10. Air quality

10.1 Assessment approach

The potential impacts on local and regional air quality as a result of the operation of the proposed Stage 2 ash repository were assessed. The air quality assessment addresses the Environmental Assessment requirements for the project provided by the Director-General of the Department of Planning (see Appendix C). The air quality investigation (included as Technical Report 4 in Appendix H) follows the assessment procedures set out in the NSW DECC's Approved Methods for the Modelling and Assessment of Air Pollutants in NSW (2005). The assessment includes:

- A qualitative analysis of the proposal to identify emissions to be considered.
- A review of dispersion conditions and a review of climatic elements.
- A review of existing air quality conditions in the area with a view to determining acceptable increments in pollutant levels to ensure that any additional emissions would not result in exceedance of the relevant assessment criteria.
- A quantitative analysis of the proposal to develop an emissions inventory suitable for use with a dispersion model.
- The development of a terrain file for use with a dispersion model.
- Modelling of the dispersion of emissions from the operation of the proposed Stage 2 ash repository.
- An assessment of the air quality effects of the proposed ash repository.
- Details of proposed mitigation and management measures to address potential impacts on local air quality.

10.2 Site context

10.2.1 Local meteorological conditions

The closest meteorological monitoring station is operated by the Mount Piper Power Station. It is located approximately 1 kilometre to the north of the Mount Piper Power Station and approximately 7.5 kilometres to the north-northwest of the proposed Stage 2 ash repository area (see Figure 10-1). Meteorological conditions in the study area would be influenced by several factors including local terrain and land use. Seasonal and annual wind roses for hourly data collected at the Mount Piper meteorological station between 2001 and 2004 indicate that the predominant winds are from the west-southwest. The annual frequency of calm periods (when winds were 0.5 metres per second or below) is about 5%, with the highest proportion of calm periods occurring during winter (8.7%). The mean wind speed in 2003 at the Mount Piper site was 2.5 metres per second.

Because of the blocking effect of the topography to the south-east of the existing Stage 1 and proposed Stage 2 ash repository areas, the south-east winds observed at Mount Piper may not be as common or as strong as they are at Mount Piper. The predominant west-south-west winds would be expected to occur at both the proposal site and at Mount Piper. The use of the Mount Piper data to assess the transport of dust from operations at the

proposed Stage 2 ash repository area is considered to be slightly conservative, at least as far as impacts on the closest residential areas is concerned, as a result of the predominantly weaker winds at the Kerosene Vale site.

10.2.2 Ambient air quality

No daily particulate matter less than or equal to 10 microns in aerodynamic diameter (PM_{10}) or total suspended particulate (TSP) monitoring data are available for the area; however, existing air quality is monitored at a network of dust deposition gauges shown in Figure 10-1. The dust gauge location most likely to be indicative of the existing Stage 1 operation and the proposed Stage 2 activities are listed in Table 10-1.

Table 10-1 Description of relevant dust gauge locations

Gauge	Location
DG5	DG5 is located to the west of Lidsdale residents.
DG27	DG27 is not near residences.
DG28	In 2006 DG28 was the only dust gauge to experience an annual average deposition level of insoluble solids above the 4 grams per square metre per month (g/m^2/month) assessment criterion. This gauge is not in a residential area.
DG29	DG29 is approximately 350 metres to the east of the residential areas of Lidsdale.
DG30	North-east of DG5 and north-west of DG29 and the existing and proposed repository areas.

Table 10-2 summarises the results of the dust deposition monitoring at the dust gauge locations. Monthly deposition levels appear to be low and the recorded exceedances appear to be caused by one or two months in the year when very high levels are recorded. The most recent data provided for this study (since February 2006) included data on the ash and combustible matter in the sample. The results indicate that the high recordings were associated with high proportions of combustible matter. This suggests that at least some of the elevated levels are due to vegetable matter, bird droppings, or other materials that are not associated with operation of the Stage 1 ash repository area.

Overall it is reasonable to conclude that dust deposition levels in the residential areas of Lidsdale would comply with the DECC assessment criterion.

Table 10-2 Dust (insoluble solids) monitoring data

Date	Dust gauge name (see Figure 10-1) (g/m^2/annual average)				
	DG5	DG27	DG28	DG29	DG30
2002		1.7	2.2	1.2	0.8
2003		1.3	2.1	7.4	0.8
2004		1.8	1.3	5.3	0.7
2005		5.7	2.0	4.9	1.0
2006	1.2	3.2	4.9	3.0	1.0
Jan–Jun 2007	1.0	3.9	1.8	3.0	1.1

Note: The DECC amenity-based criteria for dust fallout is maximum total dust deposition is 4 g/m^2/month (annual)

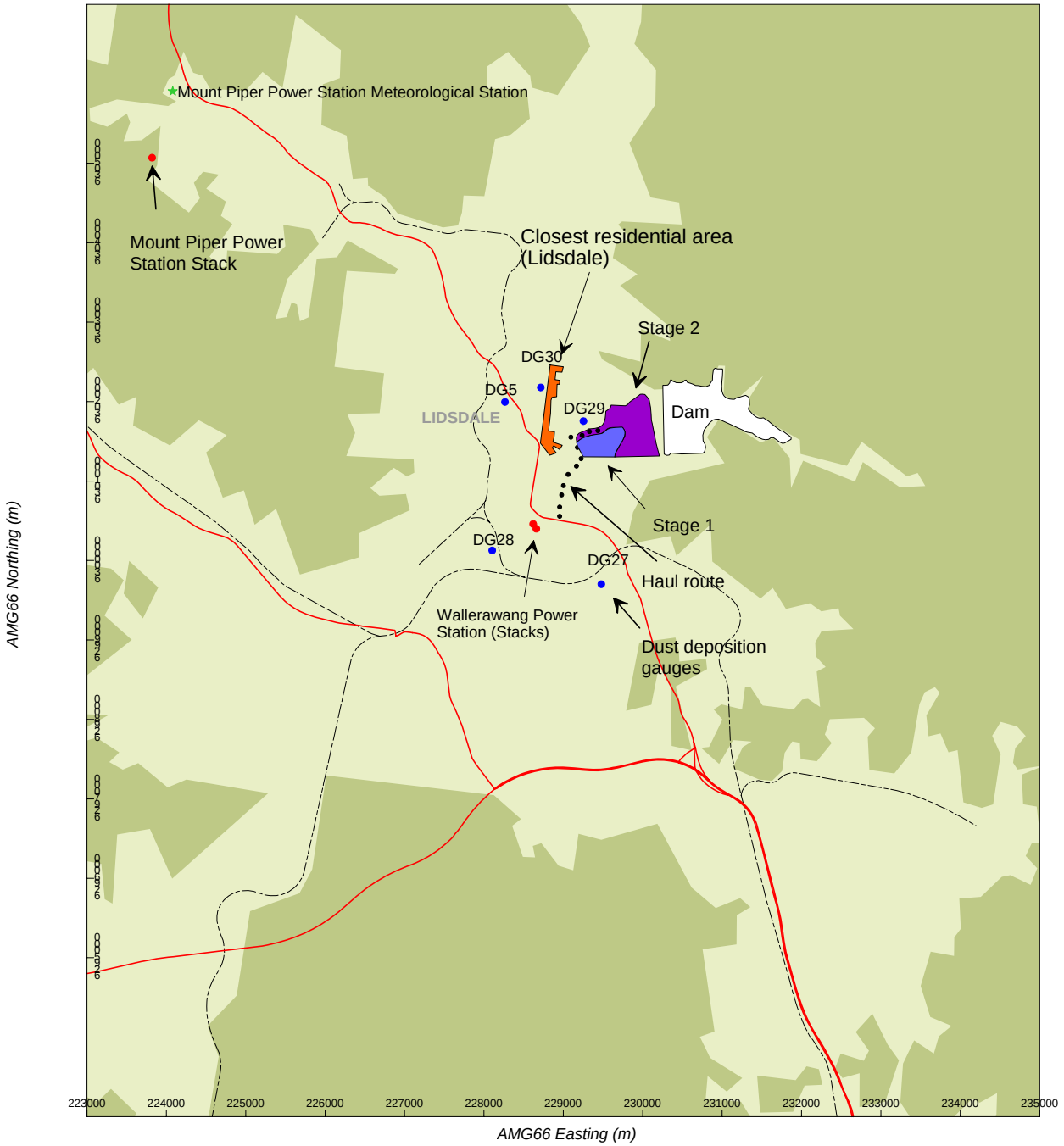

Figure 10-1 Meteorological station and dust gauge locations

As there are no daily PM_{10} or TSP monitoring data for the area, the DECC PM_{10} monitoring station at Bathurst (approximately 50 kilometres to the west of Lidsdale) has been used. The data provide an indication of the 24-hour average background PM_{10} concentrations likely to be experienced in the area. The Bathurst monitoring station is the closest daily background data set and while there is a significant distance between Lidsdale and Bathurst the air quality in the two locations is considered to be similar. This has been compared with closer weekly PM_{10} and TSP weekly monitoring data at Blackmans Flat to confirm that Bathurst data is representative. This comparison indicates similar annual background levels.

On this basis and given the nature of these estimates, it would be reasonable to add a small margin to the estimated levels, and for assessment purposes it has been assumed that annual average PM_{10} concentrations would be around 20 µg/m^3 and annual average TSP concentrations would be around 30 µg/m^3.

Table 10-3 PM_{10} monitoring data from Bathurst (maximum 24-hour percentile levels based on 24-hour averages)

Year	Data availability (%)	Exceedances of the 50 µg/m^3	Max.	99th	98th	95th	90th	75th	50th	25th
2000	32.5	0	35.2	33.6	32.4	27.6	22.4	17.7	12.2	8.9
2001	30.1	0	35.6	35.3	35.0	31.3	27.5	22.7	16.5	12.3
2002	91.8	**15**	**258.2**	**83.6**	**68.8**	45.7	35.2	25.0	16.6	12.5
2003	90.4	**12**	**621.7**	**103.4**	**75.0**	34.4	26.8	17.0	12.8	8.8
2004	88.5	4	**72.9**	49.9	46.1	37.9	33.3	24.2	15.3	9.7
2005	93.2	0	44.9	38.3	36.6	30.5	25.2	18.3	12.8	8.8
2006	98.6	2	**61.3**	45.5	43.8	34.4	28.4	21.9	15.2	11.3

Source: DECC (2006) 24-hour PM_{10} assessment criterion is 50 µg/m^3

Note: Air-NEPM standard allows five exceedances of the goal before air quality is considered to have exceeded the NEPM standard

10.3 Impacts on air quality

Emissions of fugitive dust from ash handling operations can be estimated using emission factor equations published by the US EPA (1985) for input into modelling software to determine offsite impacts of dust emitted from the site. A detailed description of these calculations and modelling is provided in Technical Report 4 (Appendix H).

Dust sources at the site have been identified as:

- Vehicles travelling on paved areas to and from the ash handling facilities at Wallerawang Power Station to the ash repository area.
- Placing of ash in the repository area.
- Shaping the placed material using dozers.
- Wind erosion from the exposed ash surface.

Dust at the emplacement site is controlled using a number of measures. There are two water carts available onsite 24-hours a day. They normally follow dozers and trucks but can be deployed to any area where emissions are occurring or anticipated to occur. Emplaced ash is permanently capped using topsoil once the volume available for emplacement has been used. Temporary PVA capping is applied to seal ash areas where ash is not currently being

emplaced and sprinklers are used for uncapped areas that have not been stabilised by other means. Further to this, an irrigation system is currently used within the ash emplacement/repository area that replicates continual wet conditions on all work areas, particularly when periods of elevated wind speeds are present at the site. The estimated emission of dust takes these control measures into account, where possible. Dust generation at the site has been calculated and used within modelling outlined below, a detailed breakdown of this is provided in Technical Report 4.

A significant fraction of this dust will fall directly back to the site area and only a small quantity has the potential to migrate off-site. In order to assess potential off-site impacts, an ISCMOD model was used and outputs for maximum and average PM_{10} concentrations, annual average dust concentrations and annual TSP concentrations were calculated. Each of these is described below.

Maximum Calculated 24-hour average PM_{10} concentrations

Maximum calculated 24-hour average concentrations due to emissions from the site are shown in Figure 10-2. The maximum calculated PM_{10} concentration due to operations at the Kerosene Vale ash repository at the most affected residential area is 17 $\mu g/m^3$. This is less than the DECC 24-hour assessment criterion for PM_{10} and would allow a background of 24-hour average PM_{10} concentration due to other sources of 32 $\mu g/m^3$ to exist before the 50 $\mu g/m^3$ criterion would be exceeded.

Bathurst is the closest DECC monitoring site with PM_{10} monitoring data and the data from this site was reviewed for this assessment (Technical Report 4). Four of the past seven years experienced 24-hour PM_{10} concentrations above the DECC 50 $\mu g/m^3$ assessment criterion and in 2003 the maximum 24-hour average recorded was 622 $\mu g/m^3$ in the presence of bushfire smoke. In the absence of strong contributions from bushfire smoke, the maximum 24-hour PM_{10} concentrations would appear to be 35 to 36 $\mu g/m^3$. If these days with the highest background levels were to correspond with the highest calculated contribution from the operation of the ash repository (17.3 $\mu g/m^3$) a marginal exceedance of 3 $\mu g/m^3$ would occur. A model run to predict the time series of 24-hour PM_{10} concentrations at a receptor located at 228900 mE and 6301425 mN (Special Receptor — Figure 10-2) was undertaken with the objective of identifying the frequency with which 'high' concentrations occurred. The second highest calculated 24-hour concentration was 13.6 $\mu g/m^3$, this would not give rise to an exceedance. Thus, assuming that the air quality at Lidsdale is similar to that at Bathurst, the probability of an exceedance occurring once a year without unusual air pollution events (e.g. bushfires, dust storms), is extremely small — 0.27% (i.e. 1/365).

Calculated annual average PM_{10} concentrations

Calculated annual average PM_{10} concentrations due to emissions from the site are shown in Figure 10-3. The annual PM_{10} concentration due to operations at the Kerosene Vale ash repository at the most affected residence is 3 $\mu g/m^3$. Given an existing annual average PM_{10} concentration of 20 $\mu g/m^3$, the total would become 23 $\mu g/m^3$, which is less than the DECC's assessment criterion of 30 $\mu g/m^3$ for annual average PM_{10} concentrations.

Calculated annual average TSP concentrations

Calculated annual average TSP concentrations due to emissions from the site are shown in Figure 10-4. The annual TSP concentration due to operations at the Kerosene Vale ash repository at the most affected residence is 4 $\mu g/m^3$. Given an existing annual average TSP concentration of 30 $\mu g/m^3$ the total would become 34 $\mu g/m^3$, which is less than the DECC's assessment criterion of 90 $\mu g/m^3$ for annual average TSP concentrations.

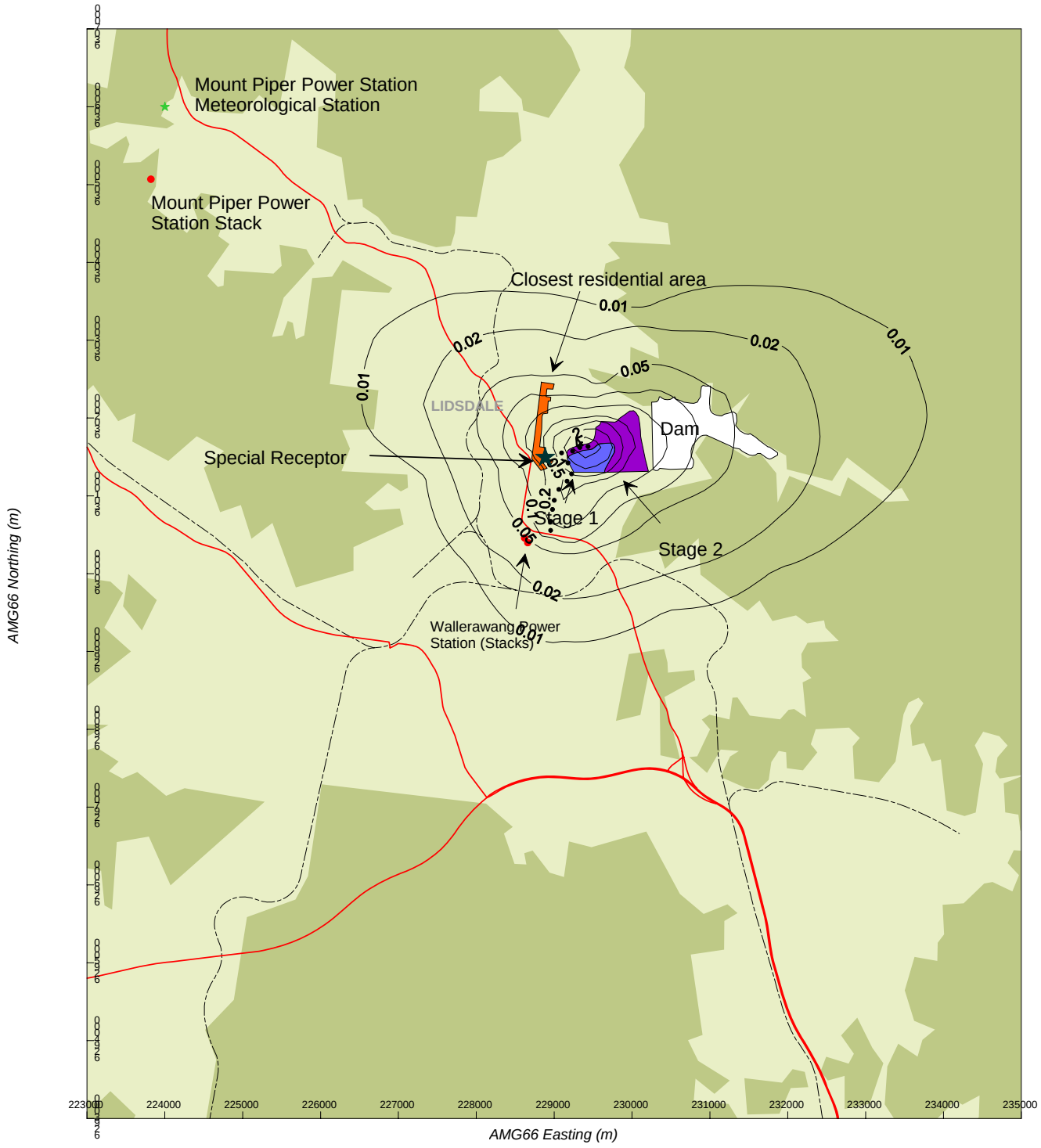

Figure 10-2 Predicted maximum 24-hour average PM_{10} concentration — µ/m^3

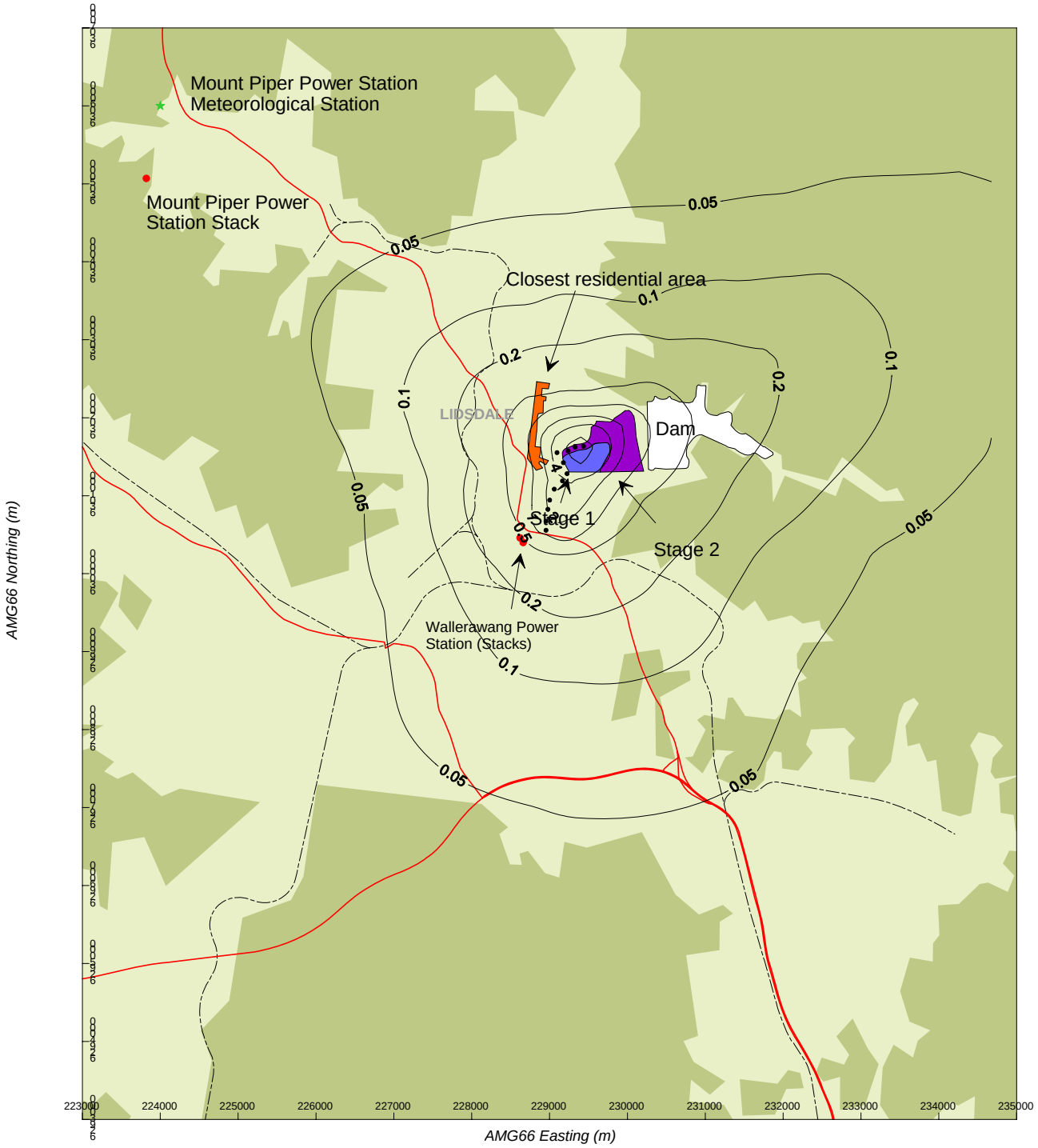

Figure 10-3 Calculated annual average PM_{10} concentrations — $\mu g/m^3$

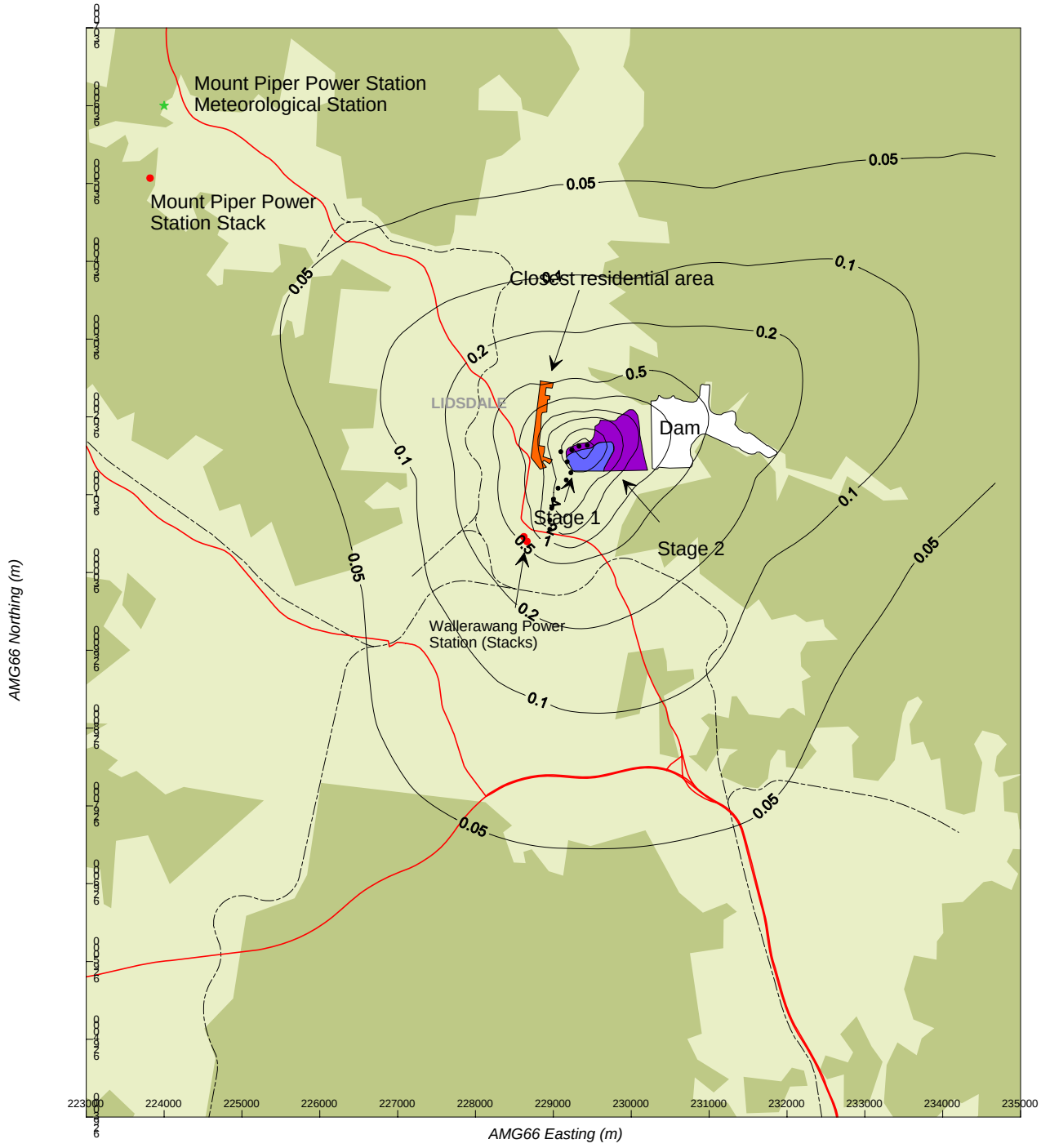

Figure 10-4 Calculated annual average TSP concentrations — µg/m^3

Calculated annual average dust (insoluble solids) deposition

Calculated annual average dust deposition levels due to emissions from the site are shown in Figure 10-5. The annual dust (insoluble solids) deposition level due to operations at the Kerosene Vale ash repository at the most affected residence is 0.5 g/m^2/month. Given that existing annual average deposition levels are less than 3 g/m^2/month, the total would be less than the DECC's assessment criterion of 4 g/m^2/month.

The model prediction indicates that deposition levels would be below the DECC's criterion of 4 g/m^2/month provided the background level does not exceed 3.5 g/m^2/month (annual average).

10.3.1 Cumulative impacts

Dust gauges in the area record the influence of dust from surrounding activities and these measurements form the basis of the air assessment described in this section. The use of these existing conditions, which incorporate existing activities in the area means that the assessment of impacts outlined above allows for cumulative impact of the proposed activity relative to existing activities.

We are unaware of any approved projects that are not yet operational that would cause a further cumulative impact on air quality over and above that indicated within dust monitoring for the area. The air assessment, whilst indicating a small incremental increase in dust, will still fall within the criteria set out in relevant guidelines on a cumulative basis. It should also be noted that in the net sense the air impacts of the proposed Stage 2 activities will be similar to those of the current Stage 1 operation, and in this respect there will not be a significant change in air quality. It is anticipated that Stage 2 activities will commence once Stage 1 activities are complete resulting in a neutral impact on air quality when compared to existing activities.

10.3.2 Summary of impacts

Model predictions have been made showing the effects of the proposed Stage 2 ash repository operating at 1,500 tonnes of ash per day assuming 365 days of operation per year and using the emissions estimated in the Air Quality Assessment (see Appendix H). It has been assumed that the operator would apply reasonable dust-control measures throughout operation (i.e. maintain sealed haul roads in a clean condition and maintain moisture levels in the ash at 15% until the material is placed in the repository area). Moisture levels in the emplaced ash have been assumed to be 15%. The continued use of the existing irrigation system within the ash emplacement/ repository area that replicates continual wet conditions during periods of elevated wind speeds will further mitigate dust impacts to less than calculated.

As previously discussed, emplaced ash is permanently capped using topsoil once the volume available for emplacement has been used. Temporary PVA capping is applied to seal ash areas where ash is not currently being emplaced and sprinklers are used for uncapped areas that have not been stabilised by other means. The area of uncovered ash face would be kept to a minimum through the use of a staged stacking approach, with completed areas capped once design height is reached, thereby minimising the potential for dust blown from the ash surface. It is expected that the damping of the ash would form a surface that is stable against wind erosion on any uncapped areas.

Calculated annual average PM_{10} and TSP concentrations and dust (insoluble solids) deposition at the most affected residence during operation of the proposed Stage 2 ash repository are summarised in Table 10-4 and discussed below.

Table 10-4 Calculated annual average pollutant emissions at the most affected residence during operation

Pollutant	Emission due to Stage 2 operations	Existing background levels	Total expected	DECC criteria	Exceedance
PM_{10} (μ/m^3)	3	19	22	30	No
TSP (μ/m^3)	4	30	34	90	No
Insoluble solids (dust) (g/m^2/month)	0.5	<3	<3.5	4	No

Existing air quality with respect to PM_{10} and TSP concentrations is not well characterised due to weekly rather than daily monitoring at Blackmans Flat; however, deposition levels are monitored at six sites. An analysis of the data from these six sites indicates that the dust deposition levels in the residential areas of Lidsdale would comply with the DECC assessment criterion. Based on the data collected at DG5 (the closest monitor) the levels are likely to be range between 0.7 and 1.1 g/m^2/month.

The proposed Stage 2 ash repository would involve similar levels of activity as Stage 1. Model prediction of the worst-case dust emissions during the operation of the proposed Stage 2 area suggests that the emissions would contribute only very minor increases in long-term dust concentrations or deposition levels at the residential areas of Lidsdale. The probability of the DECC 24-hour PM_{10} assessment criterion of 50 $\mu g/m^3$ being exceeded (in the absence of other emission sources such as bushfire smoke), is estimated to be 0.27%.

Based on the last 7 years of DECC monitoring data, the likelihood of an exceedance associated with the operation of the proposed Stage 2 ash repository is significantly lower than the chance of exceedance due to unusual conditions such as the presence of bushfire smoke, assuming that operational dust emission controls are in place.

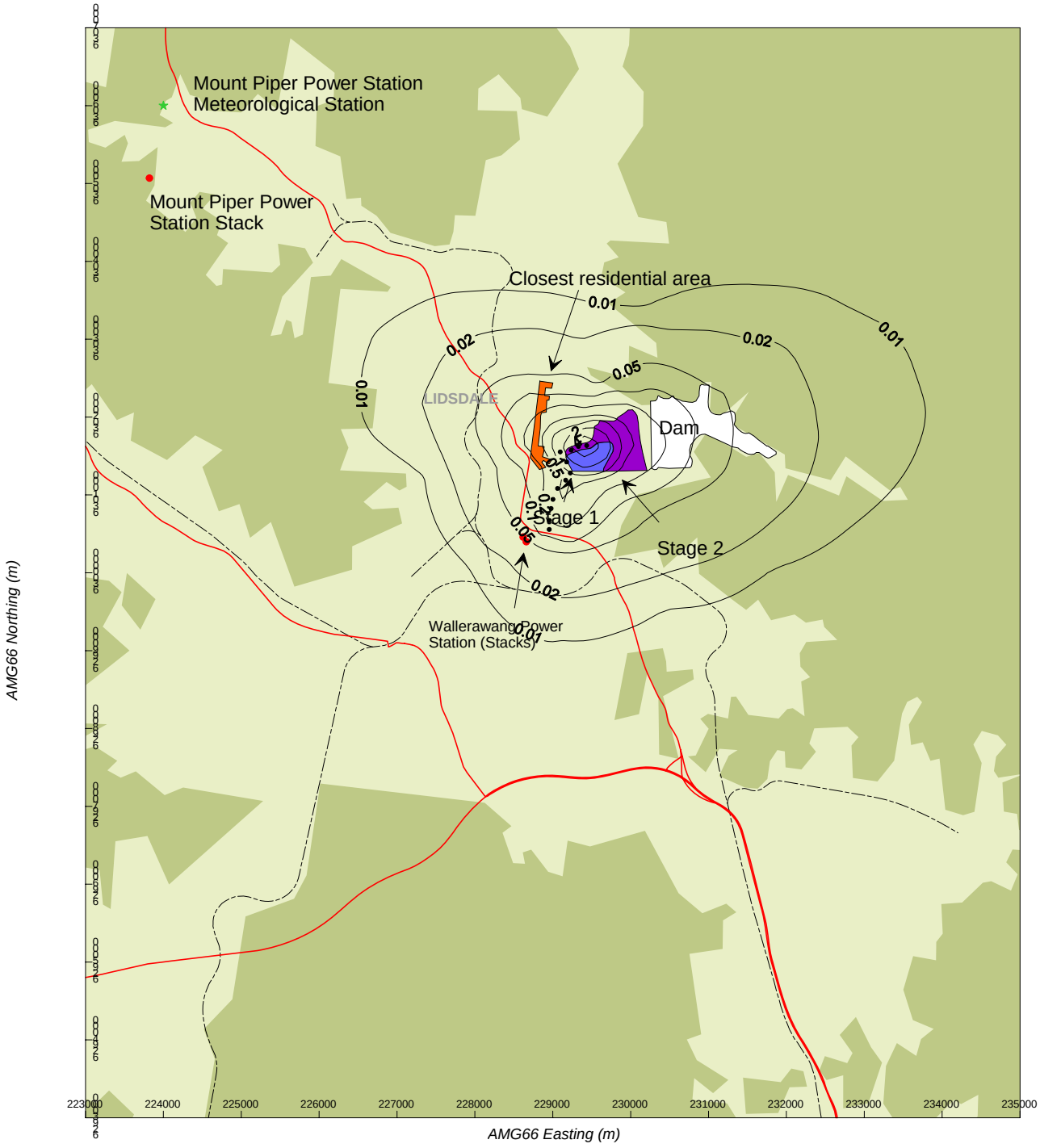

Figure 10-5 Calculated annual average dust (insoluble solids) deposition (g/m^2/month)

10.4 Management of impacts

It has been assumed that the operator would apply standard dust controls such as maintaining sealed haul roads in a clean condition and moisture levels in the ash at 15% at all times. Moisture levels in the emplaced ash have been assumed to be 15%. As previously discussed, the area of uncovered ash face would be limited through the use of a staged stacking approach, with completed areas capped once design height is reached, thereby minimising the potential for wind blown dust from the ash surface. The ash surface would be continually damped down through the application of water, as required, until permanent or temporary capping material is put in place. Ongoing monitoring of dust deposition at local gauges will be undertaken by Delta Electricity to confirm calculated model outcomes. Should this monitoring identify variations from model predications, management measures as outlined in the OEMP will be amended accordingly.

To provide a further safeguard, works undertaken during the proposed Stage 2 ash emplacement would be carried out in accordance with a documented management plan. The plan will detail all approaches adopted to minimise dust emissions and specific mitigation measures to be incorporated during emplacement activities. The plan will also include an operating protocol for the irrigation system, at a minimum: the wet suppression technique should be activated when 15 minute wind speed thresholds exceed 5 m/s. Application rates and coverage area should be such that no visible emissions from the repository area occur.

Should operations be significantly modified, additional air quality assessment would be undertaken.

11. Noise and vibration

11.1 Assessment approach

The potential noise and vibration impacts associated with the construction and operation of the proposed Stage 2 ash repository were assessed. The assessment addresses the Environmental Assessment requirements for the project provided by the Director-General of the Department of Planning (see Appendix C). The noise and vibration assessment was undertaken in accordance with the guidelines presented in the Industrial Noise Policy (INP) (NSW EPA 2000), the *Environmental noise control manual* (ENCM) (NSW EPA 1994) the Environmental Criteria for Road Traffic Noise (ECRTN) (NSW EPA 1999) and other relevant guidelines. This chapter summarises the findings of the noise and vibration assessment (Technical Report 5, Appendix I).

The scope of the noise investigation included:

- Assessing the existing ambient noise environment in the study area.
- Establishing reasonable and feasible noise design objectives and assessment criteria for the study area.
- Providing a detailed assessment of potential noise impacts associated with the proposal (construction, operation and sleep disturbance).
- Providing a qualitative assessment of potential vibration impacts associated with the proposal.
- Assessing potential impacts against relevant legislation and guidelines.
- Providing a concise statement of potential noise and vibration impact.
- Developing noise and vibration impact mitigation measures.

11.2 Site context

11.2.1 Noise monitoring locations

Ambient noise monitoring

Ambient noise monitoring locations were chosen following a preliminary site investigation to determine properties in the Lidsdale area that could be affected by noise from the proposed Stage 2 operations. The monitoring program comprised monitoring at five locations (see Figure 11-1). A description of each noise monitoring location is provided in Technical Report 5 in Appendix I.

Haul road truck monitoring

To determine noise impacts associated with trucks on the private haul road between the Kerosene Vale ash repository and the Wallerawang Power Station, noise monitoring was undertaken on 20 July 2007. Individual pass-by events were measured where the trucks were operating at a consistent speed and when accelerating.

Figure 11-1: Ambient noise monitoring locations

Truck noise monitoring locations are shown on Figure 11-2 and comprised:

- Consistent operating location (Site A) — where the road becomes level at the southern end of the road bridge and trucks are no longer accelerating, but operating at a constant speed signposted as 100 kilometres per hour. At this location, the road is elevated 15 metres above the nearest potentially affected receiver.
- Acceleration location (Site B) — at the point that trucks are required to accelerate as they travel up gradient at a sign posted speed limit of 100 kilometres per hour.

11.2.2 Existing noise environment

Ambient noise monitoring at the nearest potentially affected receivers was undertaken to establish the indicative background noise levels and determine the intrusive noise design goals for the proposal. Both unattended and attended noise levels were assessed during the survey period 20 to 2 August 2007 as presented in Table 11-1 and Table 11-2.

Unattended noise levels

Table 11-1 Median noise levels for unattended noise monitoring

Site	Daytime (7 am to 6 pm)		Evening (6 pm to 10 pm)		Night-time (10 pm to 7 am)	
	L_{Aeq}	L_{A90}	L_{Aeq}	L_{A90}	L_{Aeq}	L_{A90}
Site 1 Skelly Road	46.5	36.5	51.5	39.5	46.5	38.5
Woodlands (off Castlereagh Highway)	47.5	37	46.5	38	45.5	34.5

Notes: Values expressed as dB(A); dB(A) = decibels, A-weighted; $L_A$eq = equivalent continuous (energy average) A-weighted sound pressure level; LA_{90} = A-weighted sound pressure level exceeded for 90% of the time (background); All values rounded to nearest 0.5 dB(A).

The noise environment followed typical diurnal trends where the background noise level was reduced during the night-time period. At both monitoring locations the evening period demonstrated an increase in noise level from the daytime averages due to peak road traffic activity on the Castlereagh Highway.

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Figure 11-2 Haulage Road Noise Monitoring Locations

Attended noise monitoring

Attended daytime and night-time noise monitoring results are presented in Table 11-2. Meteorological conditions during the attended noise monitoring program were observed to be satisfactory for noise monitoring purposes.

Table 11-2 Attended noise monitoring

Category	Location	Time/Date	L_{A10}	L_{Aeq}	L_{A90}
Daytime	Site 1 Skelly Road	11.00 am (20/07/07)	54	52	49
Night-time	Site 2 Skelly Road	11.39 pm (01/08/07)	45.5	44	37
Daytime	Woodlands	midday (20/07/07)	52	49	41
Night-time	Maddox Lane	12.03 am (02/08/07)	41	39	36
Night-time	Wolgan Road	12.23 am (02/08/07)	44	52.5	36

Note: Values expressed as dB(A) and rounded to nearest 0.5 dB(A); SS = observed steady state noise level; L_{Aeq} = Equivalent noise level (average); L_{A90} = Noise level 90% of time (background); L_{A10} = Noise level 10% of the time.

Daytime influences

The daytime noise environment at Skelly Road was influenced by the operation of the Wallerawang Power Station, which was audible and could be characterised as an 'industrial hum'. Trucks travelling along the haul road were also audible and pass-by events were measured at 48 to 58 dB(A) over approximately 20 seconds duration.

Distant traffic was audible from the Castlereagh Highway, vehicle pass-by events were sporadic and measured up to 2 dB(A) above the steady state noise level.

The environment surrounding Skelly Road comprised woodland vegetation, noise from windblown vegetation was an influencing event to the measured noise levels.

At Woodlands, distant road traffic pass-by from Castlereagh Highway influences the noise environment. Road traffic pass-by events were between 41 and 58 dB(A), noise levels were dependent upon vehicle type, traffic volume and whether pass-by occurred simultaneously on both lanes.

Noise from the haul road, the Stage 1 ash repository operations and the Wallerawang Power Station was not audible at the Woodlands location.

Local fauna such as birds and insects influenced the measured noise levels at both locations.

Night-time influences

Night-time monitoring was conducted at Site 2, Skelly Road. In this location the movement of trucks on the haul road had a pass-by noise level of 39 to 41 dB(A) with a peak noise level of 50 dB(A). It was determined that air-braking noise events from the trucks had a peak noise level of 51 dB(A). Braking events were sporadic and did not occur with every truck pass-by.

Noise from the Wallerawang Power Station was audible in the steady state of 36 to 37 dB(A) with infrequent reversing alarm events having a peak noise audible above the steady state of 39 dB(A). Traffic pass-by events from local roads and the Castlereagh Highway were infrequent, noise levels were measured to be 40 to 41 dB(A).

The Woodlands property was not accessible during the night; Maddox Lane was used as a substitute location. The local noise environment at Maddox Lane was influenced by fauna, distant traffic noise from the Castlereagh Highway and local residential traffic.

Noise from the haul road, the Stage 1 ash repository operations and Wallerawang Power Station was not audible at the Woodlands location.

Additional night-time noise measurements were undertaken at Wolgan Road. This site was influenced by fauna and distant road traffic noise in the steady state measurement of 35-36 dB(A). Noise events from trucks operating on the haul road were measured at 45 dB(A).

The existing Stage 1 ash repository operations were not audible at the Wolgan Road monitoring location.

Meteorological conditions during the attended night-time measurements have been determined through analysis of meteorological data to be satisfactory for noise monitoring through analysis of meteorological data.

Haul road truck noise measurements

The attended noise measurements for the trucks operating on the private haul road when accelerating/braking and driving at constant speed are detailed in Table 11-3. Measured sound pressure levels have been used to determine sound power levels for monitored truck events. Constant speed measurements were taken over 20 second intervals and acceleration measurements over 10 second intervals.

Table 11-3 Measured sound pressure levels for haul road trucks

Truck	Event	Sound pressure level (Lp)	Sound power level (Lw)
Ash full	Constant speed	76	102
	Acceleration	81.5	105
Ash empty	Constant speed	76.5	100
	Braking	80.5	104
Coal full[1]	Constant speed	77	100.5
Coal empty[1]	Constant speed	75	99
	Acceleration	79	102.5

Note: Values expressed as dB(A) and rounded to nearest 0.5 dB(A).

1. Note coal trucks operating on this road are outside of the control of Delta Electricity and have been provided as part of the assessment of background noise and impacts for completeness. They do not form part of the proposed Stage 2 activities. Stage 2 Activities would not impact on these trucks

The attended coal and ash truck noise measurements were made within 6 and 8 metres of lane centre lines. At the monitoring distances adopted, the road wheel interface generally dominated noise source profiles during a pass-by event. The presence of personnel during measurements had some influence on measured noise levels, as drivers acknowledged the presence of personnel working in proximity to the road and reduced speed accordingly for safety reasons.

11.3 Assessment criteria

The *Protection of the Environment Operations Act 1997* (POEO Act) regulates noise generation and prohibits the generation of 'offensive noise' as defined within the Act.

In addition to the regulatory requirements under the POEO Act, the DECC provides guidelines regarding acoustic criteria and noise controls.

The current Stage 1 repository operations are not specifically licensed for noise emissions under the POEO Act. Environment Protection Licence 766 does not specify applicable noise limits within clause L6.

11.3.1 Construction noise

Noise criteria for construction sites are generally established in accordance with Chapter 171 of the ENCM (NSW EPA, 1994). The recommended criteria are planning goals only.

The potential noise impacts from construction works should be assessed with respect to additional factors such as the social benefits of the activity, economic constraints, and the nature and duration of a proposed construction program. The DECC recognise that individuals accept higher perceived noise impacts for emission sources with a limited duration and identified end date.

Based on an estimated length of construction of between 12 and 26 weeks in duration, the adopted construction noise impact design limits would be:

- Site 1, Skelly Road (nearest receptor) **46.5 dB(A)** L_{A10} (36.5 dB(A) + 10 dB(A))
- Woodlands **47 dB(A)** L_{A10} (37 dB(A) + 10 dB(A)).

Construction works would be undertaken during the daytime period only (7 am to 6 pm weekdays, 7 am to 1 pm Saturdays and no work on Sundays or public holidays). Construction of the proposed Stage 2 ash repository and associated works (including the creek realignment and stability berm) would be undertaken in stages as discussed in Chapter 2.

11.3.2 Operational noise

Noise emissions from the operation of the proposed Stage 2 area would be required to meet criteria set out in the NSW INP (NSW EPA 2000). The policy sets out two criteria that are used to assess potential off-site noise impacts. The first criterion aims at controlling intrusive short-term noise impacts for residences (intrusive criterion). The second criterion aims at maintaining the long-term amenity of particular land uses (amenity criterion). The more conservative of the two limits are established as project-specific operational noise goals.

Rating background noise level is the overall background level representing the daytime, evening and night-time periods over the whole background noise monitoring period. The rating background noise levels have been determined from the unattended noise monitoring carried out at Site 1, Skelly Road and Woodlands. Table 11-4 details the adopted intrusive and amenity noise criteria.

Table 11-4 Adopted L_{Aeq} noise criteria

Location	Period	Intrusive limit	Amenity limit	Adopted criteria
Site 1, Skelly Road (nearest receptor)	Daytime (7 am to 6 pm)	41.5	55	**41**
	Evening (6 pm to 10 pm)	44.5	45	**44**
	Night-time (10 pm to 7 am)	43.5	37	**37**
Woodlands (indicative background)	Daytime (7 am to 6 pm)	42	55	**42**
	Evening (6 pm to 10 pm)	43	45	**43**
	Night-time (10 pm to 7 am)	39.5	38	**38**

Note: Values expressed as dB(A) and rounded to nearest 0.5 dB(A)

The adopted noise criteria for the Woodlands site (the amenity limit) are representative of the indicative background levels. They shall be applied to determine the potential noise impact of the Stage 2 proposed operations as a noise source introduced to the local environment.

11.3.3 Sleep disturbance

The emission of peak noise levels for an instant or very short time period may cause sleep disturbance to residents. In accordance with the ENCM (NSW EPA 1994), the L_{A1} level of any specific noise source should not exceed the background noise level (L_{A90}) by more than 15 dB(A) when measured outside the bedroom window of the nearest potentially affected receiver. The night-time background noise level has been applied for assessment as it is considered indicative of the worst case. The calculated sleep disturbance criteria are indicated in Table 11-5.

Table 11-5 Sleep disturbance criteria

Location	Measured L_{A90}	L_{A1} Sleep disturbance criteria
Site 1, Skelly Road (nearest receptor)	38.5	53
Woodlands	34.5	49

Note: Measured L_{A90} based on unattended noise monitoring

Sleep disturbance is subjective and not all persons are affected by noise to the same degree. The noise criteria for sleep disturbance are designed to protect potentially affected residents from sleep disturbance.

11.3.4 Road traffic noise

Consideration has been given to road traffic noise events resulting from the operation of the proposal. All vehicle movements have been determined as part of the Stage 2 works where vehicles are confined to the haul road only. The assessment of potential noise impacts due to vehicle movements associated with the operation of the proposal has, therefore, been undertaken in accordance with the NSW INP and not the NSW ECRTN (EPA 1999).

11.3.5 Vibration

Construction vibration

Two main issues can occur in relation to vibration levels from construction activities, namely disturbance to residents from intermittent vibration resulting from activities such as heavy vehicle passage and potential architectural and/or structural damage to off-site buildings.

Generally, if human comfort issues are controlled, there is limited potential for structural damage to buildings.

Human comfort and structural damage limits vary across the frequency spectrum, although they are generally a constant level across the frequency range generated by most construction activities. Adopted vibration criteria are outlined below.

Annoyance/human comfort

The DECC Environmental Noise Management Assessing Vibration: A Technical Guideline (2006) provides recommendations for vibration criteria from continuous, impulsive and intermittent sources.

The construction works associated with proposed Stage 2 ash repository that represent vibration sources include the daytime movement of heavy vehicles, and operation of compactors and bulldozers. This type of vibration is assessed on the basis of vibration dose levels. Acceptable vibration doses levels for intermittent vibration at residential receivers are summarised in Table 11-6.

Table 11-6 Acceptable vibration dose levels for intermittent vibration

Location	Daytime and evening[1]	
	Preferred value (m/s)	Maximum value (m/s)
Residences	0.20	0.40

Source: BS 6472-1992

1. Daytime and evening is the period between 7 am and 10 pm.

Structural damage

Although not specified by DECC, German Standard DIN 4150: Part 3-1986 provides guidance on vibration velocity for evaluating potential structural damage. Limits range from 5 millimetres per second (less than 10 hertz), 5 to 15 millimetres per second (10 to 50 hertz) and 15 to 20 millimetres per second (50 to 100 hertz) at the foundation for a residential dwelling. At the upper-most storey floor plane, a vibration limit of 15 millimetres per second is applicable for a residential dwelling.

Operational vibration

As for construction vibration, there are two main issues relating to vibration levels from operational activities — disturbance to residents from intermittent vibration resulting from activities such as heavy vehicle passage and potential architectural and/or structural damage to off-site buildings.

Given control of human comfort issues, the potential for structural damage to buildings is limited.

Human comfort and structural damage limits vary across the frequency spectrum, although they are generally a constant level across the frequency range generated by most operational activities. Adopted vibration criteria for operation are the same as those for construction (see above).

11.4 Potential impacts

11.4.1 Construction noise modelling

The following construction activities have been identified for noise impact assessment:

- Realignment of Sawyers Swamp Creek: the realignment of the creek has a proposed construction period of 8 weeks. Construction works are anticipated to require the use of a tracked excavator, a bulldozer and two trucks for removal of excavated material. This is the closest location to noise receptors and has been used to determine worst case noise impacts from construction activities.
- Kerosene Vale stabilisation works: the existing Kerosene Vale bund is required to be buttressed and strengthened to contain the proposed ash repository.
- Development of surface water-retention structure in line with surface water management measures.
- Relocation of existing water transfer system from SSCAD and associated retention canal.
- Material from the pine plantation would be excavated to provide space for placed ash. The excavated material would be used for capping of the existing Stage 1 area and the proposed Stage 2 area.

All construction works are proposed to be undertaken during daytime hours (7 am to 6 pm Monday to Friday, 7 am to 1 pm Saturdays, no work on Sundays or public holidays). The nature of the required construction works are such that potential impact events (L_{Amax}/L_{A1}) would not be of sufficient noise level and/or duration to result in disturbance at the nearest potentially affected receivers.

Construction noise source sound power levels were determined from existing data sets to represent expected construction and equipment noise sources. The sound power levels for the associated construction activities and required plant are detailed in Technical Report 5 in Appendix I.

A noise propagation model was established as part of the assessment of potential construction noise impacts arising from the construction of the proposal. Noise modelling was undertaken through the use of ENM Noise Prediction Software (Version 3.06). The assumptions and inputs that were input into the model are detailed in Technical Report 5 in Appendix I.

Tables 11-7 and Table 11-8 below detail the calculated potential construction noise levels with regard to the construction noise design goals prescribed in Section 11.3.1.

Table 11-7 Sawyers Swamp Creek realignment noise impact

Location	Adopted noise goal L_{A10}	Cumulative noise impact L_{A10}	Compliance
Site 1 Skelly Road	46.5	23–29.5	Yes
Site 2 Skelly Road	46.5	29.5	Yes
Neubeck Street	46.5	24	Yes
Wolgan Road	46.5	38	Yes
Woodlands	47	33	Yes
Maddox Lane	47	33.5	Yes

Note: Values expressed as dB(A) and rounded to nearest 0.5 dB(A); L_{A10} = Noise level 10% of the time.

Table 11-8 Stabilisation works noise impact

Location	Adopted noise goal L_{A10}	Cumulative noise impact L_{A10}	Compliance
Site 1 Skelly Road	46.5	25.5–34.5	Yes
Neubeck Street	46.5	26.5	Yes
Wolgan Road	46.5	43	Yes
Woodlands	47	38	Yes
Maddox Lane	47	38.5	Yes

Note: Values expressed as dB(A) and rounded to nearest 0.5 dB(A); L_{A10} = Noise level 10% of the time.

Cumulative construction impact

During the construction phase, certain activities are likely to be undertaken concurrently, such as realignment and rehabilitation of Sawyers Swamp Creek and construction of the stability berm. The cumulative noise impact of construction works has been assessed. The calculated noise impact levels are detailed in Table 11-9.

Table 11-9 Cumulative construction noise impact

Location	Adopted noise goal L_{A10}	Cumulative noise impact L_{A10}	Compliance
Site 1 Skelly Road	46.5	27.5–35.5	Yes
Neubeck Street	46.5	28.5	Yes
Wolgan Road	46.5	44	Yes
Woodlands	47	39.5	Yes
Maddox Lane	47	40	Yes

In addition to the cumulative noise impacts from the proposal's multiple construction activities that would be undertaken concurrently, there is potential for cumulative noise impacts associated with other activities in the locality during the construction phase. Reference to the Department of Planning's register of major projects (www.planning.nsw.gov.au/asp/register2006) indicates two known significant developments in the locality that could contribute to a cumulative construction noise impacts. These are the Western Rail Coal Unloader and the Invincible Open Cut Extension Auger Mining project. The timing of approval, and if approval is granted, construction, of these developments is unknown; as such, the potential for contribution of these projects to cumulative construction noise is difficult to determine. Given the distance between these projects and the proposal, should construction of either of these projects occur concurrently with construction of the proposal, cumulative construction noise impacts are considered unlikely to present an issue to local noise receivers.

Statement of impact

The construction noise impact assessment for the proposed Stage 2 ash repository area construction works associated with the Sawyers Swamp Creek realignment and stabilisation works have been determined to be compliant with the NSW EPA ENCM noise design objectives for all identified potentially affected receivers. The construction noise impacts were determined based on a series of assumptions, and these assumptions form the mitigation measures that would be put in place to manage construction noise as detailed in Section 11.5.1.

Should the construction program require revision, the noise impact assessment would be revised, in particular, if works are required to occur closer to potentially affected receivers than originally proposed and additional mitigation measures adopted, if required, based on the outcome of any additional assessment.

11.4.2 Operational noise modelling

Existing operations

The established existing noise levels demonstrate that the current ash and coal haulage truck activities have an influence on the local noise environment, as follows:

- The noise impact from haul road truck movements has been determined to be 22 to 35 dB(A) daytime (7 am to 6 pm), 22 to 35 dB(A) evening (6 pm to 10 pm) and night-time 16 to 29 dB(A) (10 pm to 7 am).
- Skelly Road and Neubeck Street currently experience the greatest noise impact from the haul road. A noise impact range of 29 to 35 dB(A) occurs for day, evening and night-time periods.
- The noise impacts between the daytime, evening and night-time periods demonstrates a 1 to 1.5 dB(A) change in noise level. This reflects the consistent movement of trucks along the haul road.
- The daytime, evening and night-time periods are not subject to intensification of truck movements and the noise impacts determined are reflective of the consistent truck movements.
- The distribution of truck movements ensures that diurnal averaging does not ‘dilute’ noise impacts where the intrinsic noise impact is averaged over periods during which truck operations do not occur.

Stage 2 noise model assumptions

The predictive noise modelling undertaken to determine noise impact of the proposed Stage 2 operations ash truck movements on the private haul road have been based on several scenarios accounting for varying ash truck events that could occur during Stage 2 operations. It has been assumed that the proposed second silo for ash storage and handling at Wallerawang Power Station will be operational. Initial noise analysis was undertaken on a 24-hour operation; however, as a result of this initial assessment, operational truck movements were revised and are discussed below.

The addition of ash storage capacity provided by the further silo enables the hours of operation of trucks hauling ash to the repository to be restricted to the daytime and evening periods (7 am to 6 pm and 6 pm to 10 pm) to limit noise impacts. The Stage 2 operations would reduce the frequency of ash truck events between 10 pm to 7 am to abnormal operating and emergency scenarios only.

Abnormal operations would be limited based on assessed noise criteria (Section 11.3) and would occur irregularly and be avoided as far as practical. Abnormal activities would constitute scenarios where one of the silo's equipment or associated equipment was out of service for an extended period of time for specialised maintenance or repair. Every effort would be made to minimise truck movements during these periods. The impacts of abnormal and emergency operating conditions are outlined below.

Noise impact Stage 1 to Stage 2 operations

Increased ash storage capacity provided by the second silo would allow for the reduction in hours of truck operations along the haul road as discussed above, with truck movements to occur during the daytime and evening periods only (under normal operating conditions).

To determine the potential noise impact of the change from Stage 1 to Stage 2 operations on the local environment, a comparison of the Stage 1 noise impact and Stage 2 noise impacts has been made. Comparative analysis has determined the following:

- Calculated worst case 15-minute scenario noise impacts are expected to increase by less than 1 dB(A) due to a slight increase in truck intensity between 7 am and 10 pm.
- Daytime (7 am to 6 pm) received noise impacts are calculated to increase by less than 2 d(BA) $L_{Aeq\ 11\ hour}$ due to the change in frequency during daytime hours to avoid operation at night (10 pm to 7 am).
- Evening (6 pm to 10 pm) received noise impacts are calculated to increase by less than 3 dB(A) $L_{Aeq\ 8\ hour}$ due to the change in frequency of truck movement during daytime hours to avoid operation at night (10 pm to 7 am).
- Night-time (10 pm to 7 am) experiences no noise impacts (under normal operations) as ash trucks would not operate between these hours.

While the proposed Stage 2 ash truck operations are calculated to result in an increase in received noise impacts during the daytime and evening periods, the cease in night-time operations is considered an overriding benefit in comparison to existing Stage 1 operations.

The calculated change in noise impact associated with ash haulage activities between the Stage 1 and Stage 2 daytime, evening and night-time periods at the receiver locations are detailed in Table 11-10. Analysis of the Stage 1 and Stage 2 noise impacts determine that the calculated worst case 15-minute scenario noise impacts are not expected to change.

Table 11-10 Comparison Stage 1 and Stage 2 ash truck haul road noise impacts

Location	Period	Neutral conditions		
		Stage 1	Stage 2	Change
Site 1 Skelly Road	Worst case 15 minutes	38.5	39	+0.5
	Day (7 am to 6 pm)	30	31.5	+1.5
	Evening (6 pm to 10 pm)	29	31	+2
	Night (10 pm to 7 am)	28.5	—	Impact removed
Site 2 Skelly Road	Worst case 15 minutes	34.5	35	+0.5
	Day (7 am to 6 pm)	24.5	26	+1.5
	Evening (6 pm to 10 pm)	23.5	26	+2.5
	Night (6 pm to 10 pm)	23.5	—	Impact removed

Location	Period	Neutral conditions		
		Stage 1	Stage 2	Change
Neubeck Street	Worst case 15 minutes	38.5	39	+0.5
	Day (7 am to 6 pm)	30	31.5	+1.5
	Evening (6 pm to 10 pm)	29	31	+2
	Night (6 pm to 10 pm)	28.5	—	Impact removed
Wolgan Road	Worst case 15 minutes	29.5	30	+0.5
	Day (7 am to 6 pm)	20.5	22	+1.5
	Evening (6 pm to 10 pm)	19.5	21.5	+2
	Night (6 pm to 10 pm)	19.5	—	Impact removed
Woodlands	Worst case 15 minutes	24.5	25	+0.5
	Day (7 am to 6 pm)	15.5	17	+1.5
	Evening (6 pm to 10 pm)	14.5	17	+2.5
	Night (6 pm to 10 pm)	14.5	—	Impact removed
Maddox Lane	Worst case 15 minutes	25.5	26	+0.5
	Day (7 am to 6 pm)	17	18.5	+1.5
	Evening (6 pm to 10 pm)	16	18	+2
	Night (6 pm to 10 pm)	15.5	—	Impact removed

Stage 2 ash placement noise impact

Stage 2 ash placement activities have been modelled based on continuation of existing Stage 1 operations; it has been assumed that a bulldozer and compactor would be in operation. A worst-case scenario where plant is operational at the nearest point to the potential receivers has been assumed. Calculated noise impacts from Stage 2 ash placement activities are summarised in Table 11-11.

Table 11-11 Calculated noise impact of Stage 2 ash placement

Location	Noise goal		100% on time			50% on time		
	Daytime	Evening	Bulldozer	Compactor	Total noise impact	Bulldozer	Compactor	Total noise impact
Site 1 Skelly Road	42	43	33	23	33.5	30	20	30.5
Site 2 Skelly Road	42	43	34.5	22	35	31.5	19	32
Neubeck Street	42	43	32.5	20.5	33	29.5	17.5	30
Wolgan Road	42	43	31	19	31	28	16	28
Woodlands	42	43	29	17.5	29.5	26	14.5	26.5
Maddox Lane	42	43	29	19	29.5	26	16	26.5

Notes: Values expressed as L_{Aeq} dB(A) and rounded to the nearest 0.5 dB(A); L_{Aeq} = Equivalent noise level average.

The calculated noise impact of the proposed Stage 2 ash placement works demonstrate compliance with the required daytime and evening noise design goals of the NSW INP. Noise impact prediction determines that compliance is within 10 dB(A) of the noise goals.

Emergency and abnormal operations

The proposed Stage 2 ash placement operations on the haul road and at the ash repository area would be undertaken during the daytime and evening periods under normal operations. No night-time (10 pm to 7 am) operations are proposed except under abnormal or emergency operation conditions.

To address potential impacts from abnormal and emergency operations, an assessment of noise impacts and limitations of operations was undertaken. Predictive assessment of ash truck noise impacts has been undertaken for the night-time period (10 pm to 7 am) to NSW INP adopted intrusive night-time noise design goal of 38 dB(A) L_{Aeq} and an ENCM sleep disturbance criterion of 49 dB(A) $L_{A1.}$ It has been assumed that no coal trucks would operate during the night-time period.

To prevent potential non-compliance with the noise design goals at Skelly Road, the nearest noise sensitive receptors, ash truck movements should be, where feasible, limited to a maximum of five trucks per 15 minute. The limitation on truck movements during this period would minimise the potential for noise impacts should night-time operation be required due to emergency outage of ash silos or management equipment.

This corresponds to a total of 10 truck movements accounting for two truck passages: from the Wallerawang Power Station to the repository loaded and the return when unloaded.

The calculated noise impact of 10 ash truck movements at the nearest potentially affected receptors would be 38 dB(A) $L_{Aeq, 15mins}$, which would be compliant with the noise design criteria if trucks are limited in this manner.

Additionally sleep disturbance criterion is determined for peak noise emissions for an individual truck pass. The application of truck L_{A1} source term data determined a potential noise impact at the nearest receptors from an individual truck pass by resulting in a potential sleep disturbance.

The sleep disturbance assessment is determined through the noise impact of a discrete truck pass-by peak noise event. It should be noted that the nature of emergency and abnormal events are such that constraint of operational parameters is not always applicable and these types of activities are not proposed under normal operational conditions. A more detailed analysis of sleep disturbance is provided in Technical Report 5 (Appendix I).

Should proposed operation be amended to include works during the night-time period, an assessment of potential sleep disturbance should be undertaken.

Stage 2 cumulative noise impact compliance

The cumulative noise impact of the Stage 2 ash trucks and the coal trucks for the worst-case period (15 minutes) were assessed for the indicative nearest potentially affected receptors under proposed normal operations. Cumulative impacts are calculated to comply with relevant criteria in the Lidsdale region. Cumulative noise would comprise the following:

- Site 1 Skelly Road and Neubuck Street calculated received cumulative noise impacts: 30 to 36 dB(A) daytime (7 am to 6 pm) and 30 to 35 dB(A) evening (6 pm to 10 pm).
- Wolgan Road, Woodlands and Maddox Lane calculated received cumulative noise impacts: 21 to 26 dB(A) daytime and evening periods.
- No night-time cumulative noise impacts are calculated as ash and coal truck operations are not required during this period under proposed operations.

- Comparison to Stage 1 cumulative noise levels demonstrates received noise levels are calculated to experience an increase of up to 0.5 dB(A).

The daytime, evening and night-time periods demonstrate compliance with the intrusive noise design goals for proposed operational conditions.

Short-term intensification noise impact

The nature of the ash generation, storage and handling at the Wallerawang Power Station is such that reduced efficiency or break down of plant and/or equipment could result in short-term intensification to the Stage 2 ash truck operations.

Application of assumed worst-case 15-minute scenario operations, extended throughout daytime and evening periods, would correspond to an increase in received noise impact of up to 3 dB(A) for each period. This would account for a 'doubling' of truck movements in a given period to avoid night-time impacts as discussed above.

Given the time associated with ash loading at the silo, unloading of ash at the repository, and required journey times on the haul road, it is considered unlikely that operational capacity could be maintained for the entire period durations.

A 3 dB(A) increase to the cumulative noise impacts would not result in a potential exceedance of the NSW INP adopted noise design goal at any identified receptors (under neutral meteorological conditions).

11.4.3 Existing Stage 1 operational vibration impacts

Ash and coal truck pass-by events and ash placement activities at the Stage 1 area occur at a distance from receivers where potentially received vibration levels are not of sufficient magnitude to result in human annoyance or structural damage.

Typical vibration levels from heavy trucks passing over normal (smooth) road surfaces generate relatively low vibration levels in the range of 0.01 to 0.2 millimetres per second at the footings of buildings located 10 to 20 metres from a roadway.

Vibration impacts are expected to be insignificant at a distance of 10 metres and immeasurable beyond 50 metres. Vibration emission levels would be negligible given the separation distances to the nearest potentially affected receivers. No structural damage is expected. Furthermore, annoyance due to vibration is unlikely.

Quantification of vibration levels for assessment against the relevant criteria through an attended vibration monitoring program at the nearest potentially affected receivers is not required.

11.4.4 Proposed Stage 2 operational vibration impacts

The proposed Stage 2 operational events have been determined to be consistent with the Stage 1 operational events and are not calculated to result in a perceived impact at the nearest potentially affected receivers.

11.5 Management of impacts

11.5.1 Construction noise

As discussed in Section 11.4.1, construction impacts were determined based on the application of the following measures, which will be implemented prior to and/or throughout the construction phase as appropriate:

- Construction working hours will be restricted to between 7 am and 6 pm Monday to Friday and 7 am to 1 pm Saturday. No construction work would be undertaken on Sundays or Public Holidays.
- Construction activities would be undertaken in accordance with Australian Standard AS 2436-1981 Guide to Noise Control on Construction, Maintenance and Demolition Sites. All equipment used on site would be required to demonstrate compliance with the noise levels recommended within this document.
- Appropriate use of all plant and equipment, with reasonable work practices applied and no extended periods of 'revving', 'idling' or 'warming up' in proximity to residential receivers. Any excessively loud activities would be scheduled during periods of the day when general ambient noise levels are greater, thereby reducing the potential for cumulative noise impacts (relating to worst-case elevated operations) and extended periods of off-site annoyance.
- Construction works would adopt best management practice (BMP) and best available technology economically achievable (BATEA) practices as encouraged by the NSW DECC, and as addressed in current acoustic guidelines.
- Noise monitoring for operations would be used to verify impacts as construction and operation activities would occur concurrently (see Section 11.5.2).

All works are proposed to be undertaken during daytime hours of 7 am to 6 pm. The nature and assessment of the required construction works demonstrated that the potential impact events (L_{Amax}/L_{A1}) would not be of sufficient noise level and/or duration to result in a significant disturbance at the nearest potentially affected receivers. On this basis, standard construction noise management practices would be implemented by the contractor to ensure noise impacts remain as low as possible.

11.5.2 Operational noise

The proposed Stage 2 ash truck operational noise impact assessment has determined received potential noise levels at the nearest receptors to be compliant with NSW INP noise design goals.

The worst-case scenario of 12 trucks (ash and coal trucks combined) in operation on the haul road has been calculated to result in received noise impacts of 42 dB(A) $L_{Aeq,\ 15\ mins}$ at the nearest receptors on Skelly Road. The adopted intrusive daytime (7 am to 6 pm) noise design goal is 42 dB(A) $L_{Aeq\ 15\ mins}$.

To reduce the potential for received noise impact creep and possible non-compliance, a series of noise management measures would be considered for the proposed Stage 2 operations as outlined below.

Operational noise management

Noise management measures would be detailed as part of the OEMP for the project, including measures to manage noise associated with ash haulage. Noise management measures would consider, but may not be limited to:

Management of ash truck movements

The cumulative noise impact of ash trucks and coal trucks operating on the haul road may result in potential noise design goal non-compliance should truck movements exceed the assumed worst-case scenario, as discussed above. The worst-case scenario has been developed through application of predicted Stage 2 activities.

Ash truck operations are not routine, it is considered that implicit restriction on potential movements would be unfeasible and potentially result in intensification of truck movements at a later time. Accordingly, management of ash truck movements should be a desired objective and not an overriding requirement. During periods of consistent ash transport or where ash storage capacity allows, ash truck movements could be staged to ensure that worst-case scenario conditions are not exceeded.

It is noted that coal truck movements are not managed by Wallerawang Power Station.

Source noise emissions

The following source control procedures would be considered by Delta Electricity to ensure every reasonable effort is made to limit the potential for adverse noise impact:

- Residential class mufflers, and where applicable, engine shrouds (acoustic lining) to the engine would be considered. Noise emissions would be an important consideration when selecting equipment for the site. All equipment would be maintained in good order, including mufflers, enclosures and bearings in order to minimise the potential for unnecessary noise emissions.
- Appropriate use of all plant and equipment. Speed limit restrictions would be expected to result in reduced noise impact potential.
- The OEMP would identify and address noise impacts on all potentially affected receivers, and provide procedures, noise mitigation measures and noise management practices proposed throughout the duration of the project.

Hours of operation

Ash truck movements on the haul road would be limited to the daytime (7 am to 6 pm) and evening (6 pm to 10 pm) during normal operations. Non-operation of fly ash trucks during the night-time period (10 pm to 7 am) would remove potential noise impacts on the Lidsdale community during the most sensitive period.

Truck and haul road maintenance program

Noise emissions from operational ash truck movements typically derive from sources such as tyre/road interface, engine and gearbox, engine exhaust outlets and aerodynamic resistance.

Discrete measures to address the noise emissions are considered above. There are associated costs and time implications associated with source noise mitigation/management. Where such measures are deemed unfeasible, a routine maintenance program for trucks can prevent exacerbation of noise emissions.

Maintenance would ensure engine and mechanical component efficiency, minimise exhaust noise breakout and ensure appropriate tyre pressure and tread requirements.

Such a maintenance program could be extended, in consultation with appropriate bodies, to include the haul road surface to ensure features that can contribute to increased noise impacts, such as holes or uneven surfaces, are minimised.

Post-commissioning noise monitoring

Upon commissioning of Stage 2 operations, a noise monitoring strategy at the nearest potentially affected receptors would be implemented. The strategy would allow for validation of calculated noise impacts and would indicate whether compliance with the NSW INP noise design goal would be achieved and would involve 6 monthly assessment of noise.

Emergency and abnormal ash truck movements

The proposed Stage 2 operations could be subject to emergency or abnormal events, which may require operations on the haul road additional to the daytime (7 am to 6 pm) and evening (6 pm to 10 pm) periods as discussed above.

To prevent potential non-compliance with the noise design goals at the nearest affected receptors (Skelly Road), ash truck movements would, where feasible, be limited to a maximum of five trucks per 15-minute period. This corresponds to a total of 10 truck movements (two truck passages, outward and return). The calculated noise impact of 10 truck movements at the nearest potentially affected receptors would be 38 dB(A) $L_{Aeq\ 15\ mins}$, which would be compliant with noise design criteria.

It should be noted that the nature of emergency and/or abnormal events are such that constraint of operational parameters is not always applicable.

11.5.3 Summary

The assessment of potential noise and vibration impacts associated with the construction and operation of the proposal was undertaken on the basis of a range of operating scenarios and assessed against site-specific noise design criteria derived in accordance with DECC's Industrial Noise Policy and other relevant guidelines.

The assessment concluded that no adverse noise impacts are expected to occur as a result of the required construction works.

Stage 2 works are proposed to be undertaken during the daytime and evening periods only (7 am to 6 pm and 6 pm to 10 pm). The noise impact assessment for these periods, including an indicative worst-case cumulative ash and coal truck operational scenario, have been determined to be compliant with NSW INP noise design criteria for the nearest receptors.

The nature of Wallerawang Power Station operations can require emergency and abnormal operations, which can involve ash truck movements during the night-time period (10 pm to 7 am). Predictive noise assessment for truck events during this period determined that where ash truck movements did not surpass five trucks (10 total movements) in any given 15-minute period, the night-time period noise design goal of 38 dB(A) $L_{Aeq\ 15\ mins}$ would not be exceeded.

12. Land use and mining

12.1 Assessment approach

This chapter provides an assessment of potential land use impacts associated with the construction and operation of the proposed Stage 2 ash repository area activities at Kerosene Vale.

It addresses the additional requirements identified in the Department of Primary Industries letter of 2 March 2007 issued after the receipt of Environmental Assessment requirements for the project. The Department of Primary Industries (DPI) identifies potential conflicts with open-cut mining in the proposed Stage 2 area and the potential for possible sterilisation of these reserves.

12.2 Site context

The proposed Stage 2 Kerosene Vale ash repository area is located on the northern boundary of the Wallerawang Power Station in land owned by Delta Electricity. The proposed Stage 2 repository area has been used for ash and mine spoil storage since the 1950s and in 1990 the area was capped. The Wallerawang Power Station operated on a wet ash system with by-product ash placed in the SSCAD between 1990 and 2002. In 2002 the Wallerawang Power Station returned to a dry ash system as SSCAD was reaching its design capacity. Since approval in 2002 the Stage 1 area of the Kerosene Vale ash repository area (see Figure 1-2) has been used for ash placement.

Within the local context the proposed Stage 2 ash repository area is located on the western slopes of the Great Dividing Range, within Kerosene Vale at approximately 880 metres above sea level. The proposed Stage 2 area lies on a generally flat plateau, with a slight slope towards the Coxs River to the south-west (ERM Hyder 2002).

The predominant land uses in the surrounding area include coal mining (see Section 12.2.1), livestock grazing and timber production in the adjacent State Forest. The nearest towns are Wallerawang and Lidsdale located approximately 7.5 kilometres south-west and 1.5 kilometres west, respectively. The general surrounding land zoning in the area is predominantly rural.

12.2.1 Mining reserves

Figure 12-1 identifies the area and extent of mining lease in the vicinity of the proposed Stage 2 development. This information indicates that approximately 25 hectares or 65% of the total proposed Stage 2 area falls within areas subject to mining leases and 4 small areas have been identified by DPI as being of interest for future mining. The majority of these areas are located on the eastern and Northern edges of the proposed Stage 2 area at the base of the SSCAD as shown in Figure 12-1.

These areas have been identified by Centennial Coal as a ‘small but potentially significant reserve of open-cut resources’. In the advice provided by the Department of Primary Industries, the royalties payable to the State are estimated to be in the order of $6M, although no additional information on the feasibility of removing this coal has been provided by the Department of Primary Industries given its proximity to SSCAD; this is further discussed in the following sections.

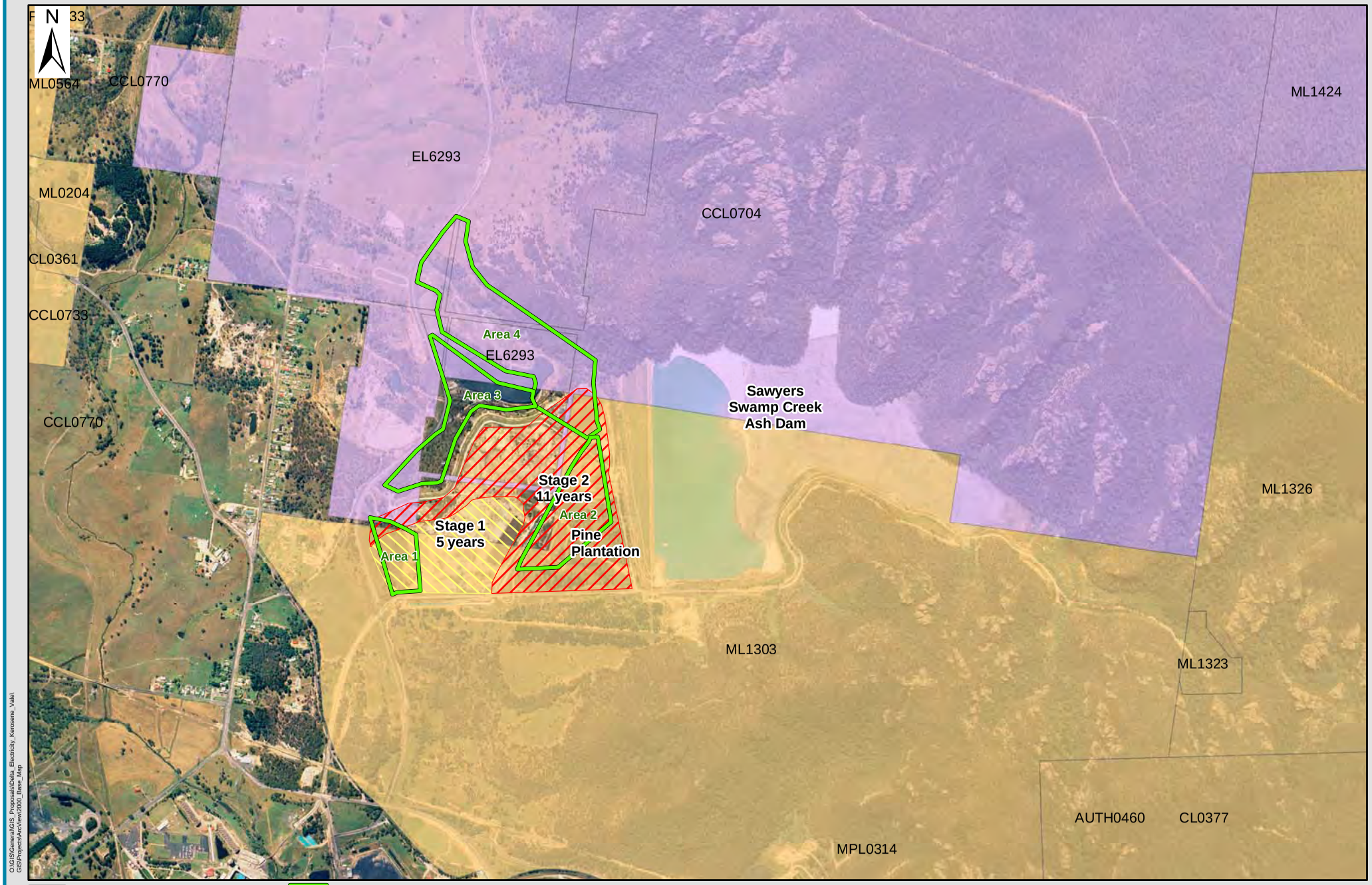

Figure 12-1 Coal leases in the Kerosene Vale area

12.3 Impact of the proposal

The proposed Stage 2 activities would impinge on land formerly used for ash management purposes, and as a result, the potential to create adverse land use impacts in relation to ash placement are limited given that the majority of the area has been used for ash placement activities for over 30 years. In this respect, the proposal is consistent with the local land use character of the power station, the existing Stage 1 operations, the adjacent SSCAD, and surrounding land uses.

The proposal may have a negative impact on future land use in relation to mining reserves, but is anticipated to have a land use benefit in the longer term as the ash placement area would be capped, revegetated and rehabilitated once the area reaches its design capacity in approximately 11 years.

12.3.1 Mining reserves

As noted above, less than 65% of the proposed Stage 2 ash repository area falls within mining leases held by Centennial Coal. Whilst these areas are small relative to overall mine lease areas, Centennial Coal through the Department of Primary Industries have indicated that they may be a significant and viable reserve in this area and have advised that royalties payable to the state have been estimated to be in the order of $6M, although it is unclear if this value has allowed for cost of extraction or is the gross value of the royalties associated with the coal.

To address this issue within the Environmental Assessment, the area of mining has been assessed based on currently available public information. It is understood that Centennial Coal is undertaking a more detailed feasibility assessment; however, this was not available at the time of writing this Environmental Assessment. Delta Electricity requires approval for future ash storage use before July 2008 as discussed in Section 2.1, as a result this assessment has been undertaken on the basis of currently available information.

Bore logs at the existing and proposed ash repository areas indicate that the geology of the site is generally characterised by sandy clay layers to between 5 and 7 metres below ground level underlain by shale and sandstone. Some bore logs show deposits of coal and coaly siltstone of between 0.5 and 1.5 metres thickness interspersed with mudstone, siltstone and claystone at depths between 7 and 15 metres. Information provided by the Department of Primary Industries indicates that Centennial Coal proposes to obtain this coal through open-cut techniques and as a result placement of ash over these areas would potentially affect the financial viability of these activities.

In assessing the viability of this mining activity, it is worth noting that of the 65% of the proposed Stage 2 area that is within mining lease, more than half of this is located adjacent to the SSCAD and DPI has indicated that not all of this area is of interest (Figure 12-1). The winning of material in such close proximity to this structure through open-cut techniques would be significantly constrained by safety and stability issues. This constraint would also potentially increase the cost of extraction relative to other areas covered by mining leases in the region.

If financially viable, it would be anticipated that that some form of buffer zone would be required around the SSCAD to ensure its long-term stability and safety. It is also likely that, for geotechnical stability purposes, some component of the coal reserves would need to remain in situ as pillar structures to reduce the risk of mine subsidence and potential for

failure of the SSCAD. However, the residual risk of impacting on the dam would require consideration. The decommissioning of the dam and/or removal of this structure would reduce this risk, but would impact on Delta Electricity's water supply, requiring alternative water sources to be found.

On the basis of the available information, the impact on mining reserves is limited to a relatively small area in the context of the overall area of the proposed development and the extent of mine reserves in the area of the proposed Stage 2 ash repository. Furthermore, in order to open cut mine reserves located on Delta Electricity property, some form of access agreement would be required; at this stage no such agreement has been reached.

In the absence of additional information the extent of impacts on mining can not be accurately assessed. Delta Electricity continues to discuss the possibility of extracting mine reserves with Centennial Coal in order to stage activities within their own operational constraints. This may allow Centennial Coal to access the small remaining areas during the 11-year life of the proposed Stage 2 ash repository should Centennial Coal determine this to be economically viable. Any mining activities would be subject to Centennial Coal obtaining the appropriate approvals, which falls outside the scope of this Environmental Assessment. It is likely that such approvals would not be in place in sufficient time to enable Delta Electricity's current schedule requirements for an approved ash repository area by July 2008.

It should be noted that at the time of writing this report it is understood that Centennial Coal is undertaking a feasibility study on the development of this area for mining purposes. Should the feasibility assessment or further information become available during public exhibition of this Environmental Assessment, this information would be incorporated into the Submissions Report for the proposal. At this stage, based on currently available information, the impact on mining reserves has not been determined, due to uncertainty in relation to the feasibility of an open-cut mine in such close proximity to a registered dam. In order to address this uncertainty Delta Electricity proposes to stage activities to optimise the timeframe in which Centennial Coal could access these reserves.

12.4 Management of impacts

To reduce the potential for land use and mining impacts associated with the proposed Stage 2 repository area, the following mitigation measures are recommended:

- Site fencing would be erected on the border of all construction sites, including storage and other ancillary areas to avoid unnecessary off-site damage to vegetation, trees and general landscape values.
- Construction personnel, equipment and vehicles would be confined to the works areas as defined by the site fences/hoardings erected at the works boundary.
- Where practical ash would be reused in local manufacturing and in on-site structures to extend operating life of the Stage 2 ash repository and enable further time for Centennial Coal to determine the viability of mining in proximity to SSCAD.
- The repository areas would be rehabilitated following completion of placement activities in line with identified rehabilitation plans.
- Placement would be staged to further provide Centennial Coal with additional time to assess the viability of mining activities.

13. Other environmental issues

Environmental issues relevant to the proposal, not identified as key issues in the Environmental Assessment requirements and identified as presenting a risk level of 'B' or 'C' in the preliminary environmental risk analysis and not already addressed within the Preliminary Environmental Assessment are considered other environmental issues that need to be addressed in this Environmental Assessment. These issues have been identified through additional risk assessment and the environmental assessment process. The risk categories applied during the environmental risk analyses are described in Table 6-1.

Other issues are issues considered to present a medium to low level environmental risk and are manageable through the application of standard management/mitigation measures (as identified in the draft Statement of Commitments in Chapter 15).

The identified 'other' issues relevant to the project that have not already been addressed in the Preliminary Environmental Assessment are:

- geology and soils
- waste, energy and demand on resources.

The standard mitigation and management measures proposed to be implemented by Delta Electricity for all key and other issues are summarised in the draft Statement of Commitments in Chapter 15.

13.1 Waste, energy and demand on resources

Waste

Construction and operation of the Stage 2 ash repository area would generate various waste streams. The disposal of wastes is regulated by the *Waste Avoidance and Resource Recovery Act 2001*. This Act establishes a hierarchy of waste management (avoid, recover, dispose) that encourages the efficient use of resources, aims to minimise or avoid environmental harm and provides for continual reduction in the volumes of waste generated. The DECC's Waste Avoidance and Resource Recovery Strategy 2006 provides guidance on waste management priorities.

Waste-generating activities during construction would include earthworks, drainage works, clearing and grubbing, works associated with the realignment of Sawyers Swamp Creek, equipment maintenance and site office activities. The key waste streams generated during these activities would include:

- concrete
- scrap metal
- general construction waste
- green waste from clearing and grubbing of vegetation in the former pine plantation area
- fuels, oils, liquids and chemicals
- wastewater
- contaminated/unsuitable spoil material

- excavated soil
- paper and cardboard.

As far as practicable, earthworks material would be re-used on-site as fill embankments and capping material.

Vegetation cover in the area is minimal; however, some clearing in the former pine plantation area has been undertaken as part of the Stage 1 activities. The cleared vegetation would be mulched, chipped or re-used on-site for sediment filter fences or other uses, where appropriate. Suitable logs and limbs may be used to provide aquatic habitat and fauna refuge in the realigned Sawyers Swamp Creek.

All other waste streams, including construction waste, would be removed and disposed of in accordance with the relevant guidelines, including the Environmental Protection Authority (now DECC) Environmental Guidelines: Assessment, Classification and Management of Liquid and Non-liquid Wastes.

Operational waste would be limited to waste generated from equipment and haul road use, maintenance and repair activities. Maintenance wastes would include green wastes from windblown limbs/trees, and vehicle oils and greases from maintenance vehicles.

Maintenance wastes such as oils and greases would be disposed of to an appropriate facility. Waste generated by site personnel would be collected on a regular basis. Wastes would either be recycled or disposed of to an appropriate facility.

The management of waste is not considered a key issue given that standard measures are available to address waste generation, disposal and reuse in order to minimise potential impacts. Measures for the management of waste would be included in the CEMP and OEMP and are included in the draft Statement of Commitments in Chapter 15.

Energy

Energy-consuming activities during construction of the proposed upgrade would not be extensive and would take place over approximately 8 months. Plant and equipment used during this time would be diverse, including heavy machinery through to tools and small equipment. The energy used during construction of the proposal would largely be in the form of fuel (petrol and diesel).

The activities undertaken and plant and equipment used during construction would consume considerable quantities of fuel. Most of the fuel used would be diesel. Fuel use and efficiency are influenced by the condition of vehicles/equipment, speed of operation and site conditions. Fuel and energy use during construction would be minimised as far as possible through the use of efficient and well-maintained vehicles and effective planning.

Energy consumption during the operation of the proposed Stage 2 ash repository area would be associated with heavy vehicle use for ash haulage, use of plant and other equipment for loading, unloading and emplacement of ash and the use of maintenance vehicles and equipment.

Energy consuming services required for operation of the proposed Stage 2 ash repository area would include lighting, equipment and machinery. Electricity would be supplied from the Wallerawang Power Station.

Maintenance activities are expected to require a small number of medium-sized vehicles and equipment. The amount of energy consumed during maintenance activities would be negligible.

Demand on resources

Water would be used during construction of the proposed Stage 2 ash repository for dust control, washing of plant and equipment, drinking, hand washing and in toilets provided for construction personnel. Water may also be required for the preparation of construction materials.

Sources of water for construction, would, where possible, be sustainable. Sustainable supply options that would be considered as alternatives to traditional sources (such as dams and rivers), include reuse and recycling. For example, reuse of runoff water collected in the existing water quality basin. Reclaimed water could be used for dust suppression and during earthworks. However, water of suitable quality would be required for the preparation of construction materials such as concrete and asphalt due to the need to avoid some pollutants.

To ensure that use of recycled water is maximised and waste minimised, the soil and water management plan within the CEMP would include measures requiring the construction contractor to prioritise recycling/reuse of water. The soil and water management plan would be prepared prior to construction and implemented throughout construction. In addition, operational water use would be managed through the OEMP.

The materials required for construction of the proposed Stage 2 ash repository and associated works would include concrete, bottom ash, excavated fill material. Bulk excavation during construction would be limited to the former plantation area and the creek realignment and stability works. Suitable material would be re-used in construction of the realigned creek section and stability structures and/or stockpiled for reuse as capping material. Should any imported material be required, this would be sourced from local contract suppliers. The requirement for imported/excavated material for the stability structures would be limited through the use of bottom ash.

As discussed in Section 2.3.8, bottom ash could be used in the construction of berms and other site stability structures to minimise the need to use naturally extracted materials. The use of bottom ash in these structures would also extend the operational life of the proposed Stage 2 ash repository. The options for the design of the stability structure(s) have assessed the properties of bottom ash to allow for its use in the structure(s). Additional materials required for construction would include concrete, steel and asphalt. These materials would be acquired from contractors.

13.2 Biodiversity

A preliminary ecological assessment for the proposed Stage 2 KVAR was undertaken (PB 2006b), comprising a desktop review and site inspection. This is provided in Appendix J.

No threatened species, populations or communities were recorded within the site. A total of seven threatened species of plant and 28 threatened species of animal have been recorded within 10 kilometres of the site. These species are considered unlikely to occur in, or be dependent on, the resources of the site.

No clearing or disturbance of the remnant woodland would be required.

The project is likely to cause some loss of aquatic vegetation as a result of the Sawyers Swamp Creek realignment. Impacts on aquatic ecology are discussed in Chapter 9.

The review concluded that the project is unlikely to significantly affect threatened species biodiversity or the ecological values of the site. Given the highly disturbed nature of the site, no site-specific mitigation measures related to biodiversity are proposed.

In conclusion, biodiversity impacts are considered to be minimal and are manageable with appropriate and well established procedures.

13.3 Archaeology and heritage

A preliminary archaeology and heritage assessment was undertaken for the proposed Stage 2 KVAR, comprising a desktop review, a site inspection and consultation with Bathurst Local Aboriginal Land Council in November 2006. This report is provided in Appendix K.

This assessment concluded that the proposed Stage 2 KVAR works pose no threat to the Aboriginal archaeological or heritage values of the study area. It has been assessed that the proposed activity would not result in any further impact on Aboriginal archaeological potential (Cultural Heritage Connections 2006).

This issue has been assessed as manageable given the application of the following recommendations to ensure no inadvertent impact on the Aboriginal heritage values in the area:

- Disturbance to the western-most portion of the study area should be kept to a minimum.
- If during the course of development of the area, any objects (as defined in the *National Parks and Wildlife Act 1974*) are discovered, all work should cease and both the DECC regional archaeologist and the BLALC should be notified so that an appropriate course of action can be determined.

In conclusion, heritage impacts are considered to be minimal and are manageable with appropriate and well established procedures.

13.4 Visual impact and landscaping issues

A preliminary visual assessment was undertaken using a viewshed analysis of the Stage 2 KVAR using existing topographic contours to generate a digital elevation model (refer to Figure 13-1). The assessment assumed that the existing Stage 1 placement was already at its completion height of 940 metres AHD and that potential viewers were located at 2 metres elevation from ground level. No natural screening was taken into account during this assessment. As a result, the outcomes are considered to be conservative. The assessment concentrated on potential viewers within 20 kilometres of the KVAR site.

The viewshed analysis identified that the most significant visual impact is expected to occur at the Wallerawang Power Station. However, as ash placement is part of the operation of this facility, this impact is not considered significant.

Following completion of the proposed Stage 2 area, residents located west and south-west of the KVAR may have a changed view of the ash placement area when compared to the existing situation (refer to Figure 13-1).The level of impact would depend on the level of screening from trees and other objects for these properties and would be managed as the project progresses. The overall impact, however, is likely to be limited, as only a small number of residents would be directly affected.

It would be difficult to identify alternative areas for ash placement that would have a lesser visual impact. It is proposed that the visual impact is managed through industry recognised mitigation measures such as tree screening and landscaping, including capping and revegetation, where required. These measures will be incorporated into the OEMP for the site.

Community engagement during the Stage 1 operations identified issues associated with operational lighting during night-time ash placement activities. Following identification of these concerns, Stage 1 operations at the KVAR have been modified so that lighting is directed away from residential properties towards SSCAD, where possible, without jeopardising the safety of the operation. This ongoing commitment would be incorporated into overall site management and environmental management plans for the proposed Stage 2 activities and recorded within the Statement of Commitments for the project.

In conclusion, visual impacts and landscaping issues are considered minimal and would be manageable with appropriate, well established procedures.

13.5 Traffic and transportation

The development of Stage 2 activities would not significantly increase traffic when compared to the existing Stage 1 operations. No traffic movements or impacts are anticipated on public roads outside of the site during ash emplacement activities. It is, therefore, anticipated that traffic management would be undertaken in line with existing site management procedures and plans.

A short-term increase in traffic movements on the local road network is expected in association with mobilisation and demobilisation of equipment during construction of the stability berm and realignment of Sawyers Swamp Creek. This would be managed through a construction traffic management plan to be developed and implemented by the construction contractor.

By restricting construction activities to the hours of 7 am to 6 pm weekdays, 7 am to 1 pm Saturdays and no work on Sundays or public holidays and restricting operations to 7 am to 10 pm (other than abnormal operating and emergency scenarios) traffic impacts will be minimised. Impacts on traffic from this project are anticipated to be minimal and would be managed through the CEMP and OEMP with well established industry practices.

In conclusion, potential traffic and transportation impacts are considered to be minimal and would be manageable through the use of appropriate and well established procedures.

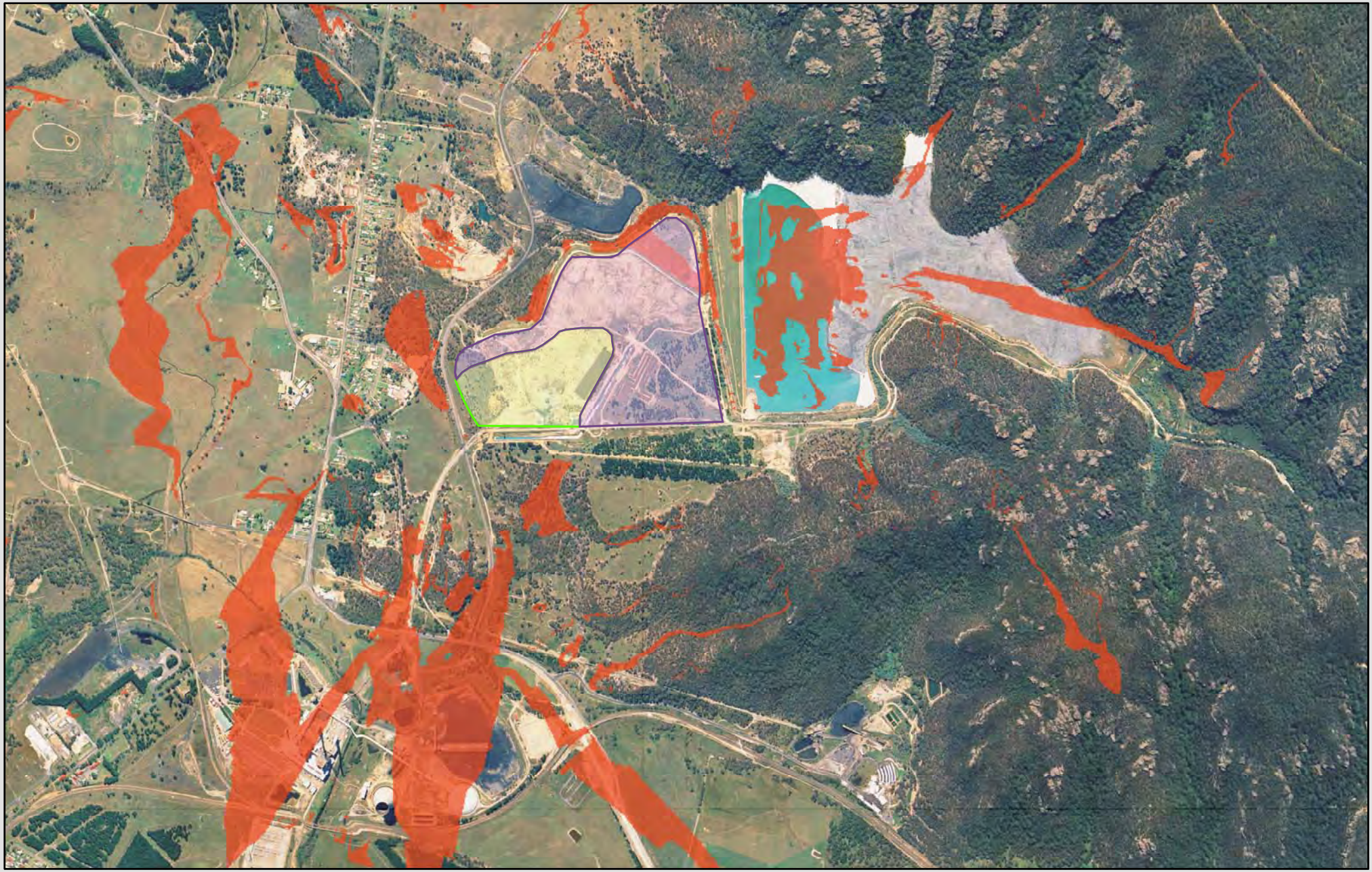

Figure 13-1 Viewpoints surrounding the Stage 2 Kerosene Vale Ash Area