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Delta Electricity

Report for Proposed Gas Turbine Power Facility at Bamarang, near Nowra

Noise Assessment – Amendments

August 2006

INFRASTRUCTURE | MINING & INDUSTRY | DEFENCE | PROPERTY & BUILDINGS | ENVIRONMENT

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Appendices

1. Introduction

This report is an amendment to GHD's Noise Impact Assessment report for Delta Electricity's proposed Gas Turbine Power Facility at Bamarang and replaces Section 7 of the original report.

GHD has been requested to revisit Section 7 of the original report to incorporate the following:

- Modelling of stage 1 (with mitigation) and discussion of results;
- A discussion of the exceedences identified in table 7.1 covering their frequency and significance;
- Include recommended mitigation measures in Section 7.2 for Stage 1 mitigation measures; and
- Include recommended sound performance levels to be included in the construction specification as a mitigation measure.

Further to these comments it has been noted that construction noise has the potential to reach project specific noise levels however this cannot be properly assessed until a construction schedule has been determined. Therefore it is recommended that further assessment be undertaken once a construction schedule is determined and a construction noise management plan be implemented.

It should be noted that there was a typographical error in Table 7.1 where 39.2 should have read 32.9 for Scenario 8. The correct level was displayed on the noise contours.

2. Recommended Mitigation Measures

2.1 Mitigation Scenarios

The exceedence levels are based on CCGT equipment raw data supplied by the manufacturers with no noise mitigation measures implemented. To meet project specific noise goals noise mitigation measures are recommended to be implemented for individual pieces of plant. However no acoustic attenuation data for the items of plant is currently available for the required attenuation of their individual component.

Therefore, CADNA-A was used to provide a mitigation scenario for each set of equipment having sound pressure level 80 and 85 dBA (SPL) respectively at 1m from the noise source which corresponds to the general industrial practice noise requirements. These sound pressure levels were converted to sound power for levels for modelling purposes using the equation:

$$SPL = SWL - 20\log r - 11$$

Where:

- SPL = Sound Pressure Level;
- SWL = Sound Power Level; and
- r =1m.

Therefore the resultant sound power levels used in the model were 91 and 96 SWL dB(A) respectively. From this the resultant predicted sound pressure levels at the receiver points can be determined for Stage 1 and Stage 2 as a guide.

To achieve the recommended noise mitigation scenario to meet project specific noise goals, the above-mentioned noise emission specification is recommended and should be provided by each individual equipment manufacturer. The below mentioned mitigation scenarios outlined should only be used as a guide to the achievable outcome.

2.1.1 Stage 2 Mitigation Scenarios and Results

The following mitigation scenarios were modelled for Stage 2:

- Scenario 7 – Stage 2 development, calm weather conditions, with no wind during day time period with 91 dB(A) SWL upgrade;
- Scenario 8 - Stage 2 development, Class F concawe weather conditions, wind speed 2 m/s towards north west (Lot 22 DP 746233 and 190 Bamarang Road) during early morning period with 91 dB(A) SWL upgrade;
- Scenario 9 – Stage 2 development, Class F concawe weather conditions, wind speed 2 m/s towards south east (213 Gannet Road) during early morning period with mitigation of 91 dB(A) SWL upgrade;
- Scenario 10 – Stage 2 development, calm weather conditions, with no wind during day time period with mitigation of 96 SWL dB(A) upgrade;

- Scenario 11 - Stage 2 development, Class F concawe weather conditions, wind speed 2 m/s towards north west (Lot 22 DP 746233 and 190 Bamarang Road) during early morning period with mitigation of 96 SWL dB(A) upgrade; and
- Scenario 12 – Stage 2 development, Class F concawe weather conditions, wind speed 2 m/s towards south east (213 Gannet Road) during early morning period with mitigation of 96 SWL dB(A) upgrade.

Modelled sound pressure levels for Stage 2 with noise attenuation measures in place are summarised in Table 7.1.

The predicted results for the Stage 2 development indicate that the project specific noise goals can be meet for all scenarios except for Scenario 11. It is predicted that for Scenario 11 at Location 1 the project specific noise goals will be exceeded by 3 dB(A) for the 96 dB(A) specification. This excedence will only occur in the presence of an F-Class inversion and a 2 m/s drainage flow in the direction of the residence. This is an extreme case as is unlikely to occur on a regular basis. A regular basis according to the INP is more than 30% of the time during the night time period.

Due to the low level and frequency of excedence for Scenario 11 it is unlikely to have an adverse acoustic impact on the residence at Location 1 if the 96 dB(A) specification is implemented.

Table 7.1 Stage 2 Predicted Receiver Sound Pressure Levels dB (A) – WITH Noise Attenuation Measures

Scenario	7	8	9	10	11	12	Project Specific Noise Goals dB(A)
Lot 22 DP 746233	29.2	32.9	29.2	34.2	37.9	34.2	35
213 Gannet Road	19.4	19.4	23.8	24.6	24.6	29.0	35
Bamarang 190 Road	11.9	15.1	11.9	17.0	20.2	17.0	35

Note – **37.9** indicates respective scenario exceeds project specific noise goal.

Predicted noise contour plots for Stage 2 are presented in Figures A7 – A12 in **Appendix A**.

2.1.2 Stage 1 Mitigation Scenarios and Results

The following mitigation scenarios were modelled for Stage 1:

- Scenario 13 – Stage 1 development, calm weather conditions, with no wind during day time period with 91 dB(A) SWL upgrade;
- Scenario 14 - Stage 1 development, Class F concawe weather conditions, wind speed 2 m/s towards north west (Lot 22 DP 746233 and 190 Bamarang Road) during early morning period with 91 dB(A) SWL upgrade;

- Scenario 15 – Stage 1 development, Class F concawe weather conditions, wind speed 2 m/s towards south east (213 Gannet Road) during early morning period with mitigation of 91 dB(A) SWL upgrade;
- Scenario 16 – Stage 1 development, calm weather conditions, with no wind during day time period with mitigation of 96 SWL dB(A) upgrade;
- Scenario 17 - Stage 1 development, Class F concawe weather conditions, wind speed 2 m/s towards north west (Lot 22 DP 746233 and 190 Bamarang Road) during early morning period with mitigation of 96 SWL dB(A) upgrade; and
- Scenario 18 – Stage 1 development, Class F concawe weather conditions, wind speed 2 m/s towards south east (213 Gannet Road) during early morning period with mitigation of 96 SWL dB(A) upgrade.

Modelled sound pressure levels for Stage 1 with noise attenuation measures in place are summarised in Table 7.2.

The predicted results for the Stage 1 development indicate that the project specific noise goals can be meet for all scenarios.

Table 7.2 Stage 1 Predicted Receiver Sound Pressure Levels dB (A) – WITH Noise Attenuation Measures

Scenario	13	14	15	16	17	18	Project Specific Noise Goals dB(A)
Lot 22 DP 746233	25.0	28.5	25.0	30.0	33.5	30.0	35
213 Gannet Road	14.6	14.6	18.9	20.1	20.1	24.6	35
Bamarang 190 Road	7.7	10.8	7.7	12.7	15.9	12.7	35

Predicted noise contour plots for Stage 1 are presented in Figures A13 – A18 in **Appendix A**

2.2 Noise Attenuation Options

It is presumed major components of the proposed CCGT power plant at Bamarang such as the combustion gas turbines, heat recovery steam generators, steam turbine and cooling towers would be selected from prospective Original Equipment Manufacturers (OEMs) following competitive tendering processes, which would occur as part of the detailed design development of the project. It is expected that the components selected would be 'off the shelf' units, provided by OEMs. Exact noise outputs, and therefore the necessary features that would need to be incorporated in the design to ensure that noise criteria will be achieved, can only be determined once the tendering processes are finalized.

The specification provided to prospective OEMs would dictate the acoustic performance and are recommended to be based on the conditions of consent from this Noise Impact Assessment. The OEMs would develop the mitigation measures such that the noise attenuation is maximised and impacts are minimised. The usual industrial practice, is to provide a performance-based specification approach involving a sound level specification, rather than a prescriptive requirement to include specific mitigation measures. This will promote design flexibility for the OEMs and to enhance their ability to achieve the optimum outcome in an efficient and effective way.

2.2.1 Potential Noise Mitigation Options for Major Equipment of the Proposed Power Plant Facility

This assessment has outlined sound power level requirements in order to achieve the project specific noise goals. It is not the intent of this report to outlined the prescriptive requirements for this project. However the following represents typical noise mitigation strategies for major equipment of similar power plant facilities.

Combustion Gas Turbine (CGT) - Stage 1 and 2

Typical noise emission mitigation improvements to be deployed for CGT include:

- Air inlet silencing;
- Acoustic insulation on the outside of the air inlet;
- Upgrades of the standard CGT acoustic enclosure;
- Upgrades of the cooling system with low noise fans and/or acoustic treatment;
- Upgrades of exhaust silencing;
- Acoustic walls and/or additional acoustic treatment for the generator enclosure;
- Placing the gas turbine in a building is usually the last resort due to capital outlay considerations; and
- The air inlet and cooling systems are generally outdoor sources and could potentially be attenuated.

Heat Recovery Steam Generator (HRSG) – Stage 2

Outlined below are general noise mitigation strategies that typically deployed in HRSGs of combined cycle power plants. This information here provided is only to be used as general guidance in developing the HRSG mitigation strategies, which is one part of the overall facility noise mitigation plan. HRSG noise mitigation strategies typically include:

- The installation of a silencer in the exhaust stack;
- Increasing the casing thickness/mass of the transition and/or boiler sections;
- Erecting barrier walls;
- Installation of an acoustical shroud over all or portions of the transition duct; and
- Installation of silencer in the transition portion of HRSG (this is normally the last resort i.e. when all other noise mitigation measures have been deployed and the noise requirement is still not met.)

Steam Turbine Generator (STG) – Stage 2

STG noise mitigation strategies typically include:

- Insulation of STG casing with acoustic blankets;
- Increase insulation thickness of all steam piping leading to STG;
- Installation of acoustic casing for STG; and
- Indoor installation of entire STG for the purpose of noise mitigation and weather protection.

Cooling Towers (CT) – Stage 2

CT noise mitigation strategies typically include:

- Barrier walls around CT;
- Implementing a low noise fan motor;
- Having acoustically designed fan blades;
- A silencer at force draft fan inlet; and
- A silencer at force draft fan outlet (not the preferred option as it will increase the fan backpressure and hence the fan power required).

It is additionally recommended that a noise monitoring program as part of a noise management strategy be implemented. The program would assess the noise compliance of the CCGT power plant, review and amend noise the noise management strategy as needed once the CCGT power plant is in operation.

2.3 Construction Noise Mitigation Measures

To minimise noise emissions during construction, the following management and mitigation measures are available to ameliorate likely noise impacts:

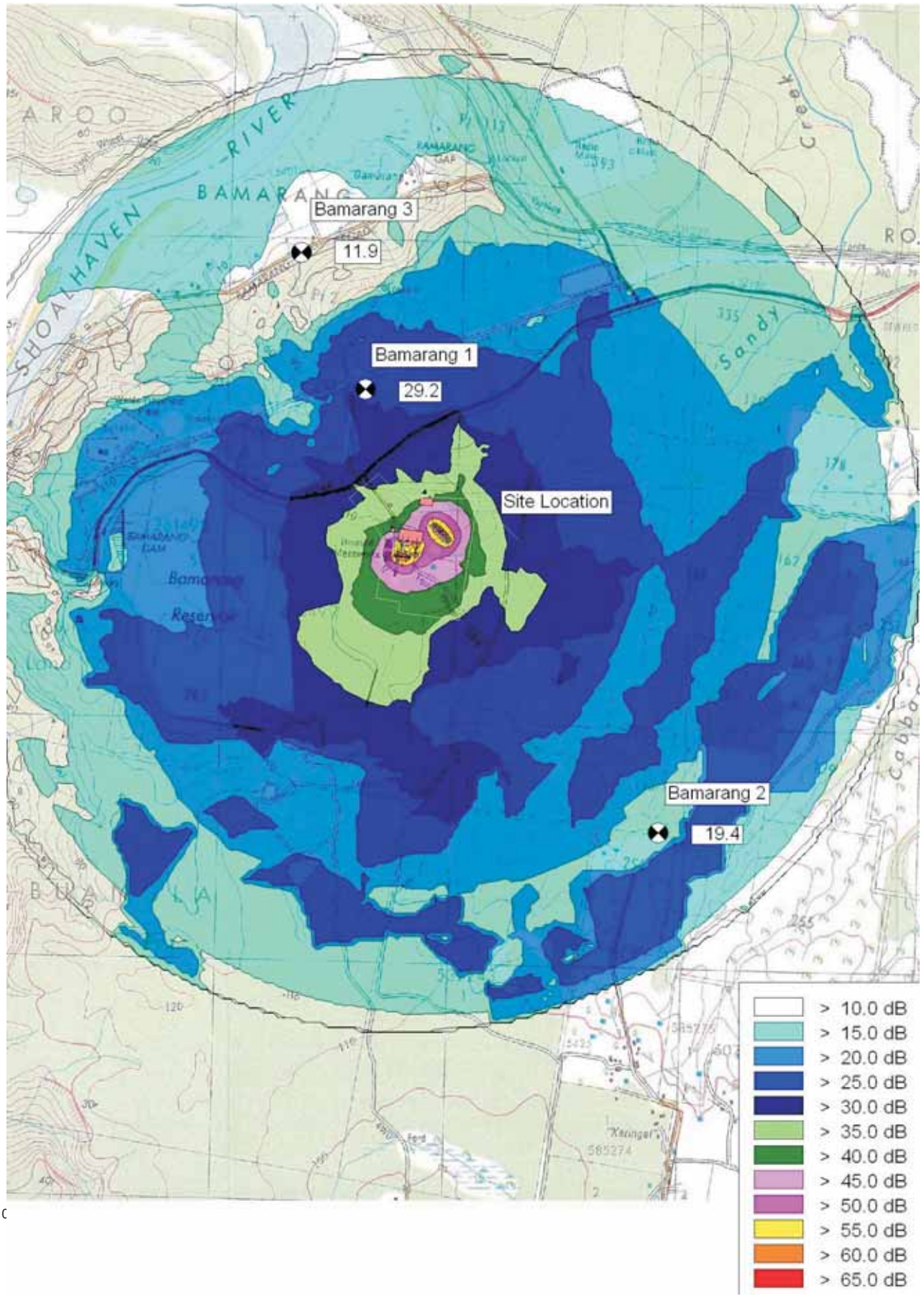
- All combustion engine plant, such as generators, compressors and welders will be checked to ensure they produce minimal noise with particular attention to residential grade exhaust silencers;
- Vehicles will be kept properly serviced and fitted with appropriate mufflers. The use of exhaust brakes will be eliminated, where practicable;
- Where practical, all vehicular movements to and from the construction site must be made only during normal working hours;
- Where practical, machines will be operated at low speed or power and will be switched off when not being used rather than left idling for prolonged periods;
- Machines found to produce excessive noise compared to industry best practice will be removed from the site or stood down until repairs or modifications can be made; and
- Where practical, impact wrenches will be used sparingly with hand tools or quiet hydraulic torque units preferred.

With regard to potential traffic noise, by keeping plant related vehicles serviced, fitted with mufflers and eliminating exhaust brake usage, noise due to trucking activity associated with the operation and construction of the CCGT power plant can be significantly mitigated.

To achieve the construction noise criteria at the closest residence (Location 1) the overall sound power level from construction as a guide should not exceed approximately 112 dB(A). This is based on distance attenuation, ground absorption and terrain shielding and it should be noted that these levels are highly dependent on the location of construction equipment. Further assessment should be undertaken once a construction schedule is determined It is additionally recommended that a noise monitoring program as part of a noise management strategy be implemented during the construction phase to assess compliance.

Appendix A

Predicted Noise Contour Levels



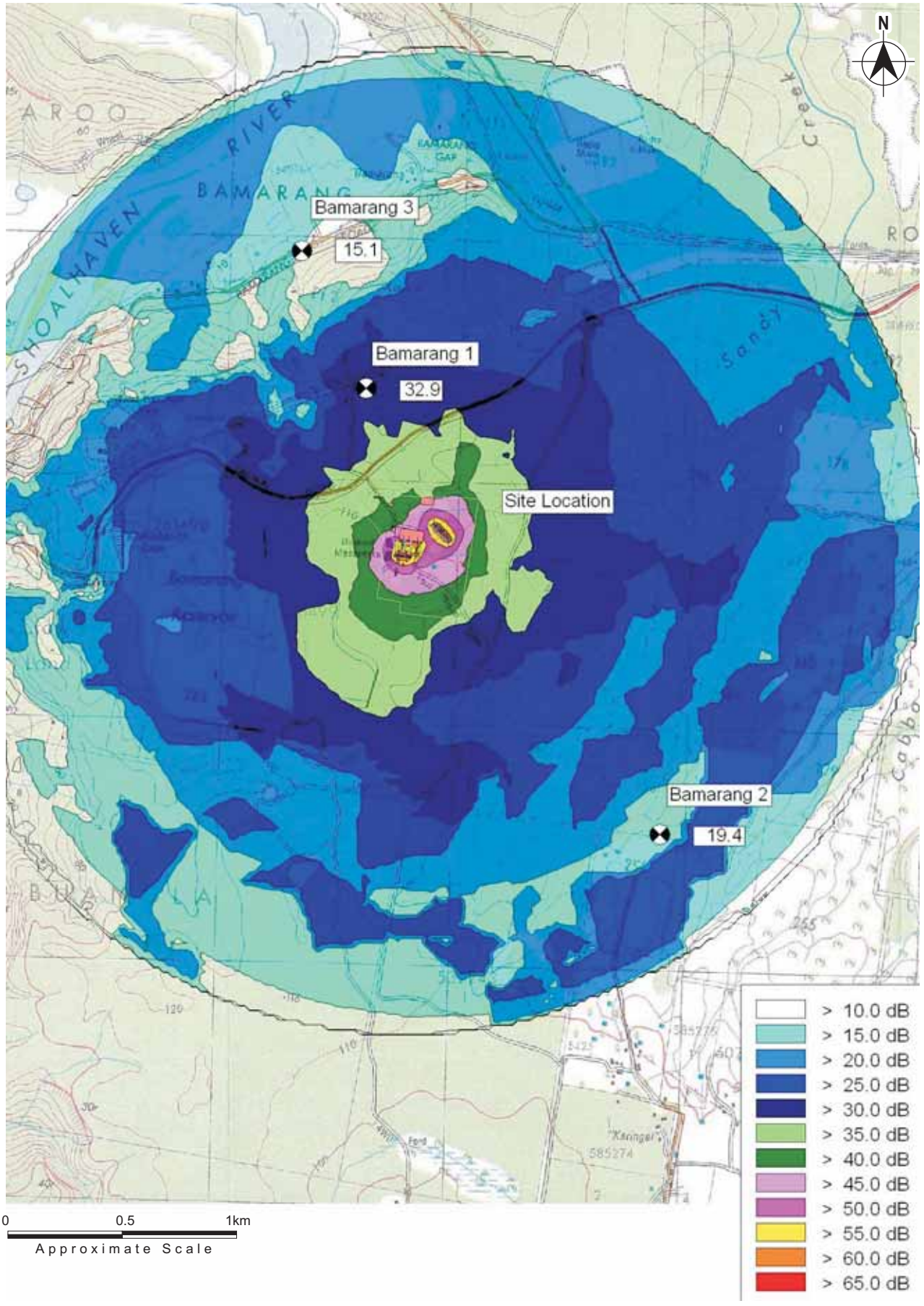
Date: 9 November 2005

Predicted Noise Levels - Scenario 7

File Name: 2211756_09.cdr

Noise Impact Assessment - Proposed Gas Turbine Power Station, Bamarang, Nr. Nowra

Figure A7



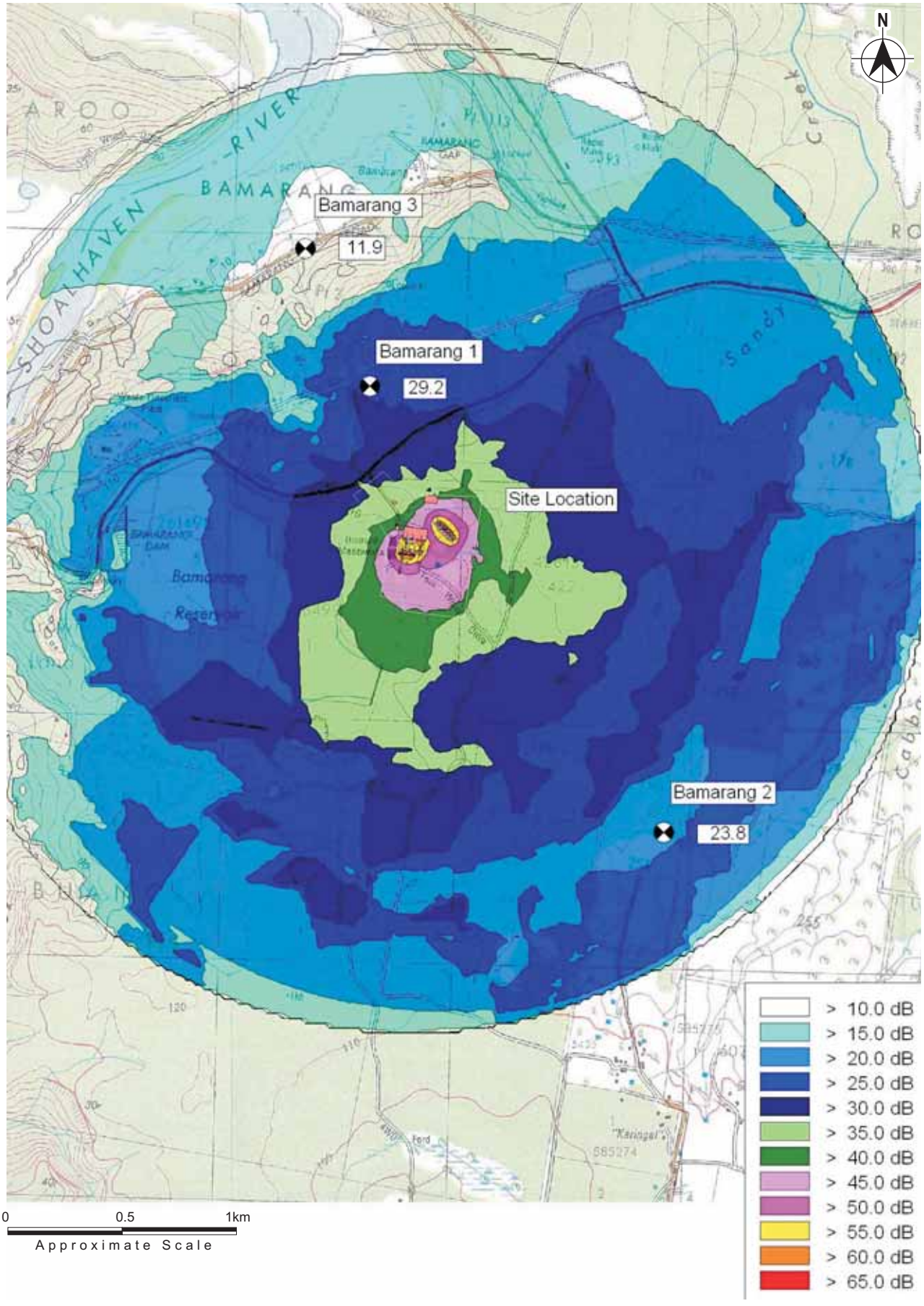
Date: 9 November 2005

File Name: 2211756_10.cdr

Predicted Noise Levels - Scenario 8

Noise Impact Assessment - Proposed Gas Turbine Power Station, Bamarang, Nr. Nowra

Figure A8

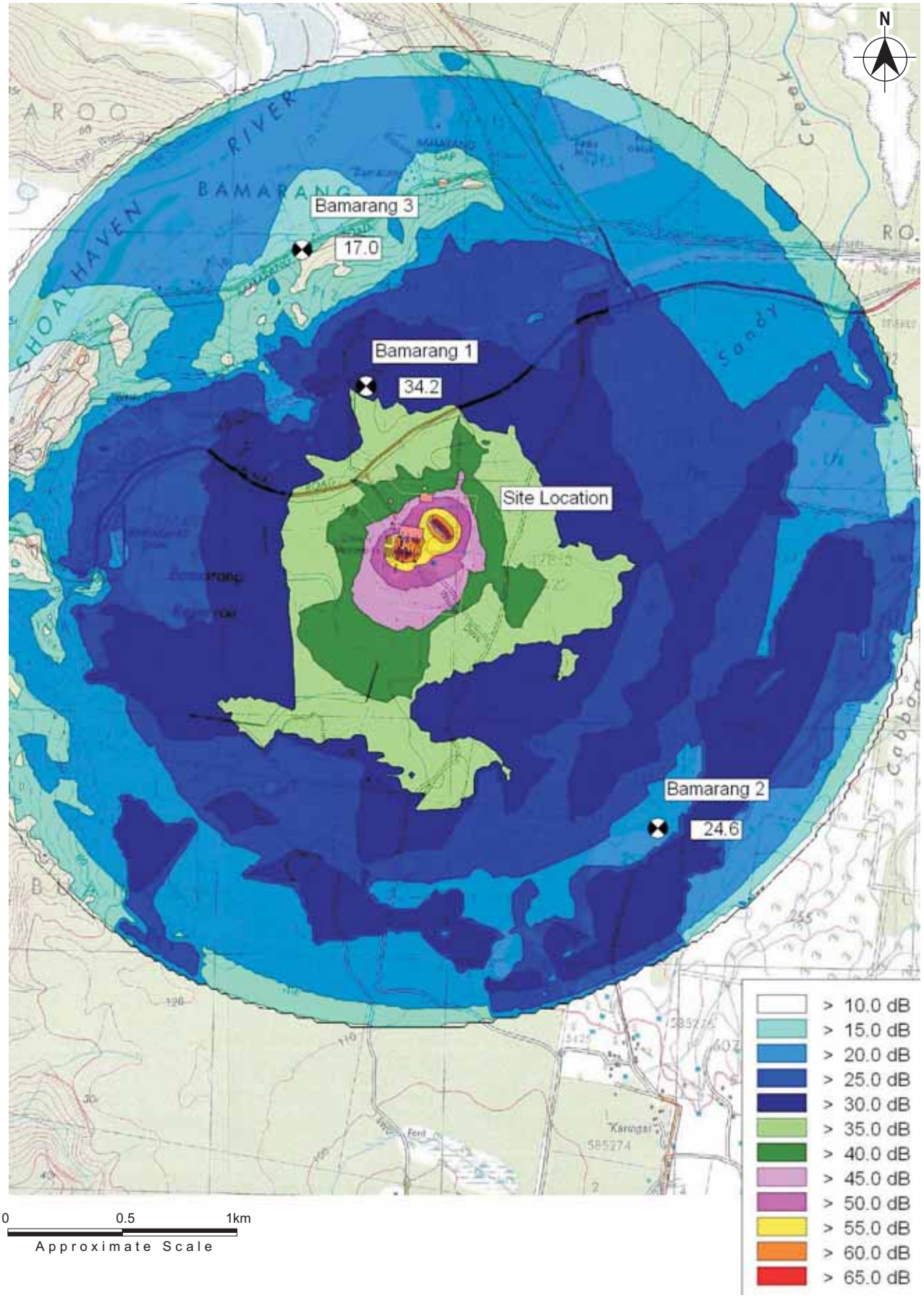


Date: 9 November 2005

File Name: 2211756_11.cdr

Predicted Noise Levels - Scenario 9

Figure A9



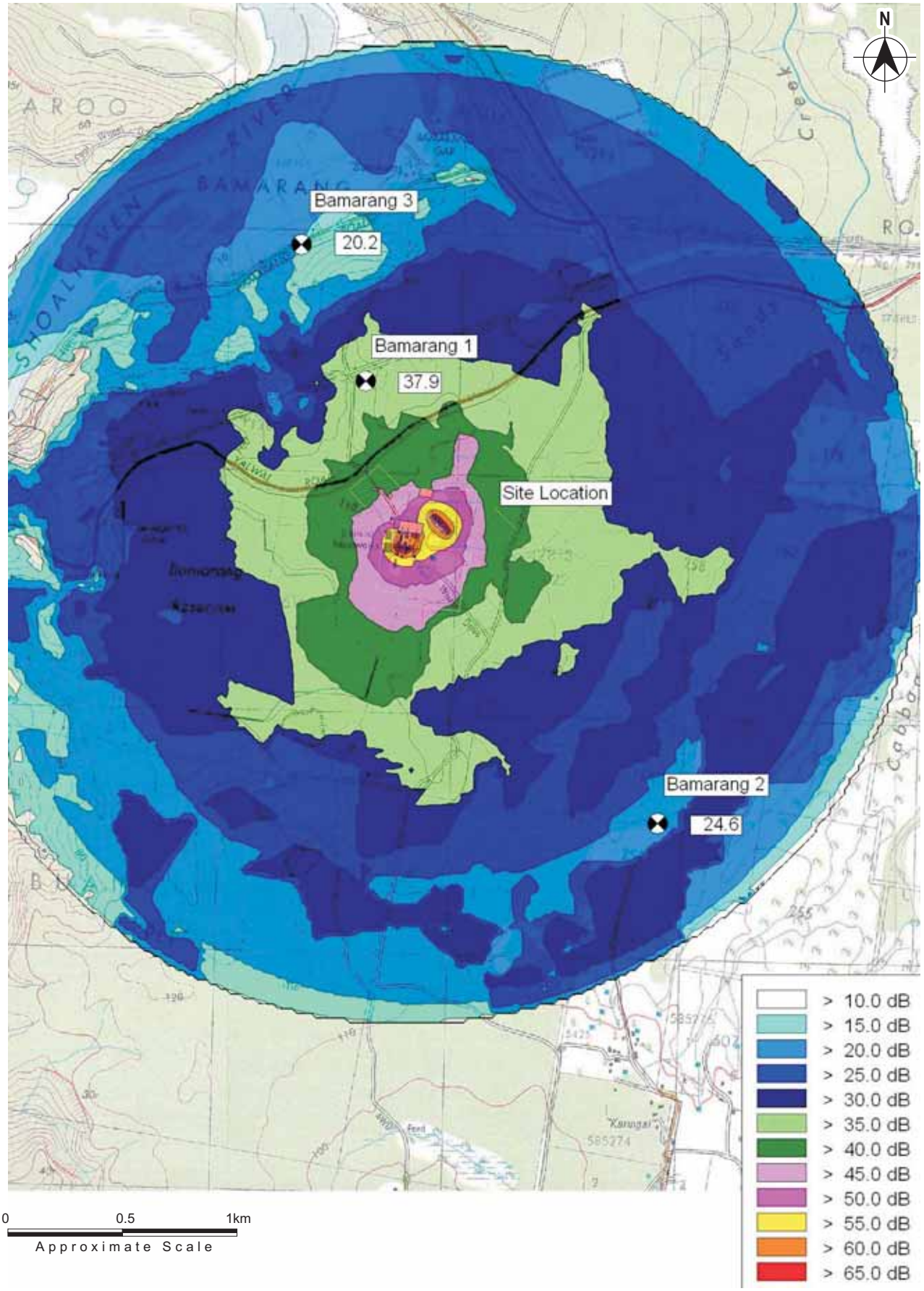
Date: 9 November 2005

File Name: 2211756_12.cdr

Predicted Noise Levels - Scenario 10

Noise Impact Assessment - Proposed Gas Turbine Power Station, Bamarang, Nr. Nowra

Figure A10

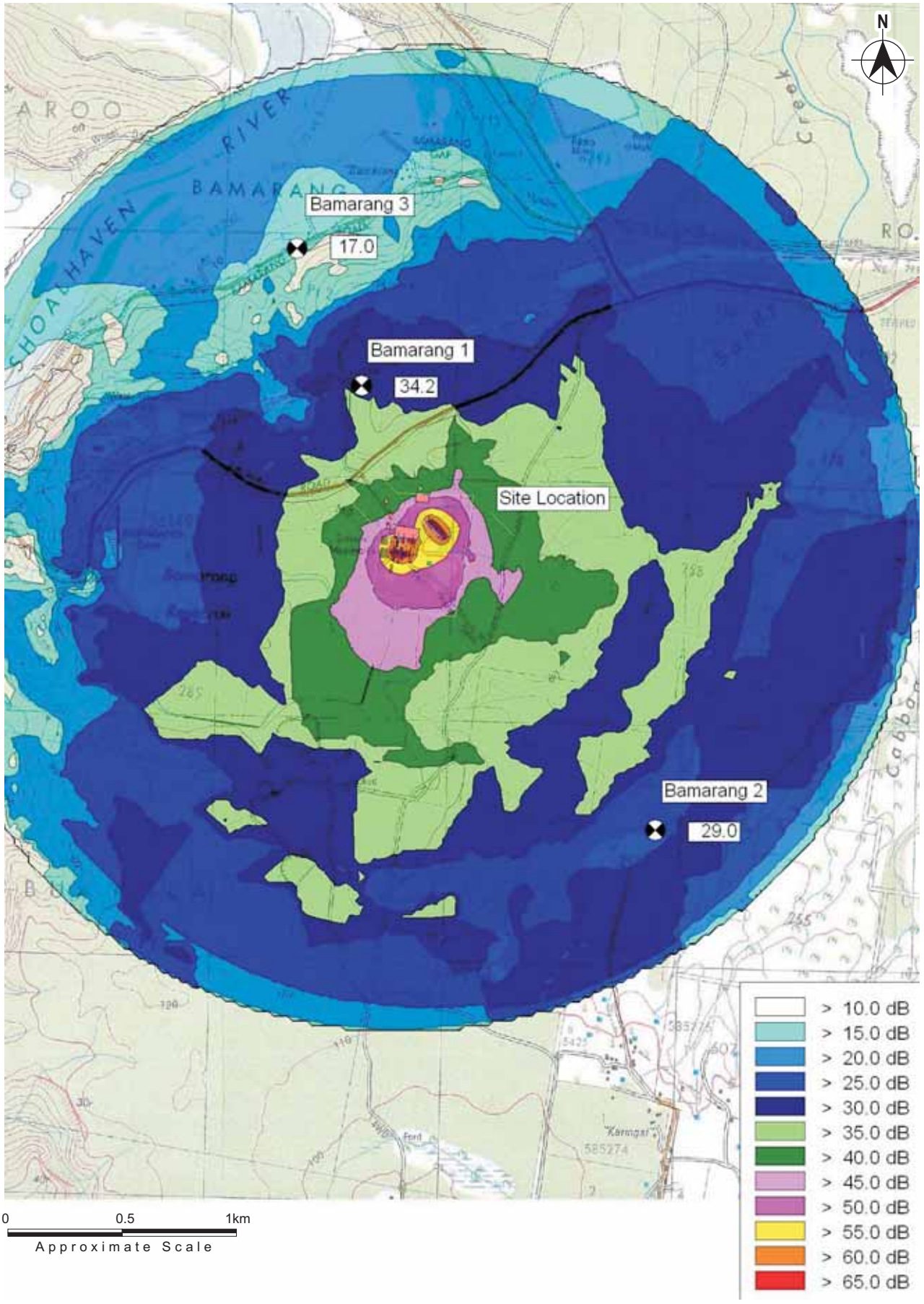


Date: 9 November 2005

File Name: 2211756_13.cdr

Predicted Noise Levels - Scenario 11

Figure A11



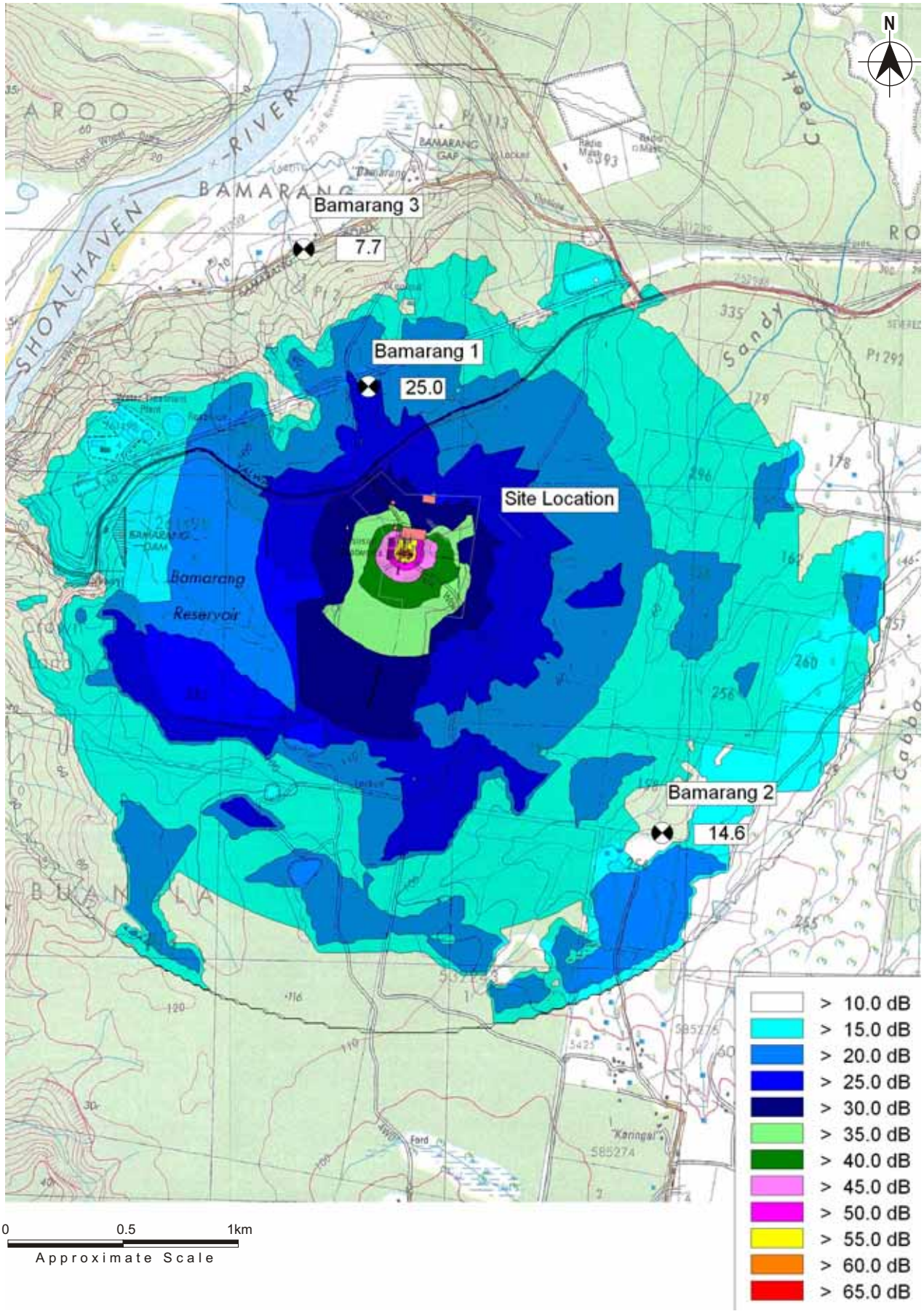
Date: 9 November 2005

File Name: 2211756_14.cdr

Predicted Noise Levels - Scenario 12

Noise Impact Assessment - Proposed Gas Turbine Power Station, Bamarang, Nr. Nowra

Figure A12



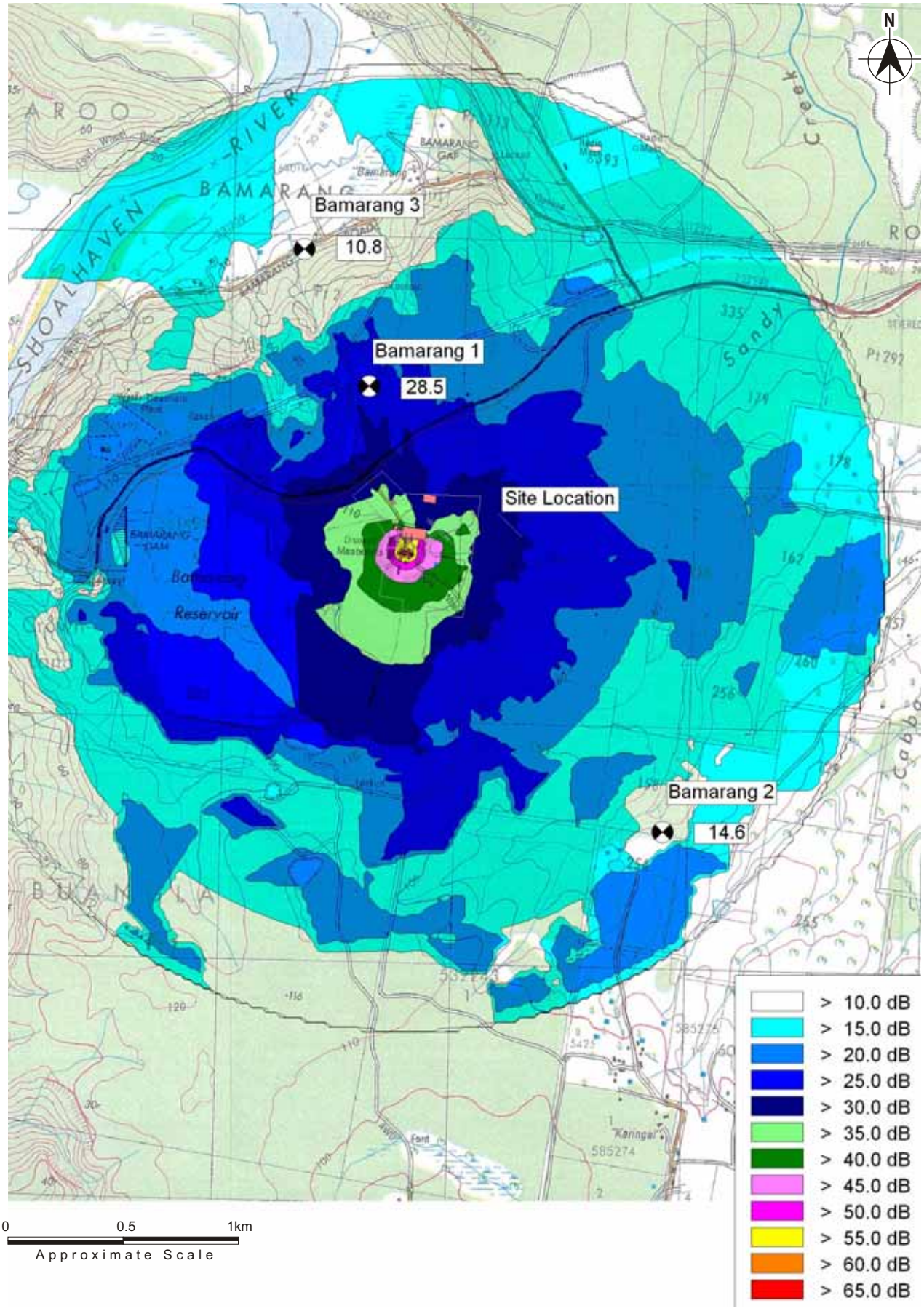
Date: 14 August 2006

Predicted Noise Levels - Scenario 13

File Name: 2113851-15_LTN_01.cdr

Noise Impact Assessment - Proposed Gas Turbine Power Station, Bamarang, Nr. Nowra

Figure A13



Date: 14 August 2006

Predicted Noise Levels - Scenario 14

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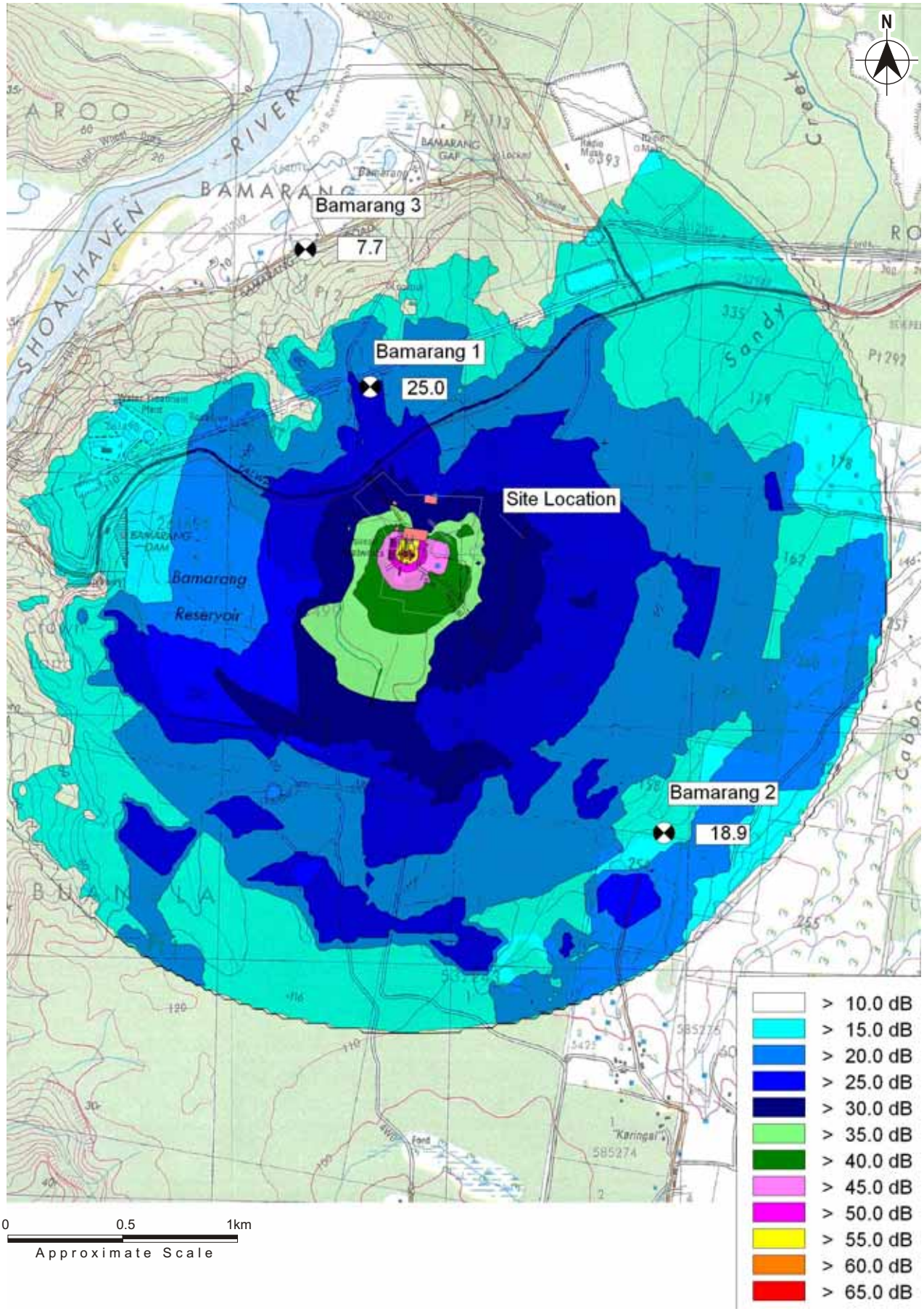
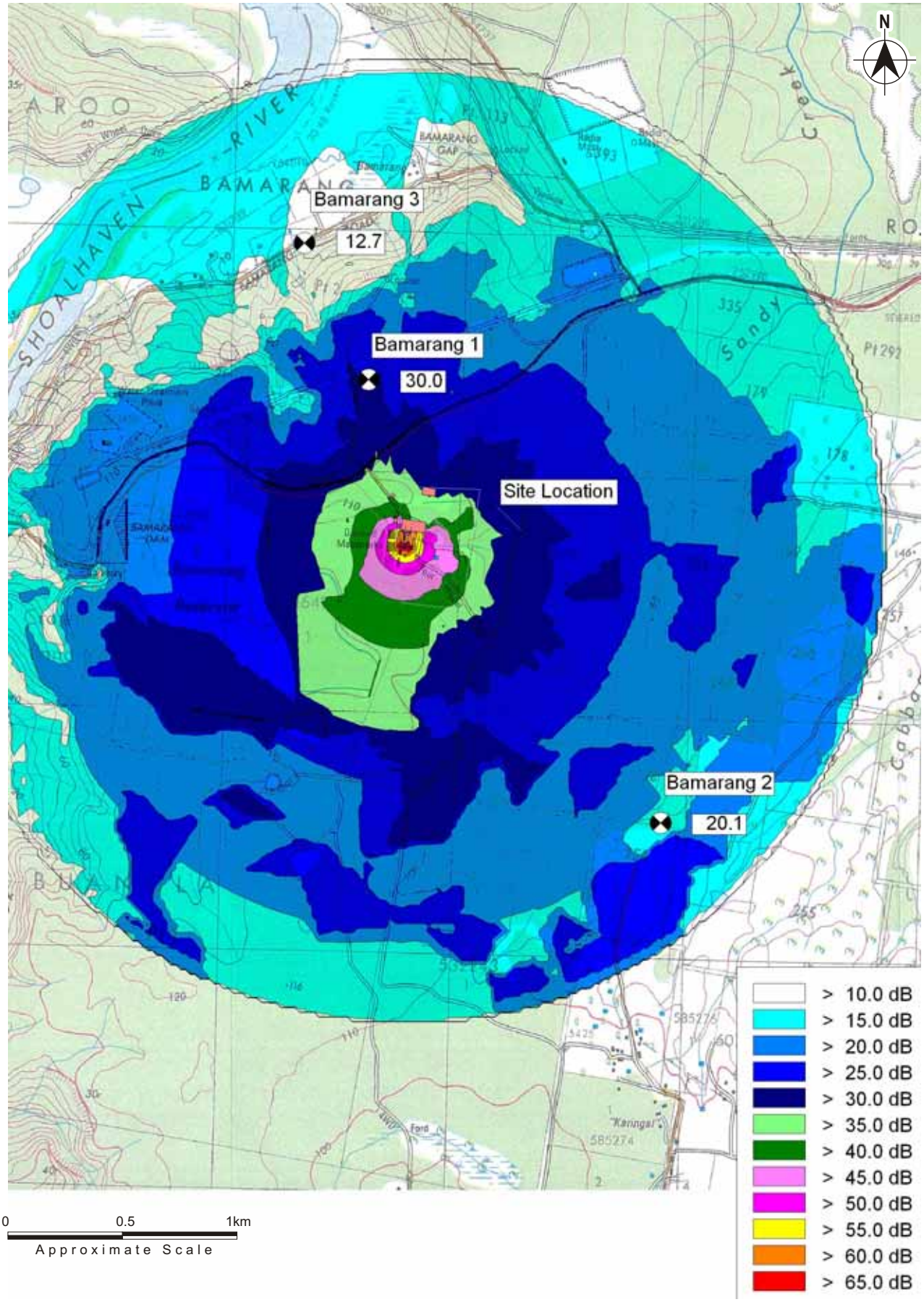
Noise Impact Assessment - Proposed Gas Turbine Power Station, Bamarang, Nr. Nowra

Figure A14



Date: 14 August 2006

Predicted Noise Levels - Scenario 15



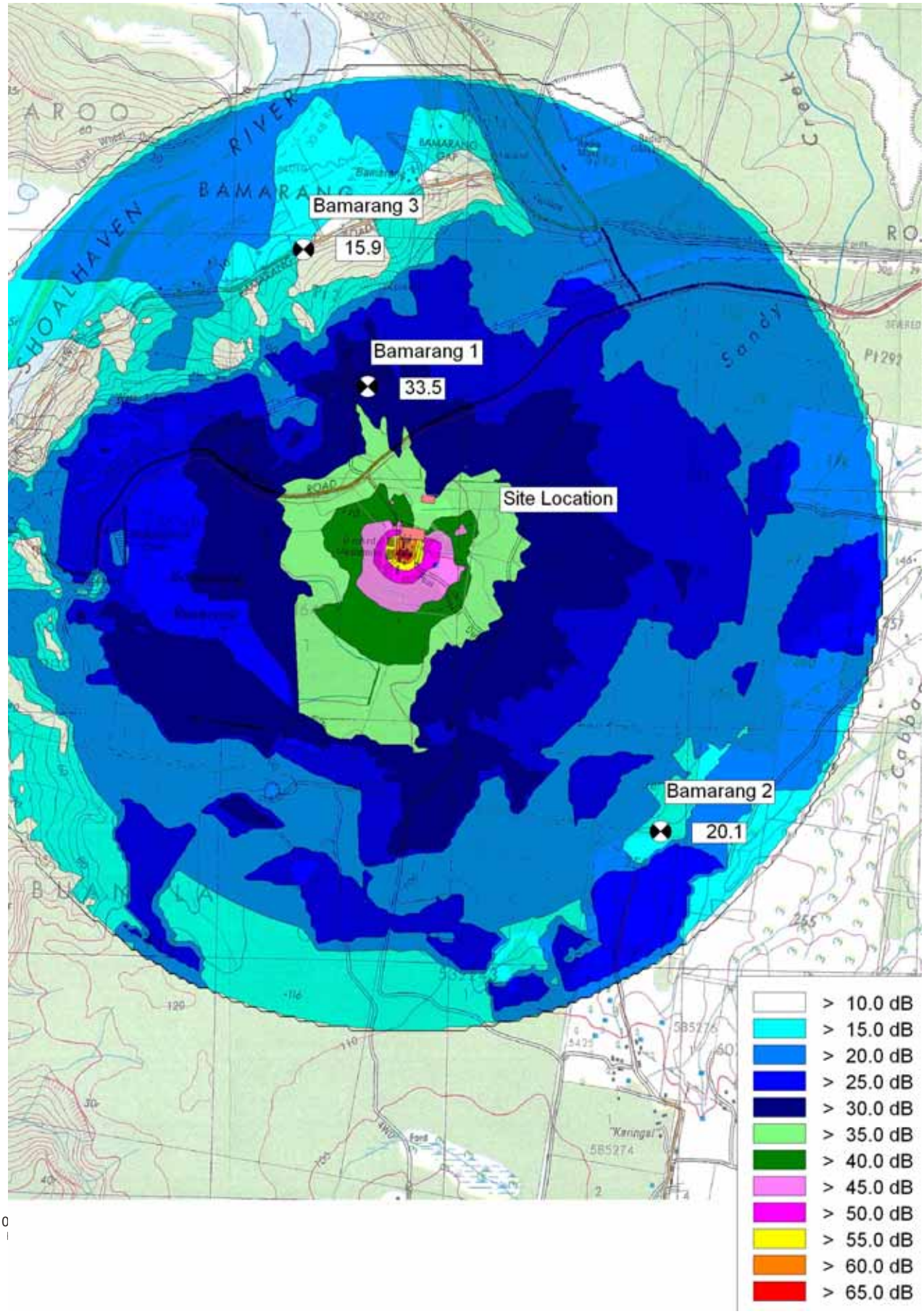
Date: 14 August 2006

Predicted Noise Levels - Scenario 16

File Name: 2113851-15_LTN_04.cdr

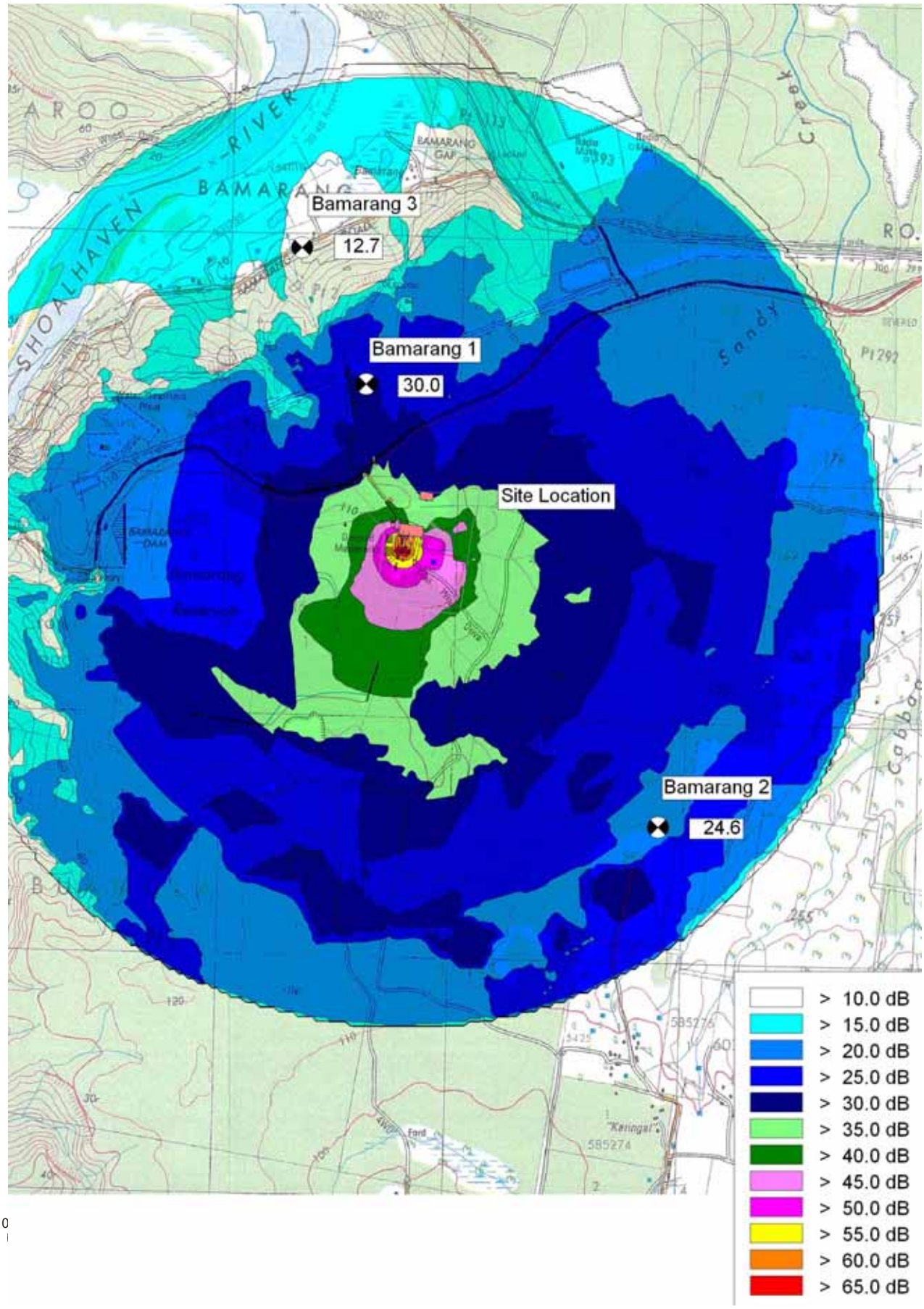
Noise Impact Assessment - Proposed Gas Turbine Power Station, Bamarang, Nr. Nowra

Figure A16



Date: 14 August 2006

Predicted Noise Levels - Scenario 17



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Predicted Noise Levels - Scenario 18

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