses of the DEC and DoD to the design change air impact study for the proposal are summarised below.

Department of Environment and Conservation

- notes that the predicted 1-hour NOx concentrations have increased marginally at some receptors while they have decreased at others; and

- it appears that the proposed changes to stack parameters will result in negligible changes to the predicted air quality impacts of the proposed facility.

Commonwealth Department of Defence

- notes the stage 1 above ground level maximum plume height, where the vertical velocity exceeds 4.3 ms^{-1} will be 887 m and for stage 2 will be 308 m;
- the maximum horizontal plume extent for stage 1 will be 276 m radius of the proposed facility's exhaust stacks and for stage 2 will be 63 m radius;
- it is noted that after construction of stage 2, the stage 1 stacks will remain and be used in a bypass arrangement during maintenance periods on stage 2. It is therefore assumed that during this maintenance period the plume dimensions will be the same as in stage 1;
- the report indicates an exceedance of the OCS will be reduced from 100 % to 40 % of the time for stage 1 of the project and from 70 % to 30 % of the time for stage 2 of the project;
- regardless of the frequency of the infringement, the infringement remains and hence the impact on air safety remains;
- only way to address this impact (other than project relocation) is through significant changes to flight procedures including the declaration of a Danger Area on the airspace encompassing the maximum vertical height and horizontal extent of the stage 1 plume;
- changes to flight procedures are possible and workable;
- DoD requires regular communication from the Proponent to ensure that procedure changes can occur within project timeframes; and
- DoD requests final design and location details for the proposed transmission line to ensure the line poses no air safety issues.

5. ASSESSMENT OF ENVIRONMENTAL IMPACTS

After consideration of the Environmental Assessment, submissions, Submissions Report and the response of the DEC and Commonwealth Department of Defence to the Submissions Report, the Department has identified the following key environmental issues associated with the proposal:

- air quality impacts;
- ecological impacts;
- water supply implications;
- noise quality impacts;
- visual amenity impacts; and
- aviation safety impacts

All other issues are considered to be minor and have been adequately addressed as part of the Proponent's Statement of Commitments.

5.1 Air Quality Impacts

Issues

An air quality assessment was undertaken to determine whether the project may result in any adverse impacts on local air quality. In this instance, two air quality assessments were undertaken as part of the assessment of environmental impacts associated with this project. The first was undertaken as part of the Environmental Assessment that was publicly exhibited while the second was conducted after the exhibition period in direct response to concerns raised by the DoD in its submission to the project. DoD had identified aviation safety concerns relating to plume rise predicted in the original air impact assessment and as such the Proponent examined a number of options to reduce plume rise impacts on local aviation activities. Consequently, the Department and DEC required that the original air quality analysis be revised to ensure that the proposed design changes would meet NSW air quality criteria.

The air quality impact assessment undertaken for the Environmental Assessment was stated to have been conducted in accordance with the *Approved Methods and Guidance for the Modelling and Assessment of Air Pollutants in New South Wales (DEC 2005)*. The key pollutants that were considered were those that are typically associated with gas fired power stations, that is, carbon monoxide, nitrogen oxides, sulphur dioxide and particulates. Dispersion modelling of emissions of these pollutants was conducted using The Air Pollution Model (TAPM) which predicts three-dimensional meteorology and air pollution concentrations. The Proponent specifically examined the predicted worse-case concentrations at a number of nearest sensitive receptors, determining the maximum predicted air pollutant concentrations for all of the pollutants to comply with the DEC ambient air quality criteria for the predicted worst-case concentration (Table 1). Results suggested that the most significant pollutant emitted from the project would be NO_2 because the NO_2 increment was of equal order of magnitude to the existing background level (although still within air quality limits). All other pollutant increments were at least one order of magnitude less than the existing background levels.

The scope of the revised air quality impact assessment was formed in consultation with the DEC. The revised assessment investigated any changes to NO_2 emission levels as a result of the proposed design change using TAPM. CO and PM_{10} modelling was also undertaken to obtain an incremental percentage increase at each receptor. Results for pollutants were then compared with the original predictions described in the Environmental Assessment. A summary of these results is contained in Table 1.

Table 1 - Summary of Dispersion Modelling Results

Pollutant	Averaging Period	Existing Background (ppm)	Increment Due Project (ppm)	Cumulative Impact (ppm)	Relevant Goal (ppm)
Stage 1 – Open Cycle Configuration					
CO	1 hour	3.2	0.8	4 (0)	25
	8 hour	2.1	0.3	2.4	9
SO_2	1 hour	34.1	0.5	34.6	200

	24 hour	1.4	0.1	1.5	80
	Annual	0.8	0	0.8	20
NO_2	1 hour	44	14	58 (4)	120
PM_{10}	24 hour	46.8	1	47.8 (0.1)	50
Stage 2 – Combined Cycle Configuration					
CO	1 hour	3.2	2.6	5.8 (0.2)	25
	8 hour	2.1	0.9	3	9
SO_2	1 hour	34.1	1.3	35.4	200
	24 hour	1.4	0.1	1.5	80
	Annual	0.8	0	0.8	20
NO_2	1 hour	44	27	71 (-6)	120
PM_{10}	24 hour	46.8	3.2	50 (0.3)	50

Note: All PM_{10} values are expressed as mgm^{-3}. Values in shaded cells are those that were remodelled in the revised air quality assessment to account for design changes; all other values were not remodelled as part of that assessment. Values contained in brackets represent the change in the predicted maximum cumulative impact value from the original design to the proposed modified design.

Consideration

The Department is satisfied that the assessment undertaken of potential air quality impacts from the proposal is adequate. Predictive air dispersion modelling was undertaken which was then further revised in response to design changes which would have changed the nature of pollutant dispersion and in turn the pollution concentrations at sensitive receptors. Both assessments found the proposal would meet the relevant DEC air quality goal for each of the pollutants. The Department highlights that pollutant increments due to the power station are significantly below existing background levels and in most cases are at least one order of magnitude less than the relevant air quality goals stated by the DEC. The only exception to this is stage 2 PM_{10} where the concentration at the worst affected receiver is predicted to be equal (but not to exceed) the DEC criterion. The Proponent notes that in this instance background levels contribute significantly, accounting for 46.8 μgm^{-3} of the 50 μgm^{-3} criterion. Furthermore, the Proponent states that this level of performance is considered conservative due to the high background concentrations used in the assessment combined with the increment due to the proposal being the predicted maximum result. The Department agrees with this conclusion. In light of the results presented in both assessments, the Department and DEC are satisfied with the predicted level of air quality performance of the project.

The Department believes that provided all the nominated environmental commitments are implemented during the construction and operational phases of the project, the resultant air quality impacts from the proposal would be negligible. Notwithstanding this, the Department has recommended a range of conditions to ensure that strict air emission limits are met throughout the entire life of the project. This commences with construction, with the recommendation of conditions that seek to minimise dust generation and ensure that fuel burning equipment will meet air emission requirements when operational. For example, the Proponent would be required to submit manufacturer's performance guarantees, stating equipment compliance with air emission limits, for all fuel burning equipment to the DEC prior to project operation.

Whilst such controls and the Proponent's mitigation measures are effective methods for ensuring a standard of air quality is likely, air quality performance should be regularly monitored and reported to ensure that local air quality is maintained. It is for this reason that the Department has recommended that the Proponent establish and maintain an air quality monitoring program throughout the construction and operation of the project. Air quality monitoring program results, demonstrating compliance with performance criteria stipulated in the recommended approval, would be required to be submitted to the Department annually.

It is the opinion of the Department then, that provided the Proponent's mitigation measures are implemented and the recommended Instrument of Approval is adopted, the project is anticipated to meet all relevant air quality criteria.

5.2 Ecological Impacts

Issues

The Proponent identified that the construction and operation of the facility would require the clearing of approximately 12.8 hectares of potential habitat for native flora and fauna. To assess the impacts of the project on ecological values, the Proponent undertook an ecological impact assessment focusing on:

- the potential for endangered ecological communities, threatened species and/ or their habitat listed under the NSW *Threatened Species Conservation 1995* (TSC Act) to occur;
- the potential presence of any matters of National Environmental Significance listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act); and
- flora and fauna impact management and mitigation options.

The assessment consisted of literature reviews and field surveys. The literature reviews were stated to have involved identifying the environmental features of the locality by reviewing available literature and government databases such as the DEC Threatened Species Database and the Royal Botanic Gardens Threatened Flora Database Records.

Field surveys of the locality were stated to have been conducted in accordance with the DEC's *Draft Threatened Biodiversity Survey and Assessment Guidelines* (2005) over a five-day period from 8 August to 12 August 2005. Surveys included vegetation mapping, targeted searches for Nowra Heath Myrtle and Illawarra Greenwood, habitat assessment, hollow-bearing tree counts, ultrasonic anabat detection and opportunistic records.

Further ecological assessment was conducted in response to concerns raised in submissions. This included further field surveys (including a targeted survey for the Giant Burrowing Frog), mapping of potential habitat, mammal trapping (including stagwatching and spotlighting), hollow-bearing tree counts and habitat assessment of the riparian zones that had been identified in the Environmental Assessment.

Results from the literature review identified a number of threatened species to have been previously recorded in the area including two significant ecological communities: River-flat Eucalypt Forest (endangered under the TSC Act) and Northern Foothills Spotted Gum – Blackbutt Moist Shrub Forest (regionally significant). The River-flat Eucalypt Forest community was observed during field surveys, noting a modified remnant community to the north of Yalwal Road, adjacent to Cabbage Tree Creek. The Northern Foothills Spotted Gum – Blackbutt Moist Shrub Forest was not detected however it was suspected to lie to the north of the area examined.

Literature review results are presented below along with the Proponent's assessment of the likelihood of species occurrence based on the findings from the surveys. The tables list all threatened flora and fauna that have been recorded in the locality, or are likely to occur within the locality, in addition to the conservation status of the species. It can be noted that while siting of specific species of flora or fauna may not have occurred, potential habitat exists in most instances.

Table 2 - Threatened Flora Recorded within the Locality

Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Likelihood of Occurrence at Site
Acacia bynoeana	Bynoe's Wattle	E	V	Potential habitat present throughout majority of study area.
Cryptostylis hunteriana	Leafless Tongue Orchid	V	V	Potential habitat present in areas supporting moist heath and open areas within the eucalypt forests.
Cynanchum elegans	White-flowered Wax Plant	E	E	Limited potential habitat for this species within River-flat Eucalypt Forest area.
Eucalyptus langleyi	Albatross Mallee	V	V	Unlikely. No suitable habitat.
Eucalyptus sturgissiana	Ettrema Mallee	V	-	Potential habitat present within study area but not recorded during surveys therefore unlikely to occur.

Genolesium baueri	Brittle Midge Orchid	V	-	Potential habitat present in areas supporting open forest and within the mossy areas over sandstone on the western side of Flat Rock Creek.
Melaleuca deanei	Deane's Melaleuca	V	V	Potential habitat present within heath vegetation adjacent to Flat Rock Creek.
Pterostylis gibbosa	Illarwarra Greenhood	E	E	Targeted searches undertaken in suitable habitat but not recorded within study area.
Pterostylis puchella	Waterfall Greenhood	V	V	Unlikely. No suitable habitat.
Solanum celatum	Violet Nightshade	E	-	Limited potential habitat north of Yalwal Road along creeks and drainage lines at the site.
Thesium australe	Austral Toadflax	E	V	Unlikely. No suitable habitat.
Triplarina nowraensis	Nowra Heath Myrtle	E	E	Recorded along creeks and drainage lines at the site.
Zieria baeuerlenii	Bomaderry Creek Zieria	E	E	Unlikely. No suitable habitat.

Table 3 - Threatened Fauna Recorded within the Locality

Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Likelihood of Occurrence at Site
Burhinus grallarius	Bush Stone-curlew	E	-	Potential habitat present within proposed easement areas.
Callocephalon fimbriatum	Gang Gang Cockatoo	V	-	Potential habitat present throughout forest and woodland areas.
Calyptorhynchus lathami	Glossy Black-Cockatoo	V	-	Recorded at site during inspection and potential foraging and breeding habitat present throughout study area.
Chalinolobus dwyeri	Large-eared Pied Bat	V	V	Recorded at the site and potential roosting habitat present.
Dasyurus masculatus	Spotted-tailed Quoll	V	-	Potential habitat present within study area along Yalwal Road and the current transmission easement.
Heleioporus australiacus	Giant Burrowing Frog	V	V	Potential habitat present throughout the majority of the study area except for pasture areas.
Hoplocephalus bungaroides	Broad-headed Snake	E	V	Unlikely. No suitable habitat.
Isoodon obesulus obesulus	Southern Brown Bandicoot (eastern)	E	E	Potential habitat present throughout study area particularly in heath and open forest areas.
Ixobrychus falvicollis	Black Bittern	V	-	Previously recorded within the study area along Flat Rock Creek. Not recorded during current surveys.
Litoria aurea	Green and Golden Bell Frog	E	V	Limited potential habitat in small drainage line adjacent to Flat Rock Creek. However, considered unlikely to occur.
Lophoictinia isura	Square-tailed Kite	V	-	Potential habitat present within forest and woodland areas and has been recorded in close proximity to study area. This species is likely to forage across study area.
Macropus parma	Parma Wallaby	V	-	Unlikely. No suitable habitat.
Miniopterus schreibersii oceanensis	Eastern Bent-wing Bat	V	V	Potential foraging habitat present across study area and potential roosting habitat within old abattoir building. However, not recorded within building during anabat survey.
Miixophyes balbus	Stuttering Frog	E	-	Unlikely. No suitable habitat.

Mormopterus norfolkenis	Eastern Freetail-bat	V	-	Recorded at the site and potential roosting habitat present.
Myotis adversus	Large-footed Myotis	V	-	Recorded at the site and potential roosting habitat present.
Neophema pulchella	Turquoise Parrot	V	-	Limited potential foraging habitat within study area but considered unlikely to occur.
Ninox connivens	Barking Owl	V	-	Potential foraging and roosting habitat within study area.
Ninox strenua	Powerful Owl	V	-	Potential foraging and roosting habitat within study area.
Petaurus australis	Yellow-bellied Glider	V	-	Previously recorded within the study area but not recorded during current surveys.
Petrogale penicillata	Brush-tailed Rock-wallaby	E	V	Unlikely. No suitable habitat.
Petroica rodinogaster	Pink Robin	V	-	Previously recorded in vegetation adjacent to current transmission line easement but not recorded during survey.
Phascolarctos cinereus	Koala	V	-	Potential habitat throughout study area.
Potorous tridactylus	Long-nosed Potoroo	V	V	Potential habitat throughout study area and in particular where areas of both dense and open understorey occur together.
Peteropus poliocephalus	Grey-headed Flying-fox	V	V	Potential foraging habitat present across study throughout study area.
Scoteanax rueppellii	Greater Broad-nosed Bat	V	-	Unlikely. No suitable habitat.
Sminthopsis leucopus	White-footed Dunnart	V	-	Potential habitat present throughout the study area in areas supporting open forest and heath.
Tyto novaehollandiae	Masked Owl	V	-	Potential foraging and roosting habitat within study area.
Tyto tenebricosa	Sooty Owl	V	-	Unlikely. No suitable habitat.
Varanus rosenbergi	Rosenberg's Goanna	V	-	Potential habitat present throughout study area.
Xanthomyza phrygia	Regent Honeyeater	E	E	Potential foraging habitat present and has previously been recorded in close proximity to study area.

Targeted surveys for Illawarra Greenwood and Nowra Heath Myrtle succeeded in identifying Nowra Heath Myrtle but failed to identify Illawarra Greenwood. Approximately 66 individuals of Nowra Heath Myrtle were observed in three locations along the proposed transmission line easement – two groups in the existing Yalwal Road easement immediately east of Flat Rock Creek on both the northern and southern sides of the road, and a further group located on the southern side of the existing transmission easement just west of the Eastern Gas Pipeline.

At the request of the DEC, further surveying for Nowra Heath Myrtle was undertaken. An additional 60 Nowra Heath Myrtle individuals were identified. This increased the total number of Nowra Heath Myrtle individuals potentially affected by the project from 66 to approximately 126 individuals. The 60 additional individuals are located to the east of Flat Rock Creek on the southern side of Yalwal Road within the existing road easement. The assessment stated that these individuals would most likely need to be cleared when constructing the transmission line. The assessment suggested that habitat off-sets could be provided as compensation for their loss.

The DEC also requested that the Proponent conduct a targeted survey for the Giant Burrowing Frog. The literature review identified this species to be listed as vulnerable under both the TSC Act and the EPBC Act, and potential habitat for the species is located across the majority of the site. Spotlighting was conducted along tracks at the site after rain (when the species is known to surface) and no individuals were observed.

Hollow-bearing trees provide potential habitat for a range of fauna including the Yellow-bellied Glider, Owls, Microchiropteran Bats and hollow-dependent bird species. Hollow-bearing tree counts were conducted to determine the number and location of hollow-bearing trees on the proposed site. This allowed the number of trees potentially requiring removal due to the construction and operation of the facility to be ascertained.

A total of 46 hollow-bearing trees were observed on the proposed site. Under the worst-case clearing scenario the assessment stated that approximately 15 hollow-bearing trees (or 33% of all hollow-bearing trees on site) would require removal.

An aquatic habitat assessment was conducted to evaluate the potential impacts of the project on drainage lines, creeks and riparian buffers located adjacent to the proposed site. The assessment noted that most of the vegetation had already been cleared in areas proposed for the transmission line however outside of this area the vegetation was relatively intact. The assessment also stated that some small areas of riparian vegetation adjacent to the facility and pipeline may need to be cleared as these areas would be located within the proposed Asset Management Zone of the project.

Consideration

The Department is satisfied that the assessment undertaken of potential ecological impacts from the proposal is adequate, however the Department does not agree with the Proponent's conclusion that significant impacts on biodiversity in the area is unlikely. The Department does not believe however that such impacts are so great as to prohibit the Department from recommending approval provided that appropriate mitigation and compensatory measures are put in place.

The Department acknowledges that the Proponent has purposely selected a site and plant layout which seeks to minimise the environmental footprint of the facility, and associated natural gas pipeline and transmission line infrastructure. This is largely achieved through the use of a partially cleared former abattoir site and the existing road/ transmission line easements. However, the assessment still identifies the need to clear/ partially clear a further 12.8 hectares of potential habitat.

The Proponent suggests that the proposed clearance would not pose a significant impact because flora and fauna listed in the area was not detected during field surveys, that the areas to be cleared are largely on the fringes of vegetation and that extensive areas of potential habitat would remain adjacent to the site and within the locality in nearby nature reserves, State Forests and National Parks. The assessment further suggests that as the project would be undertaken in two stages, clearing and modification of native vegetation and fauna habitat would be gradual and therefore the impact minimised.

Whilst the Department appreciates this argument, it is of the opinion that ultimately the proposal requires a reduction of 12.8 hectares of vegetation that serves as potential habitat for a large number of vulnerable species and some endangered species listed under both the TSC Act and EPBC Act. Furthermore the Department highlights that field survey conditions were not ideal for detecting several of the species identified in the literature review as possibly residing in the area. This is a view shared by the DEC and was raised also in the submission from Council.

To address this, the Department has recommended a number of conditions to effectively manage these concerns. The Department, on advice from the DEC, has recommended that the Proponent provide compensatory habitat to ensure that the value of the habitat lost is satisfactorily offset. Effectively, the Proponent would be permitted to clear the required area provided that the offset maintains or improves biodiversity values in the local area. In line with this approach, the Department has therefore recommended conditions which require the Proponent to provide a compensatory habitat package which would be determined in consultation with the DEC and subject to the approval of the Director-General. Any vegetation clearing would only be able to occur once the habitat package had been approved. Funding for works associated with the compensatory habitat package would then need to be finalised within 12 months of this period. The Department understands that the Proponent, as part of the Environmental Assessment process, has already discussed possible habitat offset options with the DEC.

The Department has also recommended conditions that require the Proponent to prepare and submit detailed methods and initiatives to manage the impacts on native ecology during both construction and operation phases of the project. This includes best environmental practise measures for minimising the clearance of native vegetation, vegetation re-use initiatives and programs for managing and monitoring feral pest and weed spread. Construction and operation of the project would only be able to commence after these flora and fauna management plans have been approved by the Director-General.

Further, the Department has recommended specific conditions on advice from the DEC in relation to the management of the 126 individuals of Nowra Heath Myrtle. Nowra Heath Myrtle is listed as endangered under both the TSC Act and the EPBC Act with only five known populations, all of which are based around Nowra. The proposed removal of approximately 60 individuals would represent a potentially significant impact as it would notably decrease the known long-term population of the species. As such, the recommended conditions prohibit their removal and strictly define the requirements of the Proponent when undertaking easement vegetation maintenance activities such that any adverse impact would be avoided. They also require a monitoring program to be established and implemented to manage and monitor the health of Nowra Heath Myrtle individuals potentially affected by the proposed transmission line. The Department is of the opinion that such measures are feasible and would not unduly limit the Proponent's ability to construct or operate the transmission line.

The Department believes that provided the recommended conditions are adopted and that the Proponent undertakes the actions described in the Proponent's Statement of Commitments, flora and fauna impacts can be effectively managed. While it is acknowledged that some adverse impact could potentially occur through the remove of potential habitat, the Proponent has committed to undertaking a number of additional measures such as providing compensatory habitat of equal or greater biodiversity value to that removed, to ensure that adverse flora and fauna impacts are duly compensated and that unavoidable impacts are minimised.

5.3 Water Supply Implications

Issue

The main issue in relation to water supply impacts relates to concern that the preferred water sourcing option for stage two of the project is not feasible and that an alternate source would need to be used, placing additional strain on the existing local water system. Further, concern was raised in submissions regarding the environmental impacts of constructing and operating the water supply infrastructure which would connect the site to the water source.

Stage two of the project would require 8.4 megalitres of water per day to be sourced from the local area for cooling and processes within the combined cycle gas turbine facility. As part of the Environmental Assessment for the project, the Proponent conducted a water cycle management report to evaluate water sourcing options and their potential impacts on the local water system.

The report considered a number of options for stage two water sourcing. These included reclaimed effluent; raw water from Bamarang Reservoir; industrial effluent; Shoalhaven River water; groundwater; stormwater; facility wastewater; and potable water. After consideration of each option, the report identified industrial effluent to be the preferred source, stating that the combined volumes of effluent from Manildra Starches (3 megalitres per day) and Australian Paper (6 megalitres per day) would be able to provide sufficient water for the plant.

The selection of this option would require the construction and operation of a water pipeline from both industrial sites to the plant. The Proponent did not indicate a final water pipeline route, stating that such information would be finalised as part of the detailed design and this would be submitted to the relevant approval body as part of the environmental impact assessment that would be undertaken for stage two.

Consideration

The Department is satisfied with the water impact assessment conducted by the Proponent in the context of a concept plan assessment. The Department supports the Proponent's proposed use of industrial effluent for the purposes of the water sourcing required for stage two of this project in principal. Effectively, under-utilised waste water from local industry would be re-used to provide base load electricity to New South Wales. However, the Department realises that in the event that this water source is not suitable, or cannot be feasibly and

economically sourced, an alternative water source may need to be located or alternatively, dry cooling may need to be considered by the Proponent.

The Proponent indicated in its assessment that should the use of industrial effluent not be possible then alternative water sources would be investigated. The Proponent states that in the event that all water sources are found to be unviable, then the use of a dry cooled process for stage two may be considered. Water demand under this option would be significantly less than the predicted 8.4 megalitres per day demand identified.

The Department considers that this approach is suitable, acknowledging however that further investigation into water supply would be a key part of any subsequent assessment of the project should project approval for stage 2 be sought. It is evident that such an undertaking is critical as both the DNR and Shoalhaven Council submissions questioned the availability of industrial effluent and raised concern regarding the long-term viability of alternate water sources. Similar concerns were also raised in public submissions.

Consistent with this approach, the Department has recommended a condition of concept approval which requires the Proponent to undertake a full water supply feasibility study as part of the Environmental Assessment that would be required to be undertaken by the Proponent in the event that project approval is sought for stage 2. The study would be developed in consultation with Council (Shoalhaven Water) and DNR and would need to quantitatively demonstrate water availability for stage 2 operation and the viability of these water sources for sustainable use over the life of the project. Consideration would also have to be given to the security of supply, current and future water demand in the region and, in the event water source sharing is proposed, how the proposal will likely impact on potentially affected users.

The Department is of the opinion that this approach effectively manages the issues identified by the public, DNR and Council with regards to water supply, while also providing in-principle support to the stage 2 component of the proposal. It must be remembered that should the Minister grant concept approval, this does not permit the Proponent to undertake stage 2. Rather, it requires a detailed study of water supply options to be undertaken as part of the Environmental Assessment that would be required should the Proponent seek to undertake stage 2.

5.4 Noise Impacts

Issues

A noise impact assessment was conducted as part of the Environmental Assessment to determine the potential noise impacts associated with the operation of the proposal. The assessment stated that it was conducted in accordance with the requirements of the NSW *Industrial Noise Policy* and considered both intrusive noise impacts and the impact on local noise amenity under both normal and adverse weather conditions. The assessment examined noise impacts based on three operating scenarios – no noise attenuation; noise attenuation to a sound pressure level (SPL) of 80 dB(A) (measured at one metre from noise source); and noise attenuation to a SPL of 85 dB(A) (measured at one metre from noise source).

The noise impact assessment results for stage one and stage two are outlined in Table 4 below. The assessment found that under all weather conditions the predicted noise levels would exceed the adopted noise criterion at Lot 22 DP 746233 (the nearest receiver located 750 metres to the north of the site) if no noise attenuation measures were adopted. Further, operational noise from stage two without noise attenuation is greater than that for stage one and is predicted to exceed the adopted noise criterion at all locations under all weather conditions, without noise attenuation.

With noise attenuation it can be seen that predicted noise levels are significantly reduced with no exceedance expected with sound attenuation equal to 80 dB(A) SPL at all locations and under all weather conditions. Using sound attenuation equal to 85 dB(A) SPL predicted noise levels are expected to exceed noise criterion by 2.9 db(A) at Lot 22 DP 746233 under adverse weather conditions with a north-westerly wind.

Table 4 - Predicted Noise Impacts

Location	Attenuation	Stage	Adopted Noise Criterion	Predicted Noise Impacts		
				Neutral weather	Adverse weather NW wind	Adverse weather SE wind
Lot 22 DP 746233	None	1	35	40.8	46.0	40.8
	None	2	35	48.9	54.0	50.2
	80 SPL	2	35	32.9	32.9	29.2
	85 SPL	2	35	34.2	37.9	34.2
213 Gannet Road	None	1	35	30.7	30.7	36.5
	None	2	35	38.8	38.5	44.9
	80 SPL	2	35	19.4	19.4	23.8
	85 SPL	2	35	24.6	24.6	29.0
190 Bamarang Road	None	1	35	26.7	32.1	26.7
	None	2	35	35.3	41.1	35.3
	80 SPL	2	35	11.9	15.1	11.9
	85 SPL	2	35	17.0	20.2	17.0

Consideration

The Department is generally satisfied that the assessment approach employed by the Proponent with respect to noise impacts is appropriate and consistent with the requirements of the NSW *Industrial Noise Policy*.

While predicted noise levels are anticipated to exceed the noise criterion without noise attenuation, the Department highlights that the project could comply with the noise criterion for both stage one and stage two if sound attenuation measures were to be employed. This view is shared by the DEC and the Proponent, who has described a range of sound attenuation measures to be undertaken in its Environmental Assessment to ensure that the noise levels of the project meet the adopted noise criteria. Furthermore, the Proponent has included meeting the noise limits as a commitment in its Statement of Commitments for the project.

The Department recommends the noise limits described in Table 5 below be applied to the project. These limits have been determined based on consideration of the noise impact assessment presented by the Proponent in the Environmental Assessment and are consistent with the requirements of the *Industrial Noise Policy*. The Department highlights that a noise criterion of 35 dB(A) is comparatively low, and represents 5dB(A) above the assumed minimum background noise level in the *Industrial Noise Policy* (30 dB(A)).

Table 5: Maximum Allowable Noise Contribution

Location	Day $L_{Aeq(15\ minute)}$	Evening $L_{Aeq(15\ minute)}$	Night $L_{Aeq(15\ minute)}$
Lot 22 DP746233	37	35	35
213 Gannet Road	37	35	35
190 Bamarang Road	35	35	35

The Department also recommends that a comprehensive noise audit be undertaken with respect to the project within 90 days of the commencement of operation, to confirm that the project is operating within the bounds of the project approval and predicted noise outcomes. In the event that divergence from the predicted noise impacts is measured, the noise audit would identify this and would require the Proponent to identify and apply additional noise management measures such that measured noise would not exceed the noise limits.

5.5 Visual Amenity Impacts

Issues

The main concern regarding visual amenity impacts is that the scale of the facility would reduce visual amenity within the local area. Further, it was suggested in submissions that such development is of an industrial

appearance and therefore it conflicts with the existing rural-residential/ forested landscape of the area. Concern was also raised in submissions regarding the visual amenity impact of the proposed transmission line.

The Proponent conducted a visual amenity impact assessment to ascertain the visual impact of the facility from numerous viewing points within the local area. This included a photographic assessment and the use of visual modelling techniques to simulate the visual impact of the constructed facility from key viewing points.

Consideration

The Department is satisfied with the level of visual amenity impact assessment undertaken by the Proponent. Consistent with submissions, the Department gave consideration to the visual amenity impact of both the proposed transmission line and the proposed facility/ gas pipeline.

With respect to the transmission line, concern was identified in submissions that the transmission line along Yalwal Road would be unsightly and that the line should be placed underground. In response the Proponent stated that as the new transmission line would replace an existing transmission line, minimal change in visual amenity would occur. The Department supports the Proponent's viewpoint, noting that whilst the proposed transmission line would be visible to both users of Yalwal Road and residents in the area, the impact on visual amenity would not be notably different to that posed by the existing transmission line, and hence does not adequately justify the significant additional expense or reduced asset life of an underground line.

With regards to the proposed facility and natural gas pipeline, the Proponent undertook visual modelling and photographic assessment to determine the potential views to the facility from key vantage points within the area. Potential views assessed included views towards the site from the Nowra Hill lookout; certain points within the Cabbage Tree Lane subdivision; and from the Yalwal Road entrance to the site.

The photographic assessment and simulated views generated by computer modelling demonstrated that the impact of the constructed proposal on visual amenity would be low. The Proponent suggested that the large viewing distances between the site and the nearest residential areas (two kilometres) when combined with the significant screening provided by the existing bushland, should result in low visual amenity impacts.

Furthermore, the Proponent has committed to a number of visual amenity mitigation measures to further reduce the impact of the proposal on local visual amenity. This includes minimising tree clearing, additional tree planting and the use of building materials and treatments that would minimise the potential contrast between the natural landscape and the facility.

The Department agrees with the Proponent's conclusion that the visual impacts of the facility would be low. The Department believes that this low impact could be appreciably reduced through the use of the mitigation measures described by the Proponent. In light of this, the Department has recommended a number of conditions to ensure that such measures are undertaken to a satisfactory level and as part of this recommends that such measures are undertaken in direct consultation with Council. For this reason the Department would require the Proponent prepare urban design and landscaping management methods in consultation with Council. This information would identify all high visibility structures and describe the techniques to be used to limit their visibility from both Yalwal Road and existing/ proposed future residential areas. This would also include a description of all landscaping measures to be undertaken on site to minimise the visual impact of the facility.

Provided the Proponent undertakes these measures and implements the mitigation techniques described in its Environmental Assessment, the visual amenity impact of the project would be minimal.

5.6 Aviation Safety Impacts

Issues

Aviation safety impacts were identified as a concern by the Commonwealth Department of Defence (DoD) which operates the Naval Air Station Nowra (HMAS *Albatross*) situated approximately four kilometres to the south of the proposed power station site. DoD was concerned that the hot air plume that would rise from the power station (when operating) would have a significant impact on aircraft operations and air safety at its base. Under Defence (Areas Control) Regulations, DoD controls the height of structures and the purposes for which they may be used

within a 15 kilometre radius of the HMAS *Albatross* airfield. The purpose of the regulations is to limit the height of objects which may endanger aircraft operations. The height restrictions are based on the Obstruction Clearance Surfaces (OCS) that exist for the Nowra base. The height at which these restrictions apply at the proposed site is 60 metres above ground level.

The Proponent conducted a plume rise assessment to determine the potential hazard that the exhaust plumes from the project may have on aviation activities in the local area. The Commonwealth Aviation Safety Authority's (CASA) *Guidelines for Conducting Plume Rise Assessments* (2004) identifies the need to undertake plume rise assessments because the vertical velocity from exhaust gases may result in aircraft damage and/ or affect the handling characteristics of an aircraft in flight. The Proponent confirmed this with DoD who stated that the plume velocity from the two stacks must not exceed 4.3 ms^{-1} at the height of the OCS (i.e. at a 60 m height above the site).

The Proponent stated that it had undertaken dispersion modelling of the plume rise in accordance with CASA requirements using TAPM. The plume rise from a single stack was modelled and then this was modified using a buoyancy enhancement factor to adjust for the effect of the plumes from the two stacks merging.

The air plume assessment concluded that the probability of an exceedance of the critical vertical velocity decreases significantly with increases in altitude, with 96% of predicted exceedances expected to be experienced between 50 and 90 metres above ground level. At a height of 200 m this is reduced to less than 0.05 %. Under prevailing wind conditions, the assessment stated that the maximum radius of the plume would be 29 metres. Subsequently, the Proponent concluded that it would be anticipated that the combined probability of an aircraft passing over the plume influence area and being exposed to a vertical velocity (due to the project) in excess of the critical vertical velocity would be acceptable in terms of CASA risk criteria.

Consideration

The Department notes that while an assessment of the plume impact has been undertaken by the Proponent, the assessment did not adequately demonstrate compliance with CASA air safety requirements. The Proponent, while acknowledging an exceedance of the critical vertical velocity, stated that this was acceptable when considered in conjunction with the likelihood of aircraft passing over the plume influence area when the plant would be operational. However, the Proponent had not provided information in its assessment to adequately justify this conclusion. DoD was also of the opinion that insufficient information had been provided and as such their submission requested further plume rise assessment so that they could determine potential impacts on their operations.

The Proponent sought to address these issues as part of their Submissions Report (refer section 4.5 of this report). Additional plume rise assessment had been undertaken which specifically compared the worst case impact and frequency of exceedance performance of the plume for stage 1 and stage 2 operation. Results of the assessment found approximately 70% and 97% of all exceedances of the critical vertical velocity to occur beneath 100 metres above ground level for stage 1 and stage 2 respectively. The maximum plume height where the vertical velocity reduces to 4.3 ms^{-1} for stage 1 would be 1040 metres above ground level and 388 metres above ground level for stage 2. The frequency with which this level of exceedance was predicted to occur was less than 0.05 % for both stages. The minimum and average plume height at which the average plume vertical velocity would exceed the critical vertical velocity was found to be 63 metres and 112 metres respectively for stage 1 and 53 metres and 70 metres respectively for stage 2.

These results demonstrate that an exceedance of the critical vertical velocity would frequently occur and that under the worst case scenario the vertical intrusion into the OCS would extend up to a height of 1040 metres above ground level. The Proponent however argued that despite the exceedances predicted, the exceedances would be acceptable when considered in conjunction with the probability of an aircraft passing through the plume influence area. The Proponent stated that this combined probability (probability of exceedance and probability of an aircraft traversing the plume area) would be within the CASA acceptable risk criterion and therefore the project would be acceptable in terms of aviation safety.

In light of this conclusion, the Proponent recommended that a third party aviation expert determine the probability of aircraft traversing the plume influence area so that the risk safety performance for both stages 1 and 2 could be compared with the CASA acceptable risk criterion.

The Department requested DoD provide comment on the additional assessment and the approach outlined by the Proponent to determine whether the additional assessment had adequately addressed DoD concerns and that the approach proposed by the Proponent was reasonable. DoD's review of the additional plume rise assessment concluded that it was unable to support the proposal because of the predicted infringement of the OCS. DoD stated that this infringement represented an unacceptable safety risk to their aircraft and operations.

In response to DoD's assessment the Proponent engaged DoD in a series of discussions regarding possible management measures and design changes that could possibly be undertaken to reduce the impacts of the plume rise on DoD operations. As a result the Proponent investigated possible changes to stack height, stack diameter and stack exit temperature to reduce the impact of the air plume; concluding that changes to stack height and diameter were feasible. The Proponent proposed to decrease the stage 1 stack height from 40 metres to 25 metres and to increase stack diameter from 5.6 metres to 6.7 metres (a 43 % increase in stack area). For stage 2, stack height would be increased to 40 metres (a combined cycle design limit) and stack diameter would increase from 5.6 metres to the proposed 6.7 metres.

Design changes were then modelled to determine both stage 1 and stage 2 plume rise impacts. The modelling determined the maximum plume height where the critical vertical velocity is exceeded to have decreased from 1040 metres to 887 metres for stage 1 and to have decreased from 388 metres to 308 metres for stage 2 . The assessment also found the frequency of exceedance of the OCS to be reduced from 100 % to 40 % for stage 1 and from 70 % to 30 % for stage 2.

The assessment was then reviewed by DoD. DoD concluded that regardless of the possible reductions that had been shown by the Proponent, an infringement would still exist and hence the air safety hazard would remain. DoD stated that the only way to address the impact (other than to relocate the power station) would be to undertake significant changes to flight procedures. In particular, this would involve declaring the airspace around the proposed site to be a Danger Area. The Danger Area would need to encompass the maximum vertical height and horizontal extent of the stage 1 plume and be in continuous operation.

DoD sought comment from RAAF Aeronautical Information Services (RAAF AIS) and Airservices Australia (AsA) regarding amending flight procedures such that the Danger Area would be incorporated. This assessment has been undertaken and DoD has concluded that establishing the Danger Area and modifying flight procedures are both possible and workable solutions. DoD however does highlight that such changes require considerable effort on their behalf and notes that changes to flight procedures would need to be established before stage 1 commissioning commences.

The Department is satisfied with this outcome. This course of action would effectively allow the concurrent operation of the power station and HMAS Albatross without unduly limiting the operations of DoD. Importantly, it ensures that procedures and processes would be put in place which would prevent circumstances arising whereby a potential aviation hazard would occur.

The Department notes the effort that would be required of DoD should the Minister approve the project. Further, the Department understands the importance of these changes to DoD's Nowra operations. Hence the Department has recommended an approach through conditions that would ensure that timing, design and any information requirements of DoD are adequately met. The recommended conditions would require the Proponent to only undertake the project provided approval has been granted by DoD, and that any requirements that DoD may request of the Proponent be undertaken in a manner and time period as agreed to between DoD and the Proponent. Provided this course of action is undertaken by the Proponent, the management measures recommended by DoD would be able to be implemented to effectively manage the potential aviation hazard.

CONCLUSIONS AND RECOMMENDATIONS

The Department has assessed the Environmental Assessment, Statement of Commitments, submissions on the proposal, submissions report and subsequent air impact analysis reports, and is satisfied that the impacts of the proposal can be mitigated and/ or managed to ensure an acceptable level of environmental performance.

The potential environmental planning implications of the project are several due to the environmental impacts typically associated with electricity generation and the close proximity of the site to residential areas. Concern was primarily raised by the community in relation to air quality, noise, visual amenity and water supply for stage 2. The Proponent prepared a detailed submissions report to address each of these issues in turn and in this instance of noise, ecology, air quality and visual amenity impacts, the Proponent undertook additional studies to further demonstrate an acceptable level of environmental performance in these areas.

Council and government agencies, including DEC, DNR, NSW Rural Fire Service, CASA and DoD, also provided comment. The issues raised by these bodies were similar to that identified by the community but also included potential adverse impacts on threatened/ vulnerable species and potential air safety hazards. Both of these issues were addressed in the submissions report, and in the instance of air safety hazards, a series of further air plume impact studies were consequently conducted at the request of DoD to resolve outstanding concerns regarding air safety.

The Department, on advice from the relevant agencies, has recommended a series of conditions that seek to effectively manage the concerns that have been identified by the community, Council and the government agencies. These conditions would serve to enhance the commitments that have already been made by the Proponent in its Statement of Commitments and would ensure that environmental impacts are minimised.

The Department is of the opinion that the project would be of benefit to the State of New South Wales. This is because the project would increase electricity supply during periods of peak use, plus, it would provide the Proponent (subject to further environmental impact assessment) the option to convert the facility to a combined cycle plant such that it could assist in reducing the predicted shortfalls in base load generation.

Overall, the proposed Bamarang Gas Fired Power Station project could be approved subject to the effective implementation of the Proponent's Statement of Commitments and the Department's recommended conditions of approval.

APPENDIX A – RECOMMENDED CONDITIONS OF (CONCEPT) APPROVAL

APPENDIX B – RECOMMENDED CONDITIONS OF (PROJECT) APPROVAL

APPENDIX C – STATEMENT OF COMMITMENTS

APPENDIX D – RESPONSE TO SUBMISSIONS

APPENDIX E – ENVIRONMENTAL ASSESSMENT