Mt Piper Power Station
Ash Placement Project

ENVIRONMENTAL ASSESSMENT

CHAPTER 5 – AIR QUALITY

August 2010

Contents

5. Air Quality

The Director-General's requirements for air quality are:

Air quality impacts for the Neubecks Creek and Ivanhoe 4 sites (concept plan application only) include an analysis of potential air quality impacts and constraints to the development of these sites including available mitigation and/or management options that may be applied to achieve acceptable environmental outcomes (such as low dust generation ash disposal options), with consideration of cumulative impacts from the project and other existing or proposed activities in close proximity to the project site. Key air quality risk factors and/or design criteria that would require further detailed investigation prior to the development of these sites must be identified.

For the Lamberts North and Lamberts South Sites (project application), include an assessment of the air quality impacts of the proposed development in accordance with the Approved Methods for Modelling and Assessment of Air Pollutants in New South Wales (DECC, 2005) (Approved Methods) considering worst case operating scenarios and meteorological conditions, representative monitoring and receiver locations and cumulative impacts from nearby activities (e.g. Mount Piper and Wallerawang Power Stations). The assessment must focus on potential point source emissions, odour impacts, and particulate impacts during construction and operation as well as contaminants in the ash. Detailed information for the proposed mitigation and management measures proposed to minimise identified impacts relevant to the project application must be provided.

5.1. Introduction

This chapter provides a qualitative air quality assessment of the Neubecks Creek and Ivanhoe sites and a quantitative air quality assessment for the Lamberts North and Lamberts South sites. The assessment follows the procedures outlined by the NSW Department of Environment and Climate Change and Water (DECCW) in their document titled *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW*. Full details of the study are provided in **Appendix B.**

5.1.1. Assessment Criteria

The Department of Environment, Climate Change and Water (DECCW) has set criteria to assess the air quality impacts of existing or proposed facilities. Of particular relevance to the proposed activities are criteria for particulate matter. There are various classifications of particulate matter, with the DECCW providing assessment criteria for the following:

- Total suspended particulates (TSP);
- Particulate matter with equivalent aerodynamic diameter less than or equal to 10 microns (PM_{10}); and

- Deposited dust.

Table 5-1 summarises the current air quality assessment criteria for particulate matter, as noted by the DECCW. In general, these criteria relate to the total burden of dust in the air and not just the dust from project-specific sources. Therefore, some consideration of background levels needs to be made when using these criteria to assess impacts.

Table 5-1 DECCW assessment criteria for particulate matter

Pollutant	Averaging time	Criterion	Application
TSP	Annual average	90 µg/m^3	Cumulative
PM_{10}	Annual average	30 µg/m^3	Cumulative
	Maximum 24-hour average	50 µg/m^3	Cumulative
Deposited dust	Annual average (maximum increase)	2 g/m^2/month	Cumulative
	Annual average (maximum total)	4 g/m^2/month	Cumulative

The DECCW's criteria for TSP and deposited dust have been set to protect against nuisance impacts, while the PM_{10} criteria have been set to protect against adverse health effects.

There is an increasing body of evidence to suggest that criteria for finer particulate matter (for example, $PM_{2.5}$) may be more important for protecting against adverse health impacts, however, at this stage the DECCW has not set criteria for $PM_{2.5}$ that can be applied on a project-specific basis.

5.1.2. Existing Environment

The proposed areas for ash placement and the location of sensitive receivers are shown in **Figure 5-1**. Details on locations of sensitive receptors are provided in **Table 5-2.**

Available data from the area of the project allowed an assessment of the existing air quality environment at residential locations. These data showed that:

- Annual average PM_{10} and TSP concentrations are in compliance with the DECCW's air quality assessment criteria;
- Short-term (that is, 24-hour average) PM_{10} concentrations are highly variable and are likely to have exceeded the 50 µg/m^3 criterion on occasions; and
- Average dust deposition levels are in compliance with the DECCW's air quality assessment criteria.

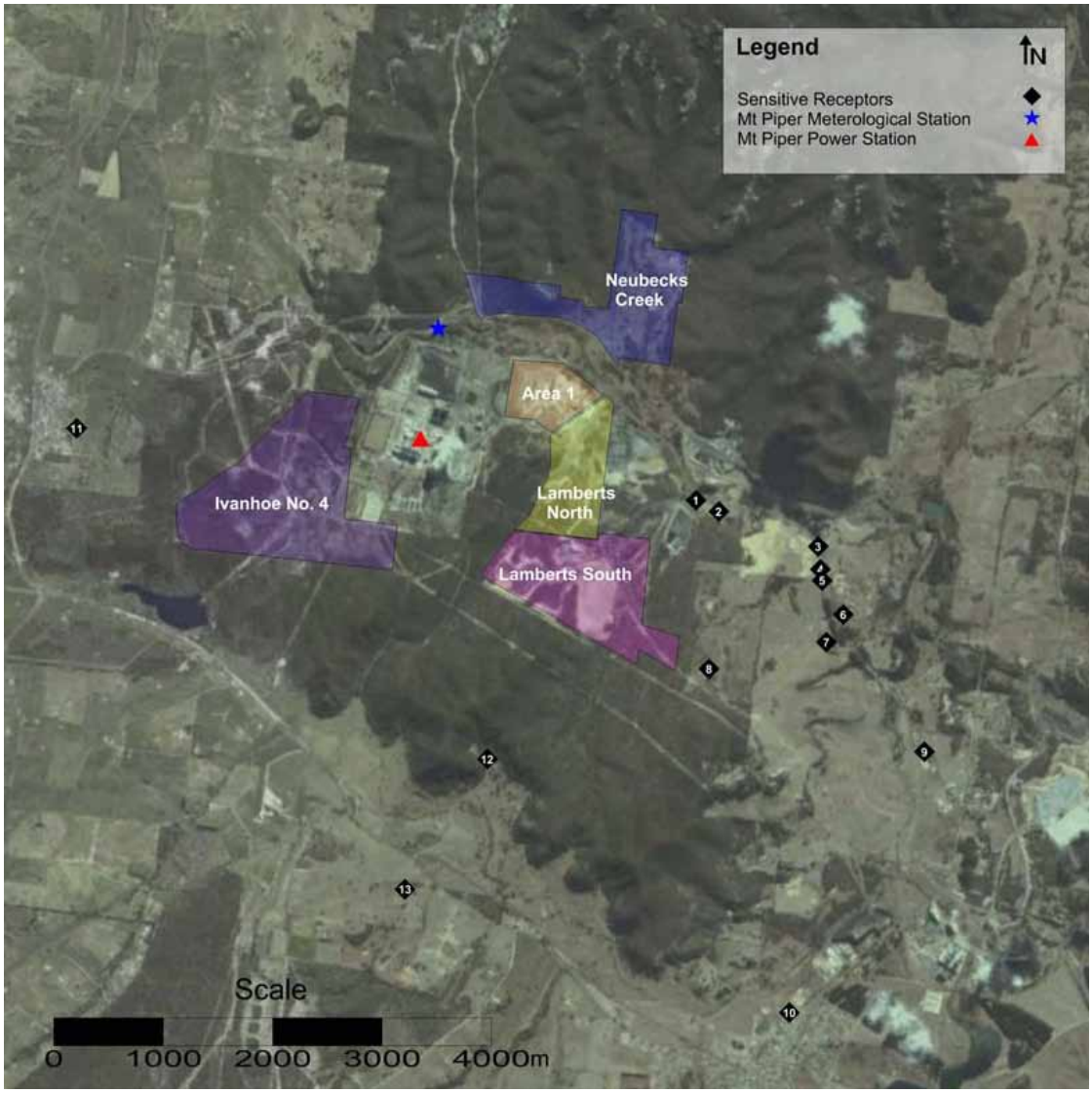

Figure 5-1 Site Location and Sensitive Receivers

For this assessment the following background levels were assumed to apply at the nearest sensitive receptors:

- Annual average TSP of 32µg/m^3;
- Annual average PM_{10} of 16µg/m^3; and
- Annual average dust deposition of 1.2g/m^2/month.

Table 5-2 Location of Sensitive receivers

ID No.	Address
1	Noon Street, Blackmans Flat
2	Castlereagh Highway, Blackmans Flat
3	Castlereagh Highway, Blackmans Flat
4	View Street, Black Blackmans Flat
5	Castlereagh Highway, Blackmans Flat
6	Castlereagh Highway, Lidsdale
7	Ian Holt Drive, Lidsdale
8	Castlereagh Highway, Wallerawang
9	Ian Holt Drive, Lidsdale
10	Commercial Hotel, Main Street, Wallerawang
11	Main Street, Portland
12	Portland Road, Wallerawang
13	Pipers Flat Road, Wallerawang

5.1.3. Existing Dust Emissions

Proposed ash handling activities were combined with emissions factors developed both locally and by the US EPA to determine total dust emissions.

The following emission factor equations discussed in this section relate to:

- The quantity of TSP generated by a particular operation to the type of operation;
- Intensity of the operation (e.g. the quantity of material handled per unit of time); and
- The properties of the materials being handled (e.g. silt content and moisture level).

Sources of dust on the site would include:

- Loading and unloading ash including:
  - Loading ash to trucks;
  - Emplacement of ash into the repository;
- Vehicles hauling ash to emplace from conveyor while travelling on unpaved areas;
- Shaping the emplaced ash using dozers;
- Wind erosion from the emplacement of ash; and
- Emplacement of topsoil on top of the ash.

Operational hours for ash placement will be 6am to 8pm, Monday to Friday and 6am to 5pm Saturday and Sunday. It has been assumed for modelling purposes that onsite operations would only occur between the hours of 6am and 8pm.

A discussion of the emission factors and operational data used for this assessment is included in **Appendix B**.

A summary of estimated annual TSP emissions, including with the proposed Mt Piper Extension scenario is shown in **Table 5-3**.

Table 5-3 Summary of Dust Emissions

ACTIVITY	Estimated annual TSP emissions (kg/y)	
	Proposed Placement Area (with existing Mt Piper operations)	Proposed Placement Area (with Mt Piper Extension)
Loading ash to trucks	80	220
Emplacement of ash into the repository	80	220
Vehicles carrying ash on unpaved roads	166,000	443,520
Shaping the emplaced ash using dozers	4,000	4,000
Wind erosion from the emplacement of ash	182,630	182,630
Emplacement of topsoil on top of the ash	400	830
TOTAL	**353,200**	**631,600**

All numbers are rounded to the nearest 10

It should be noted that the above TSP emissions have been calculated without dust emission control measures, and as such may be considered as worst case.

5.2. Methodology

This section describes the assessment methodology for dispersion modelling of the Lamberts North and Lamberts South sites. Specifically this involves a Level 2 air quality assessment conducted in accordance with the "*Approved Methods and Guidance for the Modelling and Assessment of Air Pollutants in NSW*". The Level 2 assessment uses site-specific input data, such as detailed meteorological information.

The AUSPLUME (version 6.0) model was used to predict dust concentrations within the vicinity of the proposed disposal area. AUSPLUME was developed by the Victorian EPA, and is an approved model for conducting site-specific air quality assessments in NSW.

Inputs required by the AUPLUME model include:

- Emission source locations;
- Emission rates;

- Topographical data;
- Locations of sensitive receptors; and
- Meteorological conditions.

The dispersion modelling was based on meteorological information and the dust emission estimates to predict dust concentrations and deposition levels in the vicinity of the project.

5.3. Predicted Operational Impacts from Project

This section outlines the results of modelling using AUSPLUME.

5.3.1. Total Suspended Particulates

Predicted annual average TSP concentrations show that the annual 90µg/m^3 criterion contour does not extend beyond the site boundary for the proposal. All sensitive receivers are predicted to experience an incremental increase in the annual TSP concentration of less than 6µg/m^3, with the highest TSP concentration (5.3µg/m^3) occurring at sensitive receptor one (1). These results are well below DECCW criterion of 90µg/m^3, even when added to the assumed annual average background TSP concentration of 32µg/m^3. The model predictions suggest that there will be no adverse impacts, in terms of TSP concentrations, on the nearest sensitive receivers.

5.3.2. Particulate Matter (PM_{10})

Predicted maximum 24-hour average concentrations show that the 50µg/m^3 criterion contour may extend beyond the site boundary for the proposed expansion at Lamberts South. Sensitive Receiver 1 is predicted to experience the highest maximum 24-hour average concentration of 15.6µg/m^3 which is well below the criterion.

The measurement data showed that background PM_{10} concentrations are highly variable and it is likely that the DECCW's 50 µg/m^3 criterion is exceeded in the region on a number of occasions each year. For assessment of cumulative 24-hour average PM_{10} concentrations, the approach of adding maximum measured to maximum predicted would not demonstrate compliance with the 50 µg/m^3 criterion. This is because the historical maximum measured values (over100 µg/m^3) would not permit any project contribution before 50 µg/m^3 is exceeded.

Existing PM_{10} concentrations vary from day to day but if it were assumed that the existing annual average PM_{10} concentration (16 µg/m^3) occurred every day of the year then the assessment would be very much simplified as a maximum project contribution of 34 µg/m^3 or more would be the point at which potential air quality impacts would be observed - assuming 50 µg/m^3 is the level at which potential impacts occur. No sensitive receivers are predicted to exceed 34 µg/m^3, taking this

conservative approach. It should also be emphasised that the model results present the "worst-day" at each location in terms of potential impacts from the project.

Predicted annual average PM10 concentrations indicate that the 30µg/m3 criterion contour slightly exceeds the Lamberts North boundary. All sensitive receivers are predicted to experience an annual PM10 concentration of less than 30µg/m3 with the highest incremental increase predicted to be 4.5µg/m3 at sensitive receiver 1. These results demonstrate compliance with the DECCW's criterion of 30µg/m3, even when assumed background concentrations of 16µg/m3 are added to the predictions.

For the purpose of this assessment a "worst case" condition has been assumed in which no controls have been put in place to reduce onsite dust emissions. It is noted that existing dust control measures used in Area 1 such as application of sprays to exposed surfaces within the placement area and use of water trucks on unpaved haul roads would also be applied to the proposed expansion areas. Therefore, it is likely that the maximum 24-hour and annual PM10 concentrations would be lower than predicted.

Further, the assessment has not removed any existing contribution from current ash emplacement activities within Area 1, and thus cumulative impacts discussed in this assessment are likely to be lower than predicted.

5.3.3. Deposited Dust

Predicted annual average dust deposition results indicate that the 2g/m^2/month contour (maximum increase) extends slightly beyond the site boundary, east of Lamberts North and Lamberts South. All sensitive receivers are predicted to experience less 2g/m^2/month of deposited dust due to the proposal.

The 4g/m^2/month (maximum total) criterion contour is within the site boundary. When the assumed background concentration of 1.2g/m^2/month is added to the predicted concentration at the sensitive receivers it can be seen that all sensitive receivers experience a deposited dust concentration well below the 4g/m^2/month (maximum total).

These model predictions suggest that there will be no adverse impacts on sensitive receivers, in terms of dust deposition.

5.3.4. Predicted Impacts from Project plus Mt Piper Extension

Should project approval be obtained to develop a new 2,000 MW coal-fired plant this would result in the generation of an additional 1,314,000 m^3 of ash requiring placement at the proposed ash site. Cumulative impacts of on residences during the operation of the proposed ash placement site and the proposed Mt Piper Extension are assessed in this section.

Predicted dust concentrations and deposition levels due to ash placement from the new power plant show slightly higher impacts than for the existing Mt Piper Power Station ash placement, and the annual average PM_{10}, TSP and dust deposition levels are unlikely to be exceeded. Again, the maximum 24-hour average PM_{10} concentrations are below the criterion (50 µg/m^3).

For the purpose of this assessment a worst case condition has been assumed in which no controls have been put in place to reduce on-site dust emissions. It is also assumed that existing dust control measures used in Area 1 would also be applied to the proposed ash placement areas. When taking into account the use of dust control measures and that the assumed background concentration would include the existing operational activities undertaken within Area 1, it is likely that the maximum 24-hour and annual PM_{10} concentrations would be lower than predicted.

5.4. Construction Impacts

Preparation of the proposed ash placement areas may require bulk earthworks which have the potential to result in nuisance dust emissions. Dust emissions will arise primarily from the following activities:

- Clearing of vegetation and topsoil;
- Loading and unloading of material from trucks;
- Trucks travelling over unsealed roads; and
- Wind erosion from unsealed surfaces and stockpiles.

Appropriate safeguards would be required to minimise potential air quality impacts during construction including watering of exposed soils when necessary, particularly during dry and windy conditions, stabilising work areas and minimising areas of surface disturbance.

5.5. Ivanhoe No. 4 and Neubecks Creek Sites

Placement of ash at the proposed Ivanhoe No. 4 and Neubecks Creek sites has the potential to generate dust if not managed properly. These areas would require further assessment in accordance with the DECC *Approved Methods and Guidance for the Modelling and Assessment of Air Pollutants in* NSW, should project approval be sought. A qualitative assessment has been undertaken in the current study which identifies the key dust-generating sources and suitable measures to minimise emissions.

Ash within the placement area can be exposed for a considerable time before capping, which can lead to the generation of dust emissions particularly during dry and windy conditions. A number of activities associated with the emplacement of ash would also generate ash emissions including:

- Loading and unloading ash including:
  - Loading ash to trucks;
  - Emplacement of ash into the placement area;

- Vehicles hauling ash to area from conveyor while travelling on unpaved areas; and
- Shaping the ash using dozers.

It is assumed that the same dust control methods currently used within the existing ash site (Area 1) would be applied to the proposed sites including:

- Conditioning of fly ash with water or brine, ensuring that the moisture content sits at approximately 15%;
- Application of sprays to wet the ash surface and prevent dusting, with any runoff from the ash placement area contained within onsite ponds;
- Application of molasses in areas of exposed ash, where application of sprays is not practical; and
- Use of water trucks on unpaved haul roads.

In accordance with the proposed placement strategy, once the capacity is reached the entire area would be capped. Emplacement of topsoil on top of the ash used for capping would also result in dust emissions from wind erosion and vehicle activities. Once an area is capped it would be re-vegetated, thereby avoiding the any further risk of dust generation.

5.6. Cumulative Impacts with other Projects

In addition to the proposed Mt Piper Extension, Delta has obtained approval to extend the existing Kerosene Vale ash storage area (approximately 4km southeast of the study area) to enable storage of ash from Wallerawang Power Station. Predicted TSP, PM_{10} and deposited dust emissions for the Kerosene Vale project is set out in an air quality assessment prepared by Holmes Air Sciences. The predicted cumulative TSP, PM_{10} and deposited dust levels provided in **Table 5-4**.

These results add the predictions for the most affected sensitive receptor location due to Mt Piper (that is, Receiver 1) to the predictions for the most affected sensitive receptor location due to proposed Kerosene Vale activities. Maximum 24-hour average PM_{10} concentrations are not included as the maximum impacts from the Mt Piper ash area will not occur at the same time as maximum impacts from the Kerosene Vale ash area. In **Table 5-4** it can be seen that the cumulative impact for annual TSP and PM_{10} of the Mt Piper Extension (and associated ash placement site) and the Kerosene Vale ash storage area extension do not exceed the DECCW criteria of 90 and 30µg/m^3. Predicted annual average deposited dust is also within the DECCW criterion of 4g/m^2/month. It follows that the cumulative impacts of the Project will be at acceptable levels.

- **Table 5-4 Potential cumulative impacts with Kerosene Vale ash project**

Pollutant	Criterion	Proposed Mt Piper Ash Placement (786,500m^2)*	Proposed Mt Piper Ash Placement (with Mt Piper Ext) (2,110,000m^2)*	Kerosene Vale Ash Repository	Maximum cumulative Impact
Annual PM_{10} (µg/m^3)	30	20.5	25.9	3	28.9
Annual TSP(µg/m^3)	90	37.3	43.4	4	47.4
Deposited Dust (g/m^2/month)	4	1.6	1.9	0.5	2.4

*Includes assumed background concentrations

It has been assumed that existing dust control measures used in Area 1 would also be applied to the proposed new ash placement areas, and that existing background concentrations used in this assessment (which include ash emplacement activities within Area 1) has resulted in an over prediction of cumulative impacts. Therefore, PM_{10} and TSP levels are likely to be lower than predicted.

5.7. Odour and Ash Contaminants

The fly ash produced from the burning of pulverised coal in a coal-fired boiler is a fine-grained, powdery particulate material that is generally odourless. Odour problems associated with fly ash generally only occur when ammonia-based NO_x (oxides of nitrogen) reduction systems are used at the power station. Such ammonia based NO_x reduction systems convert flue gas NO_x into elemental nitrogen through both high temperature use of ammonia (selective non-catalytic reduction [SNCR]) and the use of ammonia with a catalyst (selective catalytic reduction). Both these processes can result in deposition of ammonia on fly ash, and as a result detectable odours may be experienced from the fly ash.

Given that a NH_3 based NO_x reduction system is currently not used at MPPS, and that no odour issues have arisen within the current ash disposal area it is unlikely that the proposed ash placement activities would cause odour impacts.

Trace elements are found within the ash, naturally and due to the conditioning of ash with brine. Dust emissions from the emplacement of ash are unlikely to contain high enough concentrations of these trace elements to cause exceedances of air quality criteria at all ground level locations.

5.8. Conclusions

This chapter provides an assessment of potential dust, odour and ash contaminants associated with the proposed Mt Piper Ash Placement Project. Computer-based dust dispersion modelling was undertaken for the Lamberts North and Lamberts South ash placement areas and used to assess the impacts of the proposal. A qualitative assessment was undertaken for odour and ash contaminants, and for the proposed Ivanhoe No. 4 and Neubecks Creek sites.

Meteorological data from the Mt Piper Power Station site were combined with estimated dust emissions from proposed activities to predict off-site TSP, PM_{10} and deposited dust levels.

An additional scenario was also developed which took into account ash requiring placement from the proposed Mt Piper Extension Project.

The results from the assessment indicated that the project is unlikely to cause exceedances of annual PM_{10}, TSP and dust deposition criteria at the nearest sensitive receptor locations. There is potential for the maximum 24-hour average PM_{10} criteria to be exceeded from time to time, although it is unlikely that the project would be the cause of such exceedances. It should also be noted that the model results present the "worst-day" at each location in terms of potential impacts from the project.

The assessment was based on a worst case scenario, in which no controls have been put in place to reduce onsite dust emissions. As indicated in Chapter 3 the existing dust control measures used in Area 1, such as application of sprays and molasses to exposed surfaces and water trucks on unpaved haul roads, would also be applied to the proposed placement areas. Consequently, dust concentrations and deposition levels should be lower than predicted. Background levels would also be lower as there would no longer be ash placement at Area 1 once Lamberts North is operational.

Assessment of the Ivanhoe No. 4 and Neubecks Creek found that ash placement at these sites would have the potential to generate dust and would require further detailed assessment in accordance with the DECC *Approved Methods and Guidance for the Modelling and Assessment of Air Pollutants in* NSW, whenever project approval was sought for these two areas.

The project emissions are unlikely to cause exceedances of air quality criteria for ash contaminant and odour at all ground-level locations.

Mt Piper Power Station Ash Placement Project

ENVIRONMENTAL ASSESSMENT

CHAPTER 6 – NOISE

August 2010

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6. Noise

This chapter provides a detailed assessment of the noise from the construction and operation of ash placement at Lamberts North and Lamberts South ash placement sites. It also provides an analysis of potential noise constraints to the development of the Neubecks Creek and Ivanhoe No 4 sites, along with noise risk factors that would require detailed investigation prior to development of these two sites.

The Director-General's requirements request an assessment of the key environmental issue of noise impacts - for the Neubecks Creek and Ivanhoe No. 4 sites (concept plan application only) include an analysis of potential noise constraints to the development of these sites including available mitigation and/or management options that may be applied to achieve acceptable environmental outcomes, with consideration of cumulative impacts from the project and other existing or proposed activities in close proximity to the project site. Key noise risk factors and/or design criteria that would require further detailed investigation prior to the development of these sites must be identified.

For Lamberts North and Lamberts South sites (project application), include a construction and operational noise assessment that identifies impacts on surrounding residential premises and other sensitive receivers, with particular consideration of cumulative noise impacts from surrounding power stations (including Mt Piper and Wallerawang) and the Western Rail Coal Unloader. A framework for the mitigation, management and monitoring of noise impacts during construction and operation of the project must also be provided, particularly with respect to receptors and receptor types likely to be significantly impacted by the project and with specific references to noise-intensive works/activities (for example bulk excavation and heavy vehicle movements during construction). The assessment must be undertaken consistent with:

- *NSW Industrial Noise Policy (EPA, 2000);*
- *Interim Construction Noise Guidelines (DECC, 2009); and;*
- *Environmental Criteria for Road Traffic Noise (EPA, 1999.*

6.1. Existing environment

The noise study undertaken for the project is attached in **Appendix C**.

Background noise levels were measured at Blackmans Flat between 10 and 20 of December 2009 and at Wallerawang between 22 December 2009 and 8 January2010. The purpose of the long term noise monitoring is to provide noise level data to help characterise the influence of existing noises in the vicinity of the ash placement site.

The sites selected for logging were two key residential dwellings that represent the nearest receiver locations to the proposed ash placement areas. The locations of the noise loggers, with respect to the Power Station, are shown in **Figure 6-1**. An address and description of where the loggers were situated on the properties is given in **Table 6-1** below.

- **Table 6-1 Receiver an monitoring locations**

Location ID	Location Description	Noise monitor location
1	Blackmans Flat	Located at the western end of Noon Street on the southern side of the road. Positioned at the rear of the property approximately 100 metres from the Castlereagh Highway
2	Wallerawang	Located on a rural property west of the Castlereagh Highway. The dwelling is located approximately 1100m from the Castlereagh Highway. The logger was positioned 70m north of the house.

6.2. Environmental Noise Measurements

The following section provides a summary of the background noise surveys and the results of the attended and unattended monitoring.

The unattended monitoring was undertaken to determine the median values for the following descriptors for the day, evening and night time periods:

- L_{Amax} – the maximum noise level measured at a given location over the 15 minute interval;
- L_{A10} – the noise level exceeded for 10 percent of the 15 minute interval, this is commonly referred to as the average-maximum level;
- L_{Aeq} – the noise level having the same energy as the time varying noise level over the 15 minute interval;
- L_{A90} – the noise level exceeded for 90 percent of the 15 minute interval. This is commonly referred to as the background noise level and represents the quietest 90 seconds in a 15 minute period.

The Rating Background Level (RBL) is the overall, single-figure, L_{A90} background level representing each of the day, evening or night assessment periods over the whole monitoring period. This is often referred to as the background level and is the noise level used for assessment purposes. It is defined as the median value of all the day, evening or night assessment levels over the monitoring period. A summary of the noise data is presented in **Table 6-2**.

- **Figure 6-1 Location of proposed ash placement areas and receiver locations.**

- **Table 6-2 Summary of Unattended Noise Survey**

Location	Date	Rating Background Level (RBL) dB(A)			L_{Aeq} over the assessment period dB(A)		
		Day	Evening	Night	Day	Evening	Night
1	10/12/09 20/12/09	44	33	29	54	51	49
2	22/12/09 08/01/10	33	33	30	41	40	38

The noise monitoring at both locations indicates low background noise levels are present during the day, evening and night time periods. While the ambient noise levels at the Wallerawang location are low for each of the assessment periods, the measured levels at Blackmans Flat location shows the influence from road traffic on the Castlereagh Highway.

Attended noise monitoring was carried out at the same locations where noise loggers had been positioned. The attended monitoring was conducted on 10 December 2009 between 10:00am and 10:45am to establish the level and contribution to the noise environment. **Table 6-3** presents a summary of the monitored noise levels and the various sources that comprised the noise environment for the survey.

- **Table 6-3 Summary of Attended Noise Survey**

Location	Date & Time	Noise Levels – dB(A)				Contribution to noise environment
		L_{A90}	L_{A10}	L_{Aeq}	L_{Amax}	
1	10/12/09 10:00	48	58	54	64	Operational noise from Centennial Coal was audible at this location. Influences included: Trucks and reverse beepers ~44 dB(A) Excavator ~ 45 dB(A) Caterpillar track and engine revving (possibly dozer) ~ 50 dB(A) Traffic on Castlereagh Highway - Cars 54 dB(A) - Tucks 64 dB(A)
2	10/12/09 10:30	40	44	42	55	Operational noise from Centennial Coal was audible at this location. Influences included: Caterpillar track (dozer) ~ 44 dB(A) Traffic on Castlereagh Highway - General 40 dB(A) Cicadas (Intermittent) ~42 dB(A)

Results of the attended monitoring show good agreement with the measured data from the unattended noise survey, with L_{Aeq} values of 54 dB(A) and 41 dB(A) for Locations 1 and 2 respectively.

At Location 1, the greatest influence on the noise environment came from road traffic, although noise influences from mining operations at the Lamberts Gulley site were noted at this location.

During the attended measurements at Location 2 noise from the Castlereagh Highway and operations from the Lamberts Gulley mining site were audible. The Wallerawang residence is located approximately 3.4 km north west of the Wallerawang Power Station and is shielded by a ridgeline from the intervening topography.

This residence is also located approximately 3.3 km to the east of Mt Piper Power Station. It is expected that the ambient noise levels coupled with these large distances was the reason that there were no observed noise emissions from either Mt Piper Power Station or the Wallerawang Power Station during the monitoring period.

6.3. Environmental Noise Goals

Table 6-4 summarises the project specific noise goals outlined above at the potentially most affected residence.

Table 6-4 Summary of Project Specific Noise Criteria

	Day	Evening	Night-time
Intrusiveness Criteria	$L_{Aeq15\ min}$	$L_{Aeq15\ min}$	$L_{Aeq15\ min}$
Project Intrusiveness Criteria	RBL + 5 dB(A)	RBL + 5 dB(A)	RBL + 5 dB(A)
Project Specific RBL levels			
Location 1	49 dB(A)	38 dB(A)	35 dB(A)*
Location 2	38 dB(A)	38 dB(A)	35 dB(A)
Amenity Criteria	$L_{Aeq\ 11hr}$	$L_{Aeq\ 4hr}$	$L_{Aeq\ 9hr}$
Acceptable Amenity Criteria	50 dB(A)	45 dB(A)	40 dB(A)
Modified Amenity Criteria	-	-	-
Project Amenity Criteria	50 dB(A)	45 dB(A)	40 dB(A)
Project Noise Criteria	$L_{Aeq15\ min}$	$L_{Aeq15\ min}$	$L_{Aeq15\ min}$
Location 1	49 dB(A)	38 dB(A)	35 dB(A)
Location 2	38 dB(A)	38 dB(A)	35 dB(A)

*Adjusted to meet the INP Minimum RBL Requirement

In **Table 6-4** the information from **Table 6-3** is used to develop the intrusiveness criteria. The amenity criteria are taken from the INP. The most stringent of the noise goals for each assessment period is then adopted as the project specific noise criteria and are used to assess compliance.

6.4. Operational Noise Assessment

A quantitative assessment was undertaken for the potential noise impacts associated with the operation of Lamberts North and Lamberts South ash placement sites.

The assessment of noise impacts at residences nearest to the ash placement area is based on the prediction of noise levels using a noise model.

The operations of the ash placement area have been assessed for the Lamberts North and Lamberts South regions based on 3 scenarios for each site. These scenarios include the initial operations that include the existing terrain, a mid stage scenario based on projected terrain contours at that time and a final stage scenario based on the projected final terrain contours.

6.4.1. Sources of Noise Emissions

Operation of the ash placement areas involves the transportation, distribution and compaction of the ash within the placement area using dumpers, dozers, drum rollers and water carts. The operation is undertaken according to the following.

- Cycle times for the haul trucks are approximately 8 minutes with 60-70 loads per shift;
- Operational hours for the Lamberts North and Lamberts South areas would be between 06:00 and 20:00 during weekdays and 06:00 and 17:00 on weekends;
- The equipment operates cyclically with the following percentages; dozer 60%, water trucks/tankers 65% (10 hrs/day summer and 7 hrs/day winter), and drum roller 30%;
- Normal operational cycle is for ash to be dumped until the required amount is in place. The dozer then distributes the ash along the bench. Once distribution is complete, it is packed with the drum roller until the required compaction is achieved;
- Capping is progressive and is undertaken as an addendum to ash placement utilising the equipment.

Each modelling scenario includes a static dumper and dozer noise source as well as a dumper represented as a moving noise source. This combination is representative of a typical combination of equipment at any time during operation of the placement area.

6.4.2. Operational Noise Impacts Assessment

The operational noise impacts have been assessed at the nearest affected receiver locations for both the Lamberts North and Lamberts South ash placement areas. The noise levels for each location represent the predicted levels for the daytime and evening shoulder operational hours. The predicted levels would be the same for the morning shoulder period between 06:00 to 07:00 and for the evening shoulder period between 18:00 and 20:00.

During the morning shoulder periods, the noise levels in the area are generally increasing due to traffic movements on the Castlereagh Highway, which tend to dominate the noise environment. During the evening the noise levels are reducing from about 18:00 to 22:00 hours, where they reach the lower night time noise levels.

The results are presented for each receiver location for the north and south placement areas which have been assessed separately for both neutral and adverse weather conditions. Adverse weather conditions have been assessed using a 3m/s wind from the source to the receiver. The noise goals for the daytime period are shown for reference for each site.

Table 6-5 and **Table 6-6** present the results for the Lamberts North and Lamberts South placements for neutral weather conditions.

- **Table 6-5 Predicted noise levels at sensitive receiver locations Lamberts North (neutral meteorology).**

Receiver	Assessment Period	Noise Goal dB(A)	Initial Stage	Mid Stage	Final Stage
Location 1	Daytime Evening	49 38	37	37	38
Location 2	Daytime Evening	38 38	34	35	35

- **Table 6-6 Predicted noise levels at sensitive receiver locations Lamberts South (neutral meteorology).**

Receiver	Assessment Period	Noise Goal dB(A)	Initial Stage	Mid Stage	Final Stage
Location 1	Daytime Evening	49 38	38	38	36
Location 2	Daytime Evening	38 38	39	37	36

Table 6-7 and **Table 6-8** present the results for the Lamberts North and Lamberts South placements for adverse weather conditions.

- **Table 6-7 Predicted noise levels at sensitive receiver locations Lamberts North (adverse meteorology).**

Receiver	Assessment Period	Noise Goal dB(A)	Initial Stage	Mid Stage	Final Stage
Location 1	Daytime	49	39	40	41
	Evening	38			
Location 2	Daytime	38	37	38	39
	Evening	38			

- **Table 6-8 Predicted noise levels at sensitive receiver locations Lamberts South (adverse meteorology).**

Receiver	Assessment Period	Noise Goal dB(A)	Initial Stage	Mid Stage	Final Stage
Location 1	Daytime	49	41	40	39
	Evening	38			
Location 2	Daytime	38	42	41	40
	Evening	38			

6.4.3. Discussion of Results

Under neutral weather conditions, the operation of the ash placement areas for Lamberts North and South both indicate that compliance with the noise goals would generally be expected for both day time and evening periods. A marginal exceedance of the project specific noise goals may occur at Location 2 when operations reach the Lamberts South placement area in 2023. This is likely to occur in the early stages of the operations due to the topography of the site and the proximity to the receiver at this location near the eastern edge of the placement area.

At Lamberts North, the predicted noise levels under adverse meteorological conditions indicate general compliance during the daytime for both locations, with a marginal exceedance possible during the latter stages at Location 2. The same result is again expected at Location 2 for the evening period, although an exceedance of up to about 3 dB(A) is possible at Location 1 during this time.

At Lamberts South, the results generally indicate that, without mitigation, there may be exceedances for both receiver locations; the exception during this phase of works is Location 1 for the daytime period, which is expected to comply even under adverse weather conditions. The exceedances during the evening period are predicted to be up to 4 dB(A) at Location 2. These are

expected, however, to reduce to approximately 1-2 dB(A) at both locations during the final stage of works.

6.4.4. Mitigation Measures

The nature of the operations for the ash placement makes mitigation feasible by utilising the benched ash mound as a noise barrier. Testing various barrier options has indicated that where the top of the barrier is 4 m higher than the ground level of the equipment, a 5-6 dB(A) reduction in the noise level at the receiver location is possible.

There are limitations to this method due to the mobile nature of the noise sources and the movement of trucks to and from the dump location, since the barriers effectiveness would be decreased as the noise source moves further from it. While the use of the ash placement as a barrier has been identified as a potential solution, the construction of the ash mound and its progression through the site will require more detailed planning and may be subject to safety and process constraints.

Given the life cycle of the sites it may be feasible to purchase new, quieter equipment when the existing equipment requires replacement. In a similar fashion, maintenance of the equipment should include the use of quiet components such as exhausts when replacements are being considered.

Means by which mitigation measures would be applied will be addressed in the Construction and Operational Management Plans for the site.

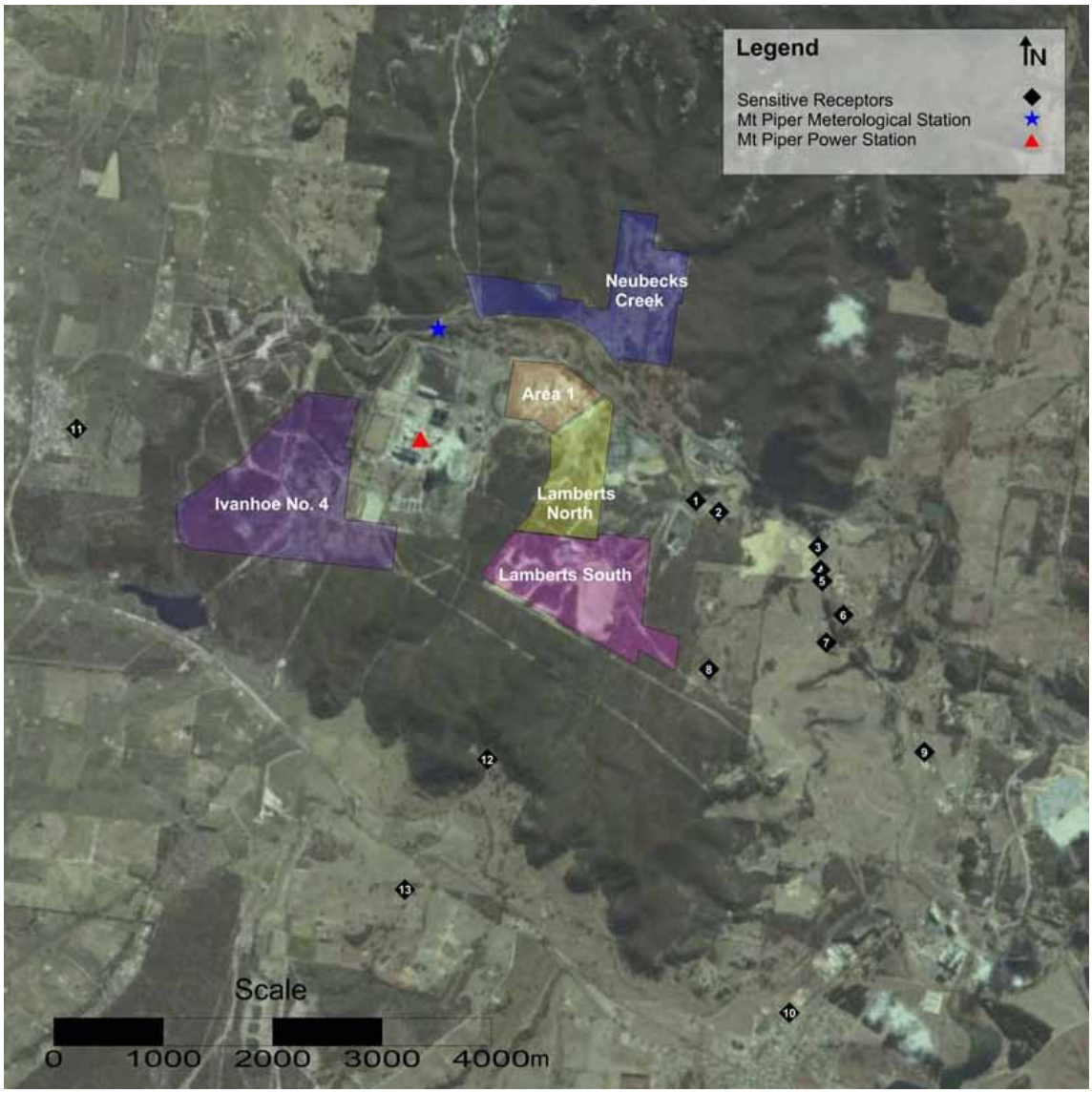
6.4.5. Ivanhoe No. 4 and Neubecks Creek Sites

Placement of fly ash and furnace ash at the proposed Ivanhoe No. 4 and Neubecks Creek sites would have potential noise impacts on nearby sensitive receivers and would require further detailed assessment in accordance with the NSW Industrial Noise Policy (EPA, 2000).

Potential noise emissions associated with the Ivanhoe No. 4 and Neubecks Creek ash placement areas would primarily be from operations of the haul trucks, dozer, roller and water cart within the site. The key risks with these operations include the simultaneous use of multiple pieces of machinery during operations and for the Neubecks Creek site, and the haul road route used to deposit the ash in the placement area. For the Ivanhoe No.4 site, the existing topography is likely to provide sufficient noise barrier effect. In addition haul roads would not need to pass near any residential locations. The layout for the site works has not been developed, so any qualitative assessment assumes that the distance to an affected receiver is taken from the nearest edge of the defined concept area.

A review of sensitive receivers was undertaken for the air quality assessment, and these same sites applied for noise impacts. These sites are shown in **Figure 6-2**. For the Neubecks Creek concept approval site, potentially affected residences would primarily be located in Blackmans Flat (sites 1 and 2), some 1.5 km away. These residences are also across the Castlereagh Highway from the concept area. Any impact would be fairly localised, and it is unlikely there would be evidence of noise impact at Blackmans Flat.

- **Figure 6-2 Concept Approval Sites and Sensitive Receptors**



At Ivanhoe No. 4 the residences in the eastern areas of Portland (Site 11) and the rural properties in Pipers Flat are the closest receiver locations. The distance to Portland and to Pipers Flat is about 1.5 km and the potential for noise impact in these locations would be minimal, due to the distance

between the possible ash placement area and the residences as well as the significant intervening topography.

Potential mitigation measures for the concept approval sites would include options such as the use of noise barriers constructed from the ash placement and strategic benching during the site lifecycle.

Further detailed assessment would be required for these sites at project approval stage. This would be undertaken following the guidelines set by the NSW Industrial Noise Policy, using the version relevant to the timing of the proposal. The INP is used to determine an acceptable level of impact to the existing noise environment within a community. Where the INP criteria are met at the closest or most affected receivers, no adverse noise impacts would be reasonable expected. The study would include:

- Noise monitoring for the projects to enable the setting of appropriate criteria with respect to the existing environment. This would need to be done closer to the time it is likely for the works to be required;
- Establishing appropriate noise criteria and project noise goals;
- Estimating noise emission levels from the project operations;
- Assessment of noise impacts at residences nearest to the proposal based on the prediction of noise levels at those sites using a noise model; and
- Identifying mitigation measures, if required, to manage any impacts identified. These would include hours of operation.

6.5. Construction Noise Assessment

6.5.1. Methodology

The NSW DECCW has established an *Interim Construction Noise Guideline* (ICNG) that supersedes any previous guidance on management of construction noise impacts. This Proposal has been assessed in accordance with the guideline requirements to determine the potential for the construction activities to create an adverse noise impact at the nearby receiver locations.

The ICNG recommends standard hours for construction work as summarised in **Table 6-9** although these may be able to be varied in specific circumstances to undertake work for safety or accessibility reasons.

- **Table 6-9 Recommended standard hours for construction work**

Work type	Recommended standard hours of work
Normal construction	Monday to Friday 7 am to 6 pm Saturday 8 am to 1 pm No work on Sundays or public holidays
Blasting	Monday to Friday 9 am to 5 pm Saturday 9 am to 1 pm No blasting on Sundays or public holidays

Works outside these hours may be permissible where the following circumstances apply:

- Works that do not cause construction noise to be audible at any sensitive receivers;
- For the delivery of materials required outside these hours by the Police or other authorities for safety reasons;
- As agreed by the DoP and the DECCW.

Local residents and the DECCW would be informed of the timing and duration of work as soon as possible before that work commences.

Recommended noise levels for airborne noise at sensitive receivers and advice on how they should be applied are provided in **Table 6-10**. The RBL described in the table is the overall single-figure background noise level measured in each relevant assessment period (during or outside the approved construction hours).

The ICNG states that the noise management level applies at any property boundary that is most exposed to the construction noise, at a height of 1.5 m above ground level. In cases where the property boundary is more than 30 m from the residence, the location for measuring or predicting noise levels is at the most noise-affected point within 30 m of the residence.

6.5.2. Construction Noise Impacts

The construction activities for the Lamberts North and Lamberts South areas would involve the preparatory works prior to ash deposition. Due to the nature of the existing areas proposed as placement sites, works such grubbing and clearing and re-profiling are expected to be minimal. The following section provides a description of the anticipated works specific to each of the ash placement areas.

- **Table 6-10 Recommended construction noise management levels (DECC 2009).**

Recommended Standard hours: Monday to Friday 7 am to 6 pm Saturday 8 am to 1 pm No work on Sundays or public holidays	Noise affected RBL + 10 dB	The noise affected level represents the point above which there may be some community reaction to noise. ▪ Where the predicted or measured LAeq (15 min) is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level. ▪ The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.
	Highly noise affected 75 dB(A)	▪ The highly noise affected level represents the point above which there may be strong community reaction to noise. ▪ Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account: ▪ 1. times identified by the community when they are less sensitive to noise (such as before and after school for works near schools, or mid-morning or mid-afternoon for works near residences. ▪ 2. if the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.
Outside recommended standard hours	Noise affected RBL + 5 dB	▪ A strong justification would typically be required for works outside the recommended standard hours. ▪ The proponent should apply all feasible and reasonable work practices to meet the noise affected level. ▪ Where all feasible and reasonable practices have been applied and noise is more than 5 dB(A) above the noise affected level, the proponent should negotiate with the community. ▪ For guidance on negotiating agreements see section 7.2.2, ICNG.

* Noise levels apply at the property boundary that is most exposed to construction noise, and at a height of 1.5 m above ground level. If the property boundary is more than 30 m from the residence, the location for measuring or predicting noise levels is at the most noise-affected point within 30 m of the residence.
-Noise levels may be higher at upper floors of the noise affected residence.

Near the end of the life of the current ash placement area the northern area of Lamberts North, would require the following preparation:

- Clearing and grubbing of remnant vegetation across the site;
- Re-grading/profiling of the existing gully area known as Huons Gully to remove any existing stockpiles from current mining operations;
- Extension of haul roads from Area 1 by the placement of fill to maintain road grades of less than 10%;

- Earth banks would be constructed around the boundary of the proposed Lithgow City Council Landfill Site and construction of containment bunds around the footprint;
- Placement of drainage material and a geotextile drainage blanket would be installed in the invert of the Huons Gully.

Approximately 12 months in advance of the Lamberts North site reaching its capacity, site preparation works would commence for the Lamberts South site. Preparatory works would include:

- Clearing and grubbing of remnant vegetation across the site;
- Extension of haul roads from Lamberts North by the placement of fill to maintain road grades of less than 10%;
- Earthen bunds would be constructed around the boundary of the placement area.

6.5.3. Construction Noise Impact Assessment

The predicted noise levels for construction activities for each of the placement areas are presented in **Table 6-11**.

Table 6-11 Predicted construction noise levels

Receiver	Noise Goal dB(A)	Lamberts North	Lamberts South
Location 1	54	32	33
Location 2	43	35	37

The predicted levels for the construction activities are based on the use of an excavator, a dozer and a dump truck operating simultaneously. The predictions are based on the specific location of the works such as Huon Creek drainage for Lamberts North site and therefore some topographic shielding is apparent, which is not available during the ash placement operations. The modelling predictions indicate that the noise levels from construction activities would be below the project noise goals at the receiver locations.

No construction noise mitigation measures would be required.

6.6. Management and Monitoring

Monitoring would need to be undertaken for specific equipment and overall construction noise levels on the project. Specific equipment levels will be measured and assessed against equipment types and overall noise levels assessed in consultation with relevant noise criteria.

Noise monitoring and measurements would be performed according to relevant standards and policies including but not limited to:

- The DECCW's *Environmental Noise Control Manual*;
- The DECCW's *Industrial Noise Policy*; and
- Australian Standard *AS1055.*

If the noise from a construction activity is substantially tonal or impulsive in nature (as described in Chapter 4 of the NSW Industrial Noise Policy above), 5dB(A) must be added to the measured construction noise level when comparing the measured noise with the construction noise objectives.

Equipment noise levels would be monitored:

- When key items of equipment are first brought onto site to establish baseline noise levels (measured at a distance of 7 m); and
- At 12 month intervals.

Prior to commencement on site, a noise test would be completed for items of plant which includes a check of reverse / travel alarm noise levels (L_{Amax}) at 7 m as well as operational noise levels. Long term environmental noise monitoring using unattended noise monitoring equipment will be carried out to confirm actual operational noise levels at the sensitive receiver locations or where a noise complaint has been received. The objective of the measurements is to measure the $L_{Aeq\ 15min}$ noise levels, to determine compliance with the noise project specific goals.

Environmental noise monitoring would be conducted:

- When works and activities have commenced at a new location;
- Every 12 months; and
- In response to complaints, where necessary.

Mt Piper Power Station Ash Placement Project

ENVIRONMENTAL ASSESSMENT

CHAPTER 7 – WATER MANAGEMENT

August 2010

Contents

7. Water Management

This chapter provides an assessment of the key environmental issue of water management. The Director-General's requirements specific to water management are:

- *For Neubecks Creek and Ivanhoe No 4 sites (concept plan application only) include an analysis of potential surface water, hydrology, groundwater and water supply constraints to the development of these sites including available mitigation and/or management options that may be applied to achieve acceptable environmental outcomes, with consideration of cumulative impacts from the project and other existing or proposed activities in close proximity to the project site. The assessment must demonstrate sufficient water supply availability to accommodate the requirements of the concept plan as a whole and that these sites can be developed without significant risks to hydrology or groundwater resources, with consideration to cumulative impacts. Key water related risk factors and/or design criteria that would require further detailed investigation prior to the development of these sites must be identified.*
- *For the Lamberts North and Lamberts South sites the Environmental Assessment must characterise and assess site hydrology and water management including drainage, stormwater, flooding and water supply and provide an assessment of potential risks to surface water and groundwater quality with consideration of relevant State policies and ANZECC water quality guidelines. The water quality investigations must address the cumulative impacts on water of the proposal in conjunction with other activities in the area such as power generation, coal mining and a landfill, in particular the potential impact on the Coxs River system, Huon Creek and Neubecks Creek. The Environmental Assessment must provide details of proposed water quality monitoring during construction and operation so as to assess changes to the quality of receiving waters and the groundwater table.*

7.1. Introduction

A technical paper on hydrology and water quality was prepared and is provided as **Appendix D** to the EA. This chapter summarises the paper and provides:

- A review of surface water hydrology and identification of potential for water quality impacts due to surface run-off in Neubecks Creek and Coxs River. A water management system is described for the Lamberts North and Lamberts South sites to demonstrate that sufficient water would be available for site usage without any requirement to extract water from any new sources, and how water on the sites would be managed to minimise the risk of water pollution in Neubecks Creek;

- Information on groundwater quality and movement, using existing bore hole data collected for the on-going monitoring of the existing ash storage area (Area 1) and data from new bore holes drilled in Lamberts North and Lamberts South as part of this study. Based on data collection and modelling undertaken for Area 1 an assessment is made of the potential for groundwater impacts to result from new ash storage areas;
- A review of available water quality data from Neubecks Creek and an assessment of it against ANZECC/ARMCANZ (2000) *Australian and New Zealand Guidelines for Fresh and Marine Water Quality*. It also provides an assessment of the contribution to the existing water quality from groundwater inflow from mine workings and the existing ash placement Area 1. Cumulative effects from other developments within the Neubecks Creeks catchment are also considered;
- An assessment of the impacts on receiving water quality and identifies the measures needed to mitigate any potential impacts on water quality during the life of the facility. Monitoring plans are proposed in the context of identifying impacts on water quality in Neubecks Creek from the placement of ash at Lamberts North and Lamberts South and providing a baseline for assessing potential impacts from Neubecks Creek and Ivanhoe No 4 sites.

7.2. Hydrology

7.2.1. Drainage Catchments

A detailed hydrological study was undertaken in the Lamberts Gully area to assess issues associated with surface runoff from the proposed ash placement areas of Lamberts North and Lamberts South.

The area contains two waterways referred to as Huons Gully and Lamberts Gully. These two gullies or waterways appear to have derived from the original Lamberts Creek which was present when the Western Main Colliery holding was active. The waterways have been disturbed by previous mining activities in the catchment. The location of the original Lamberts Creek alignment is unclear but the existing drainage elements comprise Huons Gully (known previously as Eastern Drain and more recently as Huons Creek) and Lamberts Gully which both drain from south to north, with the headwaters of both waterways in the Ben Bullen State Forest (see **Figure 7-1**). Huons Gully drains to a large pond known as Huons Pond or Groundwater Collection basin (GCB), an impoundment which is not connected to Neubecks Creek, rather it is pumped to settlement ponds and reused on site. Lamberts Gully drains through the existing Lamberts Gully Coal Mine and then into Neubecks Creek. The Lamberts Gully area lies within the Western Main Colliery and since the 1940s this area has been worked by shallow underground and open cut mining.

The Ivanhoe No. 4 area includes a number of drainage lines. The catchment for these drainage lines in the drain from the ridge that is on the western and southern sides of the Ivanhoe No. 4 Concept Area. The drainage lines drain from this ridge north and east through the Ivanhoe No. 4 Concept Area. The drainage lines combine and continue to drain north-east to the western arm of Neubecks Creek.

The Neubecks Creek area includes a number of drainage lines and the northern arm of Neubecks Creek. The catchment for these drainage lines and Neubecks Creek drain from North to South. The drainage lines combines with Neubecks Creek, which continues to flow east.

The catchments for Neubecks Creek and Ivanhoe No 4 are illustrated in **Figure 7-2.**

7.2.2. Water Management Strategy

Water would be used within the proposed ash placement areas for dust management and for progressive rehabilitation through capping and revegetation. The water management within the proposed ash placement areas is discussed below.

Water for ash conditioning prior to placement in the ash area is derived from the reuse water within the power station operation. The ash is treated within the power station area and the treated ash is then transported to the ash placement areas. This same process will operate for the new ash placement area. Should Mt Piper Extension be constructed as a coal fired plant, the ash conditioning processes are also planned to be undertaken within the existing Mt Piper Power Station. The water requirements for the Mt Piper Extension were addressed in the EA undertaken for the concept approval for that project (SKM, 2009). Accordingly, water used for ash conditioning is not addressed in this EA.

Lamberts Gully

The objective of the water management strategy is to provide adequate water to the proposed ash storage facility to operate successfully while minimising environmental impacts by collecting and managing dirty runoff water. Delta has managed the existing ash placement area at Mt Piper since plant operations commenced in the early 1990s and the water management techniques developed at that site will be applied to the proposed sites at Lamberts North and Lamberts South.

On this basis a water management strategy for the two sites would be developed with the following key principles:

- Stormwater runoff from undisturbed areas surrounding the Project site to be diverted away from disturbed areas and released directly into adjacent waterways;
- Design of any drainage systems operating for the life of the project to ensure erosion is minimised;

- Staging ash placement to minimise the operational area exposed at any one time to reduce the potential for erosion;
- Separating sediment-containing stormwater from other sources of water on the site such as the ash placement area;
- Incorporating the reuse of contaminated stormwater into the overall water management strategy for the project to meet the demands for rehabilitation and dust suppression;
- Minimising the extent and duration of disturbed areas by implementing a progressive rehabilitation strategy including prompt stabilisation of landforms; and
- Modifying water usage and ash placement activities in times of very low water availability to continue to meet dust suppression and rehabilitation objectives.

The key elements of the water management system are sediment dams and water storages (which collect water from capped and rehabilitated areas), Dirty Water Area Storage Area[1] (which collects run-off from the on-going ash placement activities) and diversion drains. Water management in very low water availability conditions would comprise:

- Controlling dust by minimising work areas and using DUSTEX instead of water. The most distant and least used areas (about 40%) would be capped with a thin layer of overburden. The remaining areas would be capped with sealant such as DUSTEX, thus allowing the sprinklers to be turned off as no water would be required, with labour and time dedicated to keeping the temporary capping intact. The working areas would be minimised and rotated to allow continued placement without affecting production. The method would involve a small area or pad for ash placement and ash would be progressively placed until the pad reaches optimum height. The pad would then be coated with DUSTEX and the placement moved to a different working area. Working areas could be rotated indefinitely by placing temporary capping and placing ash over previously capped areas;
- The use of water only for the management of roads and some working areas. Water carts would be used to supply about 40 kL/hr for 3 hours per day (120 kL/day or less than half of the nominated daily volume of water required). It should be noted that about 20% of the water cart water is sourced from dirty water ponds and surface drains and, although this will reduce demand on water by minimising usage, while maintaining an effective system for gathering all water from the site.

[1] The Dirty Water Storage Area would be required to have a storage capacity of about 500 ML and would move with the progression of the active ash placement areas.

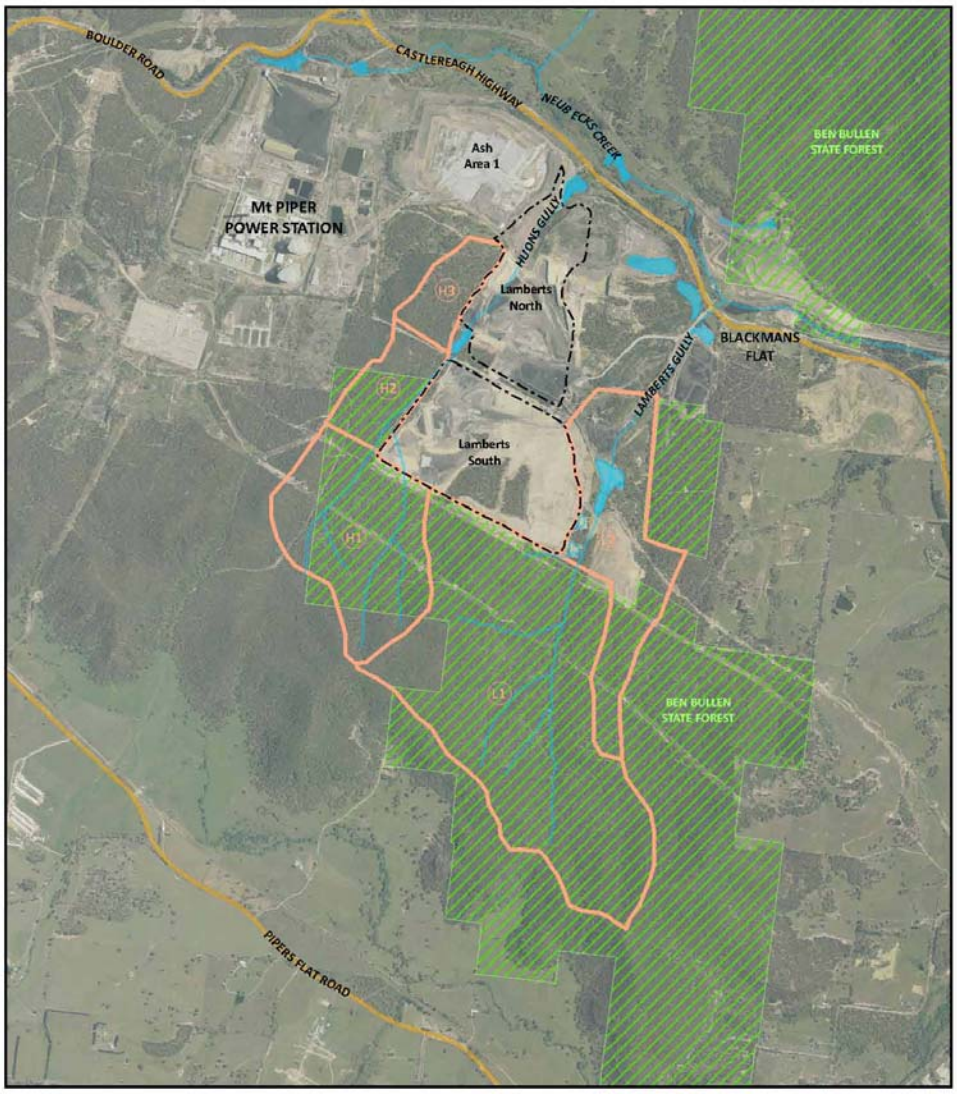


Figure 7-1 Catchment Plan - Project Approval Areas

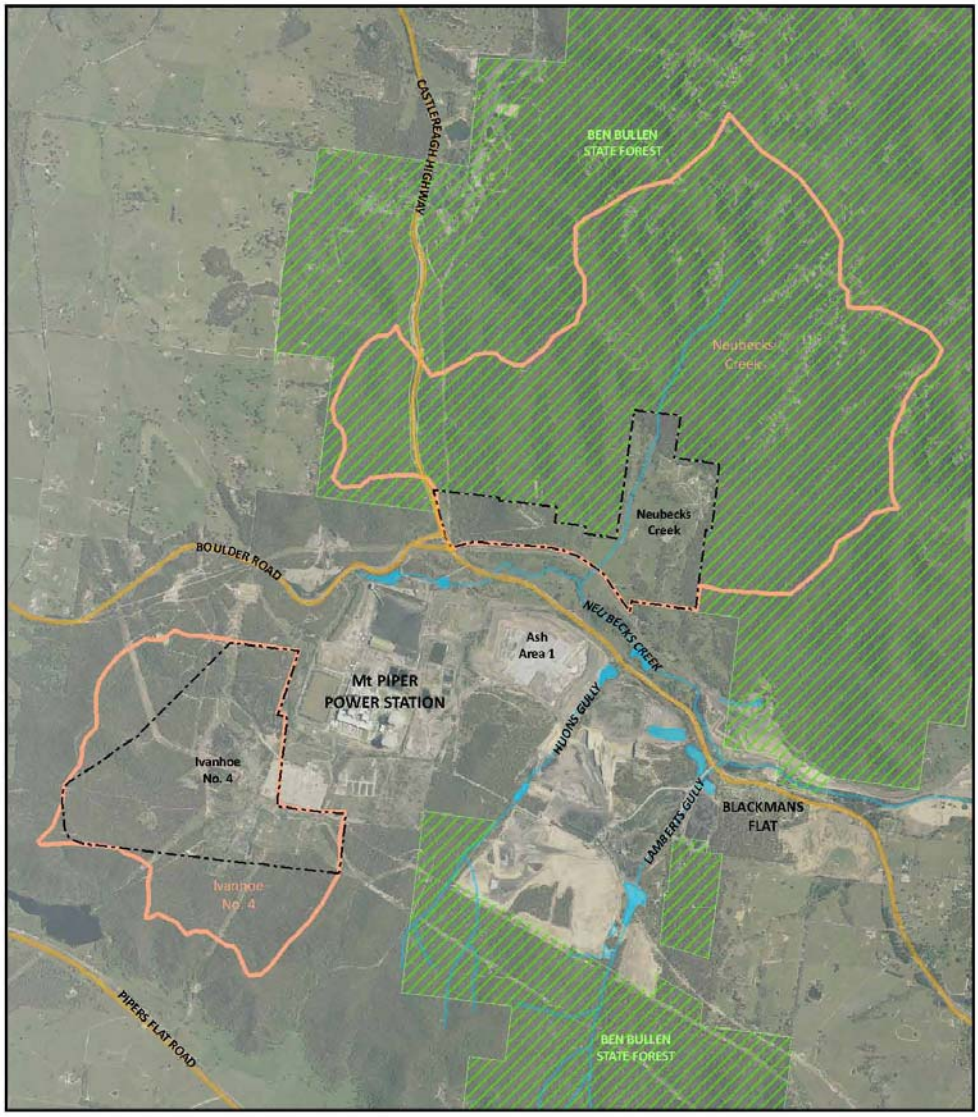


Figure 7-2 Catchment Plan - Concept Approval Areas

Water requirements for rehabilitation are minimised by the use of native plants of local provenance, ie species which are hardy and drought tolerant. In the case of extreme conditions, no water would be available but these plants would be no worse off than the surrounding flora.

All of these activities form part of the current water management strategy for ash placement at Mt Piper Power Station and reflect the local water situation. Should the Mt Piper Power Station and Mt Piper Extension be operating together during very low availability conditions, the water management procedures for ash placement and the minimum water requirements of 120 kL/day would be the same. Work face areas and access roads for the two plants operating would be similar, although the placement rate would be higher.

Water collected in the water storage areas would be used for rehabilitation and dust suppression. As the ash placement areas are progressively capped and rehabilitated, the runoff from these areas would be directed to sediment dams. The diversion drains would be designed to convey the 100 year ARI flood event from the external catchments.

The performance of the water management system for Lamberts North and Lamberts South was assessed using the modelling software program GoldSim to model continuous systems. The modelling was undertaken for the placement of ash generated from the existing Mt Piper Power Station and for the option of the existing plant plus Mt Piper Extension operation as a coal fired plant. The water balance model was used to predict the reliability of the water for the rehabilitation and dust suppression demands. The maximum daily water demand for Mt Piper would be 250 kL/day, and for Mt Piper plus Mt Piper Extension 450 kL/day. The rehabilitation and dust suppression water demand would vary, however, depending on the amount of rainfall received at the site and the amount of ash to be placed. More rainfall means less watering for both dust suppression and rehabilitation. The water balance modelling assumes a constant daily demand of 250 kL/day for Mt Piper Power Station alone and a daily demand of 450 kL/day for Mt Piper and Mt Piper Extension Power Stations together, regardless of ash production and local rainfall.

The water balance modelling results are presented in two ways:

- The overall project reliability – which calculates the total number of days in the 30 year project life in which demand is fully satisfied; and
- The annual reliability – which assesses the number of days per year that the demand is fully supplied. This provides an added level of detail to assess which specific phase of the project may have the potential for water storage.

For overall project reliability the water balance model predicts the average dust suppression and rehabilitation reliability for the project life is 80-82%. This means that, on average over the life of the project, daily dust suppression and rehabilitation demand is predicted to be satisfied for 80-82%

of the days of the project life, assuming maximum daily water usage. On the other 18-20% of days the water available would be less than the maximum requirement (250 or 450 kL/day).

For annual reliability the water supply reliability was assessed for a range of different likelihoods ie the chance of the risk of water shortage occurring. The aim of this type of assessment is to look at the results with the potential for water shortage and determine how likely that is to occur. This water balance modelling predicts there will be suitable water availability to supply the rehabilitation and dust suppression demand for the proposed ash placement facility. The consequence of a shortfall of water to supply dust suppression and rehabilitation is minor in that during periods of median rainfall the shortfall from 250 kL/day would occur on no more than 19% of days of the year for Mt Piper operating and from 450 kL/day it would occur on no more than 23% of days of the year for Mt Piper and Mt Piper Extension both operating at full output.

When rainfall is significantly below average, for half of the year the full quota of 250 kL/day or 450 kL/day is able to be supplied; for the other half of the year there is only a 10% chance that the full quota will be provided or a 90% chance that the rainfall will be less than the full quota. As discussed below the minimum requirement for dust management on the site is 120 kL/day. There would be a substantially reduced risk of being able to provide 120 kL/day compared with 250 kL/day indicating, when linked to strict management of water storages, a moderate to high likelihood that the 120 kL/day would always be available.

The reliability of water supplied for dust suppression and rehabilitation is regarded as moderate to high but, in the event of a significantly below average period of rainfall and a shortfall occurring, alternative management processes exist for water management. The management processes were described above and form part of the current water management strategies which reflect the local water situation. As noted, the minimum water requirement for ash placement is 120kL/day and when that number is set as the requirement for water supply, there is a substantially reduced risk of a shortfall occurring. The management of water on the site is based on timing for the adjustment of water extraction from the on-site storages (which collect rainfall). This allows the water extracted to be reduced to a maximum of 120 kL/day as early as practicable, thus ensuring the maintenance of water in the storages for much longer periods during times of low or no rainfall.

The water balance model predicts that the maximum volume of water to be stored in the Dirty Water Storage Area, as a result of a major rainfall event, is 200 ML. This maximum volume is less than the volume of the dirty water storage area. Therefore, the model predicted there would be no releases from Dirty Water Storage Area of the proposed ash placement facility for the simulated project life.

The sediment dams and existing water storages on the site will manage the runoff containing sediment from the capped and rehabilitated areas. There would be no planned releases from this

system and the final retention dam would overflow to the waterway after the runoff has been treated appropriately. The frequency of the overflows from the sediment dams system was determined from the water balance model in terms of Average Recurrence Interval. This assessment equates to an ARI of approximately 1 in 5 years and therefore, on average, the site would be predicted to have an overflow from the sedimentation dams in six years of the 30 year project life.

This result represents the maximum likely overflows from the sediment dams over the life of the proposed ash placement facility.

Neubecks Creek and Ivanhoe No 4

To manage the potential impacts of the development of the areas of Ivanhoe No. 4 and Neubecks Creek, a site water management system at each site would need to be developed.

The philosophy of the water management strategy would be to provide adequate water to the proposed ash placement facility to operate successfully while minimising environmental impacts by collecting and managing dirty runoff water. A water management system developed for each area would have the following key principles:

- Stormwater runoff from undisturbed areas surrounding the site would be diverted away from disturbed areas and released directly into adjacent waterways;
- Design of any drainage systems operating for the life of the site to ensure erosion minimised;
- Staging ash placement to minimise the operational area exposed at any one time to reduce the potential for erosion;
- Separating sediment-containing stormwater from other sources of polluted water on the site such as the ash placement area;
- Incorporating the reuse of contaminated stormwater into the overall water management strategy for the project to meet the demands for rehabilitation and dust suppression;
- Minimisation of extent and duration of disturbed areas by implementing a progressive rehabilitation strategy including prompt stabilisation of landforms; and
- Modifying water usage and ash placement activities in times of very low water availability to continue to meet dust suppression and rehabilitation objectives.

In the process of developing the water management system, a number of studies would need to be undertaken for water management and to assess flooding. The development of the water management for the site would require the development of a water balance model. The objectives of the water balance model would be to:

- Control the release of water from the storages so that that releases occur in a manner that minimises impacts upon downstream users and the environment;

- Manage dam storages so as to have enough water to adequately supply to demands for rehabilitation and dust suppression;
- Control and manage the separation and use of clean and dirty water.

7.2.3. Water Availability

The project investigation area for the Lamberts North and Lamberts South ash placement facilities is only a very small portion of the Upper Coxs River Catchment, and development of the ash placement area would have no impact on the water catchment in terms of water availability. As the Lamberts Gully project investigation area has been previously disturbed by mining, the runoff from the water has already been removed from the Upper Coxs River Catchment.

Similarly, the Neubecks Creek and Ivanhoe No. 4 sites are only very small portions of the Upper Coxs River Catchment and would have no impact on the Sydney drinking water catchments in terms of water availability.

The development of the ash placement facilities require water to be used for rehabilitation and dust suppression to supply to the operation. The water for the demands of the proposed ash placement would be sourced from water harvested from the disturbed areas of the proposed ash placement facility and would not require water to be derived from the Coxs River system.

7.2.4. Flooding Impacts

The development of the ash disposal facility has the potential to affect the flooding regime of the local creeks by modifying the landform of the area to include the proposed ash placement facility. The potential for flooding impacts would be managed by the use of diversion drains to separate clean water from undisturbed catchments upstream of the proposed ash placement facility. The diversion drains would be designed to convey the 100 year ARI flood event.

7.2.5. Water Quality

As the proposed ash placement facilities would have the potential to affect the water quality of Neubecks Creek and consequently the Coxs River the system would be designed to manage the contaminated water from the site and minimise the risk of affecting the water quality by:

- Separating clean water from undisturbed catchments and dirty water on the site;
- Managing the dirty water generated on site by use of sediment dams for runoff containing sediment laden water and a dirty water area for water containing runoff from the exposed ash placement areas;
- Designing for no regular controlled releases from the site;

- Reusing the water generated on site to satisfy the demands for rehabilitation and dust suppression;
- Designing the sedimentation dams to release water in large rainfall events after the water has been treated through the dams;
- Incorporating the reuse of contaminated stormwater into the overall water management strategy for the project to meet the demands for rehabilitation and dust suppression; and
- Minimising the extent and duration of disturbed areas by implementing a progressive rehabilitation strategy including prompt stabilisation of landforms.

7.3. Groundwater

7.3.1. Geology and Mining Activities

The Mt Piper area is located at the western edge of the Sydney geological basin, within rocks of the Illawarra Coal Measures. The geological sequence in the vicinity of Mount Piper is as follows, in descending order: Lidsdale Seam (1-1.5m): interbedded high ash coal and shale; Blackmans Flat Conglomerate (up to 20m, but probably only a few metres here): coarse sandstone and conglomerate; Lithgow Seam (2-3m); Marrangaroo Conglomerate (about 20m) massive sandstone and conglomerate, with some boulders; Shoalhaven Group (>20m): marine sandstone, siltstone and mudstone, sulphide-bearing and acid-generating in places. Coal mining commenced in the Wallerawang and Mount Piper district in about 1873 and it is likely that the miners were initially drawn by the presence of the thick Lithgow Seam at shallow depth.

The Lamberts Gully area lies within the Western Main Colliery holding, which occupies the land immediately east of the power station. Since the 1940s the Lithgow Seam here has been worked by shallow underground bord and pillar methods and subsequently by open cut, the latter being generally ‘roof lifting’ exercises to extract pillar remnants. Underground mining ceased in the 1990s and open pit extraction has continued.

The Ivanhoe No 4 area is known to be extensively underlain by shallow bord and pillar workings of the former Ivanhoe No 4 colliery. The condition of these workings is likely to be similar to those beneath the Lamberts Gully site, except that no open cut “roof lifting” has been carried out there.

The proposed Neubecks Creek ash placement area appears to be partly within the Neubecks Creek mining lease (eastern side) and partly on the Ivanhoe colliery holding (western side). Bord and pillar mining and open cut mining have been carried out in this area (Huon Colliery and Huon Extended Colliery, plus No 3 and 5 open cuts). The mined areas are separated by undisturbed portions of the Lithgow Seam, and workings extend to at least 500m north of the Mudgee Road. The condition of these workings is likely to be similar to that of the Lamberts Gully area.

Undisturbed coal measures rocks in the Sydney Basin are generally considered poor groundwater prospects because of low bore yields and water quality that is only fair to poor – that is, of stock quality but non-potable. The seams themselves act as semi-confined aquifers of low hydraulic conductivity and moderate to high salinity. The underlying Shoalhaven Group rocks contain small but significant amounts of fine-grained sulphide minerals.

7.3.2. Groundwater Bores

Connell Wagner (2007) and Aurecon (2009) reported on the use of groundwater bores in the area of the existing ash placement area at Mt Piper Power Station. Some bores were located up-gradient of the existing ash placement area (MPGM4/ D4 and D5). Others were placed inside the ash placement area to monitor the effects of normal ash placement, although some (including B904 at the southern part of the ash placement area) were located to sample underground mine (goaf) workings. Borehole locations are shown in **Figure 7-3.**

A Statement of Environmental Effects (SEE) for the extension in 2007 of the brine placement area includes a summary of groundwater monitoring results obtained from the borehole sites (D10 – D14) in and around the operating ash emplacement area (Connell Wagner, 2007). Surface monitoring data from the groundwater collection basin (GCB), known as Huons Pond or Dam, at the end of Huons Gully are also provided. The GCB is the former Huon Mine No 6 void. Connell Wagner (2007) indicated that groundwater seepage at the ash placement locality is generally to the east to Huons Gully and the GCB due to the gradient of the strata at this location. Any seepage that reaches Huons Gully is contained within the basin and is reused, thus avoiding discharge to Neubecks Creek.

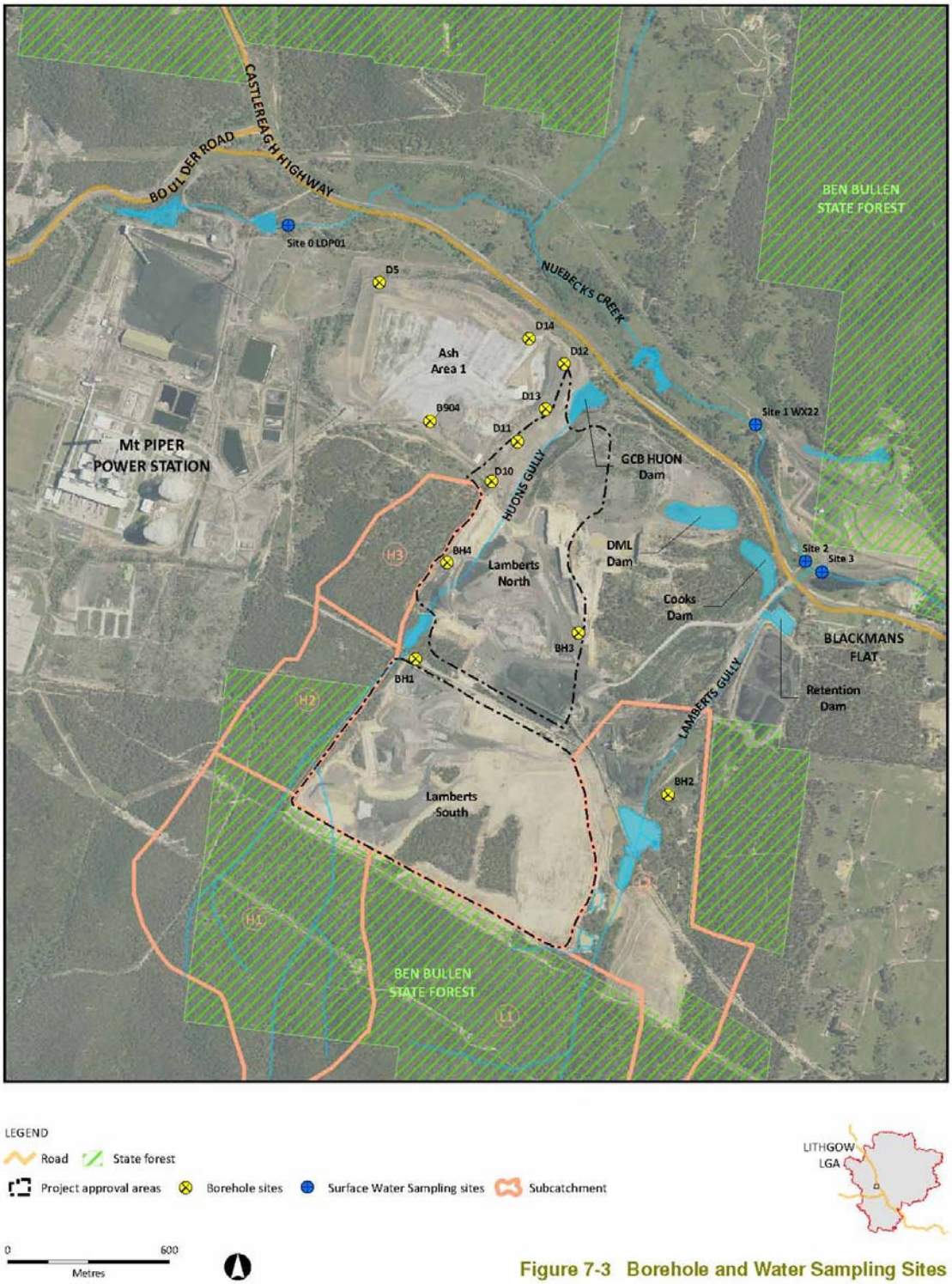


Figure 7-3 Borehole and Water Sampling Sites

The Protection of the Environment Operations Act requires consideration of the ANZECC (2000) guidelines when assessing effects on ambient water quality in receiving waters. The wider context of the ANZECC (2000) guideline was used to define acceptable ambient water quality. The guidelines used are for protection of freshwater aquatic life. Where appropriate other guidelines used were for protection of livestock, irrigation water or drinking water.

Aurecon (2009) updated these data and provided a comparison with upstream site D5. These data are summarised in **Table 7-1**.

Table 7-1 Average Groundwater Concentrations in Monitoring Bores and GCB

Parameter (mg/L) (sampling time)	MPG M4 / D10 (2001-2009)	B0904 (1997-2000)	MPG M4 /D11 (2001-2009)	MPGM4 /D12 (2001-2006)	MPG M4 /D13 (2001-2005)	MPG M4 /D14 (2001-2003)	MPG M4/D 5	GCB (2001-2008)	Guideline (mg/L)
Cond-ivity (uS/cm)	1618	-	2076	1263	1245	1209	1098	1554	30-350
TDS	1374	1384	1390	960	982	865	879	1216	1500**
Mn	3.16	9.2	2.4	6.9	1.46	1.35	8.35	4.26	1.9
Cl	44	22	229	29	68	26	26	41	350 *
SO_4	864	892	228	624	418	356	583	791	1000 #
B	1.8	1.5	0.3	0.7	0.04	0.02	0.15	0.893	0.37
Fe	1.26	10.6	6.37	13.63	0.16	3.66	49.9	0.103	0.3 ##
F	0.34	5.3	0.46	0.1	0.2	0.14	0.181	0.089	1.0##
Ni	0.372	0.84	0.047	0.672	0.055	0.458	0.066	0.313	0.011
Zn	0.458	2.6	0.104	0.524	0.03	0.02	0.077	0.073	0.008

ANZECC (2000) guidelines for protection of freshwaters, livestock or irrigation waters (# Livestock water; * Irrigation water for moderately tolerant crops; ## drinking water; ** conductivity conversion applied by Connell Wagner (2007))

The summarised groundwater results show:

- Sulphate, boron, nickel, manganese and iron are naturally elevated in the area due to the local mineralisation associated with groundwater from the coal mining workings;
- Elevated trace elements concentrations are particularly evident at bores B904 and D10 which are adjacent to areas of mine coal pillars (goaf);
- The effect of the underground mine water quality (as indicated from B904 and D10) is reflected in the values for the groundwater collection basin, notably in the higher sulphate and boron compared to the D11 to D14 bores. Trace elements such as nickel and zinc are also elevated in these areas.

Chloride is regarded as an indicator of brine leachates, although no criterion is available for ecosystems. As a guideline an indicator of 350 mg/L is used for moderately tolerant crops. The low chloride concentrations in the groundwater bores (except for D11), indicate no significant effects on the local groundwater from the existing brine conditioned ash. The elevated chloride concentrations at D11 indicate a separate localised source of chlorine in the mine goaf water (Merrick, 2007).

Aurecon (2009) looked at long term trends for chloride since 1993 in the GCB, compared with chloride trends in Neubecks Creek and showed that the goaf chloride has not affected the creek concentrations.

A new groundwater drilling program was carried out at Lamberts Gully Colliery on 10-11 December 2009. Four boreholes were drilled (BHs 1-4) and two of these (BH2 and BH4) were completed as groundwater observation wells (piezometers). Full analytical results from testing of groundwater samples drawn from BH 1 and BH 2 in January 2010 are given in **Appendix D**, and are compared with earlier testing from observation wells MPGM4/ D10 to D14) in the NW corner of Lamberts North. The principal differences arising from this comparison are that:

- The groundwater salt level (TDS) in BH 1 and BH 2 is very low; and
- Sulphate, manganese and iron are also much lower.

The existing groundwater in the Lamberts South area falls within ANZECC guidelines in many respects. Note, however, that nickel (Ni) and zinc (Zn) at BH1 are above criteria. As noted above, underground mine water quality is reflected as trace element levels for Ni and Zn.

No groundwater investigations are known to have been carried out in the Ivanhoe No 4 area. The potential ash placement area is more elevated than the Lamberts Gully site, but the abandoned mine workings appear to be at least partially saturated. This was deduced from iron stained groundwater discharge in gutters adjacent to the access road to Mt Piper Power Station. Groundwater flow in this area appears to be generally to the east or north east, consistent with the fall of surface topography and the dip of the Lithgow Seam.

No information is available on the groundwater at Neubecks Creek site. It is presumed, however, that the groundwater generally moves towards discharge points along the main watercourse (Neubecks Creek) and the extent of flooding in the abandoned colliery workings will be dependent on topography.

7.3.3. Groundwater Modelling at Existing Ash Storage Area

Connell Wagner (2007) reported on groundwater modelling undertaken in 1999 and 2006/7 to assess the potential impacts associated with brine co-placement in the ash storage area 1.

Groundwater flows were shown to be from west of the ash placement area to the drain which enters the groundwater collection basin (GCB). The model also showed a limited connection between the GCB and Neubecks Creek.

Modelling undertaken in 1999 by Merrick and Tammetta (1999) for brine production and co-placement predicted an insignificant increase in salts and trace elements in the groundwater seeping into the GCB and from there to Neubecks Creek. The modelling showed:

- Water conditioned ash and brine conditioned ash contributed evenly to concentrations of groundwater discharging into Huons Gully and the GCB (Huons Pond);
- The stable background concentrations of major ions throughout the area are not related to the ash deposit. It appeared that the mine goaf zones were bleeding continuously into the spoil material under the attraction of the groundwater sink at the pond;
- There is a low risk that any trace elements generated from ash disposal would increase background levels by more than ANZECC guidelines at Huon Gully or the GCB. There would be no risks at Neubecks Creek, with extremely low concentrations predicted.

The results confirmed that the brine constituents were essentially immobilised in the pores of the water conditioned fly ash and brine conditioned fly ash. Overall the ash had a low rainfall infiltration rate, so the passage of the infiltration through the existing ash deposit was very slow.

Further modelling was undertaken in 2006/7 to predict the potential impacts of the proposed expansion of the brine co-placement area on the GCB and Neubecks Creek (Merrick, 2007). The modelling results showed that the extended area for placement of brine conditioned ash was not expected to cause a significant increase in the concentrations of water quality parameters in the local groundwater or in Neubecks Creek.

The minimal effects of leachates from the ash deposits were due to the slow rate at which leachates from the brine conditioned ash entered the groundwater and the mixing of this with the background groundwater under the ash deposit. The groundwater then flows to the GCB with some possibly reaching Neubecks Creek. The predicted values did not exceed the ANZECC (2000) criteria.

The modelling also noted that the predicted increases in water quality parameters due to inputs from the underground mine areas were also below the ANZECC guidelines, with the exception of boron, nickel and zinc which were naturally elevated. Most of the predicted increases were assessed as being due to poor water quality in the underground mine workings moving toward the GCB and are unrelated to the brine placement area or water conditioned ash placement.

7.3.4. Neubecks Creek and Ivanhoe No 4

To assess the potential impacts of ash placement at these sites a detailed groundwater study would be required for each site. A bore hole monitoring program will be required for each new ash placement site. Given the timeframe and uncertainty of whether these sites would be used for ash placement a limited monitoring program should be established to provide preliminary information on the hydrogeological conditions in the project area and provide a basis for planning a future monitoring network. The information to be collected from any new bore holes established would include water levels, seasonal fluctuations and water quality test results.

7.4. Surface Water Quality

Neubecks Creek is the primary potential receiving water for any discharges from the existing and proposed ash placement areas, which can in turn influence the quality of water feeding into the Coxs River and Sydney's drinking water system.

The assessment of existing water quality conditions within the study area has been made through interpretation of existing water quality data and review of existing reports. Generally water quality information is available for Neubecks Creek at a number of locations, although collection dates vary. Sampling locations are shown in **Figure 7-3**. Data are summarised in **Appendix D**.

7.5. Summary of Impacts

The Director-General's requirements require the Environmental Assessment to assess the impacts on Neubecks Creek, Coxs River and Huons Creek of the proposal at Lamberts North and Lamberts South and the cumulative impacts from other activities such as the operation of the Mt Piper Power Station, its current ash placement Area 1, coal mining in the area and the proposed Lithgow Council Waste Management Facility (not part of this assessment).

The impacts of coal mining and the existing power station operations are included in the assessment. The proposed waste facility has yet to begin operation. The EIS prepared for the waste facility project (HLA Envirosciences 2005) indicated potential water quality impacts from contaminants associated with leaching of land fill material as well as pollution from leaks and spills. Management measures are proposed within the EIS, including a comprehensive leachate management system.

The impacts on receiving waters will focus on Neubecks Creek. Coxs River is downstream of Neubecks Creek, and any cumulative impact within Coxs River would only be evident if a significant impact due to the proposal was noted in Neubecks Creek.

As indicated in the chapters above, the status of Huons Creek as a waterway is unclear. It is described as Huons Gully in the area associated with the existing coal mining activities, as it

appears for some time to have functioned as a gully or drainage line, receiving groundwater drainage from the existing ash placement area and from the operating open cut coal mine, and is not connected to Neubecks Creek. The drainage above the coal mine activities functions as a dry creek drainage area in catchment without any obvious disturbance. The project proposes to cover Huons Gully with ash to provide the necessary volume for ash and to divert any drainage from the undisturbed areas upstream to Lamberts Gully and thence to Neubecks Creek.

The direct and cumulative impacts of the proposal on Neubecks Creek and Coxs River are summarised below.

7.5.1. Impacts on Surface Water Hydrology

The development of the proposed ash placement facility has the potential to affect the water availability of the Upper Cox River Catchment in two ways, by:

- Reducing the volume of runoff to the Coxs River by reducing the catchment area; and
- Requiring external water sources to supply water demands at the proposed ash placement facility.

The project investigation area for the Lamberts North and Lamberts South ash placement facilities is approximately 0.4% of the Upper Coxs River Catchment. Similarly, the Ivanhoe No. 4 area and the Neubecks Creek area equate to approximately 0.4% and 0.3% of the Upper Coxs River Catchment respectively and represent less than 0.01% of the Warragamba (Lake Burragarang) catchment. These are only very small portions of the Upper Coxs River Catchment and would have no impact on the water catchment in terms of water availability.

The proposed ash placement facilities would not require water allocations or licences to operate, as the facilities would be supplied by the water harvested from the disturbed areas of the sites. The water would be used for rehabilitation and dust suppression to supply to the operation. The water sourced from the disturbed areas of the proposed ash placement facility would be achieved by the development of a site water management system for each site.

The development of the ash disposal facility has the potential to affect the flooding regime of the local creeks by modifying the landform of the area to include the proposed ash placement facility. The potential for flooding impacts is mostly likely due to the upstream catchments of the ash placement facility. The development of the site water management system would include diversion drains to separate clean water from undisturbed catchments upstream of the proposed ash placement facility. The diversion drains would be designed to convey the 100 year ARI flood event.

The proposed ash placement facility would have the potential to affect the water quality of the receiving waters. The proposed ash placement facility would generate water contaminated by

sediment and the site water management system would be designed to manage the water from the site and minimise the risk of affecting the water quality of Neubecks Creek and Coxs River by:

- Separating clean water from undisturbed catchments and dirty water on the site;
- Managing the dirty water generated on site, based on the contaminants including sediment dams for runoff containing sediment laden water and a dirty water area for water containing runoff from the exposed ash placement areas;
- Allowing no regular controlled releases from the site;
- Reusing the water generated on site to satisfy the demands for rehabilitation and dust suppression; and
- Allowing water releases from sedimentation dams only in large rainfall events after the water has been treated through the dams.

7.5.2. Impacts on Groundwater

The findings from the 2009 groundwater drilling, and from the review of other sources, show that:

- Water quality is the groundwater is due primarily to the existing water quality from coal mine workings. Sulphate, boron, nickel, manganese and iron are naturally elevated in the area due to the local mineralisation. Elevated trace elements concentrations are particularly evident at bores which are adjacent to areas of mine coal pillars (goaf). The effect of the underground mine water quality is reflected in the values for the groundwater collection basin, notably in the higher sulphate and boron. Trace elements such as nickel and zinc are also elevated in these areas;
- Chloride is regarded as an indicator of brine leachates, and the low chloride concentrations in the groundwater bores indicate no significant effects on the local groundwater from the existing brine conditioned ash;
- Modelling undertaken showed that water conditioned ash and brine conditioned ash contributed evenly to concentrations of groundwater discharging into Huons Gully and the GCB (Huons Pond). The stable background concentrations of major ions throughout the area are not related to the ash deposit and it appeared that the mine goaf zones were bleeding continuously into the spoil material under the attraction of the groundwater sink at the pond. The results confirmed that the brine constituents were essentially immobilised in the pores of the water conditioned fly ash and brine conditioned fly ash. Overall the ash had a low rainfall infiltration rate, so the passage of the infiltration through the existing ash deposit was very slow. The minimal effects of leachates from the ash deposits were due to the slow rate at which leachates from the brine conditioned ash entered the groundwater and the mixing of this with the background groundwater under the ash deposit. The groundwater then flows to the GCB, with some possibly reaching Neubecks Creek. There is a low risk that any trace

elements generated from ash disposal would increase background levels by more than the water quality guidelines at Huons Gully or the GCB;

- The main aquifer in the proposed Lamberts North and Lamberts South ash storage areas is the disturbed rock mass up to 50m thick lying between the base of the Lithgow Seam and the ground surface. This is unconfined and probably extremely permeable in places. It is only partly saturated, with standing water levels generally below RL 920m, discharging eastwards towards water courses such as Lamberts Gully;
- Present disposal practices require the brine conditioned ash to be placed 35-40m above the water table (at 946m AHD). Groundwater quality results and modelling discussed above suggest that this practice is sufficient to ensure brine does not leach through to the groundwater. Continuing this practice of placing brine conditioned ash at an appropriate height would allow for groundwater quality to be unaffected by ash placement in Lamberts North (at 946m AHD) and Lamberts South (956m AHD).

7.5.3. Surface Water Impacts

Based on the processes associated with ash placement the key indicators of concern with respect to water quality include electrical conductivity, total dissolved solids, chloride and trace metals.

Neubecks Creek is the primary potential receiving water for any discharges from the existing and proposed ash placement areas, which can in turn influence the quality of water feeding into the Coxs River. Overall, the Neubecks Creek monitoring results indicate that:

- Electrical conductivity can be elevated at all sites, although immediately downstream of the existing ash Area 1 it falls within guidelines;
- Chloride ion levels are consistently low where measured;
- Metal concentrations are often below criteria, but are shown to be elevated in Neubecks Creek immediately downstream of the existing ash area (particularly silver, arsenic, cadmium, chromium, copper and zinc), at the site upstream of the existing ash area (silver and aluminium) and at downstream sites associated with the existing mine operations (manganese and zinc). The increased manganese and zinc indicated that the flow in Neubecks Creek was dominated by groundwater inflows during the dry weather rather than catchment runoff. The local groundwater is elevated in these metals due to the acid sulphate conditions in the local underground mine waters.

7.5.4. Conclusion

There exists sufficient data from the on-going monitoring and the modelling studies undertaken (described above) to show that the main contribution to elevated water quality parameters in

Neubecks Creek is due to past, underground coal mining activities rather than the existing ash placement works at Area 1 or the operation of Mt Piper Power Station. The Council Waste Management Facility site has yet to begin operation so there is no suggestion of any existing cumulative impact from it.

The management of works at the existing Area 1 is appropriate to minimise the risk of a discharge from the construction and operation of the active ash placement areas. A continuation of these practices in the Lamberts North and Lamberts South areas, as well as similar practices at the Neubecks Creek and Ivanhoe No 4 sites would be enough to ensure that ash placement has limited if any effects on the water quality of Neubecks Creek.

The sections below discuss the mitigation measures necessary to minimise the risks.

7.6. Operational Mitigation and Monitoring

7.6.1. Site Surface Water

Mitigation

As the proposed ash placement facilities would have the potential to affect the water quality of Neubecks Creek and consequently the Coxs River, the system would be designed to manage the ash and sediment contaminated water from the site and minimise the risk of affecting the off-site water quality. This would be done by:

- Separating clean water from undisturbed catchments using catch drains and directing this clean water directly to waterways;
- Managing the water generated in the exposed ash areas to a Dirty Water Area (dams) and designing these dams to provide for no releases from these sites. This water will evaporate and/ or be used for dust suppression and rehabilitation sites;
- Reusing the water generated from capped and rehabilitated areas to satisfy the demands for rehabilitation and dust suppression. This will be done on site by use of sediment dams and water storages for runoff containing sediment laden water. The sedimentation dams will be designed to release water in large rainfall events after the water has been treated through the dams. Once the rehabilitation is established, the runoff would be allowed to return to the waterway without the need for any dams.

The management of potential for water runoff during ash placement would involve:

- Placement of ash in layers, with steps to produce a batter slope and bunds at batter extents to prevent discharge of water over the benches and down batter slopes to minimise scour and erosion; and

- Drainage of surface water runoff from permanent batters to flow along benches and/or formalised channels. It would be typically directed to the centre of the ash placement area and into dirty water storage areas.

Monitoring

The adequacy of the structures to control water quality runoff will be monitored. This would include water quality testing of sedimentation dams and water storages to ensure any discharge is appropriate for release to the receiving waterways. The information from this monitoring would also provide advice as to when water from rehabilitated areas will be able to runoff directly to the environment, rather than through a sedimentation dam.

7.6.2. Groundwater

Mitigation

The management of groundwater quality would be achieved by appropriate design and operation of the ash placement facilities. This would include:

- Regrading and profiling of storage areas to provide a base area above groundwater for the placement of ash materials;
- Placement of brine treated ash at defined heights above groundwater levels to minimise risk of seepage into the groundwater table;
- At Huons Gully the placement of a subsurface drainage at the gully invert to provide a discharge area for groundwater seepage from Area 1 as well as ground water movement from upstream in Huons Gully.

Monitoring

The development consent of 1 April 1982 for the Mt Piper Power Station ash placement was modified in April 2000 to allow for brine conditioned ash placement at the site. The 2000 consent requested the preparation of a Water Monitoring Program which would include groundwater quality testing in monitoring bores on or in the vicinity of the Area 1 site. The most recent update to the plan is provided in Aurecon (2008). The results of this testing are reported in an annual Environmental Monitoring Report, the most recent being Aurecon (2009).

A bore hole monitoring program would be required for each new ash placement site. At Lamberts Gully the present two observation wells in Lamberts South, even supplemented by those installed in the NW corner of Lamberts North, are not sufficient for a groundwater monitoring network. They do, however, give preliminary information on the hydrogeological conditions in the project area and provide a basis for planning a future monitoring network. Further well installation would need to be delayed until after the mining activities cease, and until detailed planning for the ash storage areas is further advanced.

The information to be collected from any new bore holes established would include water levels, seasonal fluctuations and water quality test results. The water quality parameters would include pH, conductivity, ions (especially chloride) and trace metals. As with the previous consent for ash placement, the data from the monitoring sites would be reported in an annual Environmental Monitoring Report.

The annual Environmental Monitoring Report will include available results and analyses from the borehole monitoring and actions taken or intended to be taken, if any, to mitigate any adverse environmental impacts.

7.6.3. Off-site Surface Water

Management

Neubecks Creek is the primary potential receiving water for any discharges from the existing and proposed ash placement areas, which can in turn influence the quality of water feeding into the Coxs River. Overall, monitoring results from the four in-stream sites (at Mt Piper licensed discharge point and 3 sites downstream of the existing ash Area 1) indicate that the identified exceedances of water quality criteria within the receiving waters may be due to varied activities within the catchment, in particular disused mining works. The occasional elevated conductivity and trace metal results cannot be attributed to the existing ash Area 1.

The means of managing water runoff were described above and the maintenance of those processes is important to ensure that ash storage areas do not contribute to any water quality impacts within Neubecks Creek.

Monitoring

A monitoring plan would be developed for the project. The intent will be to identify sufficient sites in Neubecks Creek to:

- Provide background data showing the existing water quality impacts from the Neubecks Creek and Ivanhoe No 4 sites;
- Allow the possibility of separating out potential impacts from the Lamberts North and Lamberts South sites from the existing Area 1 site.

As noted above the development consent for the Mt Piper Power Station ash placement was modified in April 2000 to allow for brine conditioned ash placement at the site. The consent requested the preparation of a Water Monitoring Program which would include water quality testing in receiving waters (Aurecon, 2008). The results of this testing are reported in an annual Environmental Monitoring Report (see Aurecon, 2009).

Water quality monitoring would be based on existing monitoring undertaken in Neubecks Creek so that results between sites are comparable. Currently this involves monthly monitoring by Delta

Electricity in Neubecks Creek at the licensed discharge point LDP01 and at site WX22 approximately 400m upstream of Blackmans Flat. Other sites in Neubecks Creek would be selected that are representative of the proposed areas of work and that may identify any proposed impacts from the sites. Monitoring sites would take into consideration groundwater monitoring to ensure the source of any water quality issues may be identified ie groundwater seepage or surface runoff.

Water quality monitoring should consider the ANZECC/ARMCANZ (2000) guidelines and monitoring results should be compared against recommended trigger values for protection of upland river aquatic ecosystems. The recommended water quality monitoring parameters have been devised based on the likely pollutants of concern during the construction and operating stages of Lamberts North and Lamberts South. These parameters include:

- In situ**:** pH, electrical conductivity, total dissolved solids, alkalinity and turbidity;
- Total anions and cations: chloride, fluoride, sulphate, sodium, calcium, magnesium and potassium
- Trace elements/metals: Aluminium, arsenic, silver, barium, boron cadmium, chromium, copper, iron, mercury, manganese, lead, selenium, silica and zinc.

Concentrations would be in accordance with the ANZECC/ARMCANZ (2000) guidelines for protection of aquatic ecosystems.

The results from the monitoring would be reported in the annual Environmental Monitoring Report which will include all available results and analyses from the in-stream monitoring and actions taken or intended to be taken, if any, to mitigate any adverse environmental impacts.

Cumulative Impacts

As forestry, mining and power generation have been the dominant land use practices for many years these practices have contributed to the existing water quality of surrounding creeks.

To assess the relative contributions from various sources to receiving water contribution, sampling design should consider a means by which various inputs can be separately identified. This would require an integrated sampling program to identify contribution from surface drainage from around and on the ash placement facility, ash placement seepage or leachate to groundwater, existing underground coal mine groundwater contribution, contribution from mine sites directly associated with Neubecks Creek and Ivanhoe No 4, contribution from Delta's existing licensed discharge and, should it proceed, from Mt Piper Extension. Cooperation would also benefit from any monitoring program required from Council's waste management site.

It is important that appropriate mitigation measures and a comprehensive monitoring and control program to identify water quality issues and sources of pollution be continued and expanded to enable assessment of any cumulative effects on surface water quality.

7.7. Construction Mitigation and Monitoring

7.7.1. Construction Impacts

There are a number of construction phase activities for the preparation of areas for ash storage which include:

- Clearing and grubbing. Areas for ash placement will be cleared of any vegetation and unsuitable founding materials;
- Re-grading/re-profiling of sites to control seepage and maintain uniform drainage;
- Earthworks and fill construction involving the construction of soil banks, filling of areas and spreading and compaction to achieved desired levels;
- Temporary rehabilitation and stockpile remediation of areas previously disturbed by mining activities to control surface flow and erosion. This may involve construction of sedimentation ponds, surface water diversion and revegetation of disturbed areas;
- Construction access and haul roads will be progressively created as ash placement continues;
- Construction of surface drainage works and sub-surface drainage which may include retention basins, sediment and erosion control measures, capping and re-vegetation of areas;
- Construction of rock drainage blanket in Huon Gully.

These construction activities may affect the water quality of Neubecks Creek in the following ways:

- The potential to generate sediments and pollutants such as nutrients to local waterways as the soil in cleared areas becomes exposed and the likelihood of erosion is increased;
- Increased vehicle movements in the area in and out of construction sites, increase the likelihood for hydrocarbons and chemicals to enter the surrounding waterways as a result of spills and leakages from construction vehicles;
- General litter and gross pollutants from construction materials;
- Contaminants such as nutrients, metals and other potential toxicants that attach to the sediment particles can be transferred to waterways if appropriate sediment and erosion control measures are not in place or working effectively.

As such the potential impacts to surface water quality of Neubecks Creek as a result of construction phase activities for the preparation for ash storage include:

- Increased salinity;
- Increased turbidity and sedimentation;
- Increased nutrients and risk of eutrophication;
- Increased metal concentrations which could be toxic to aquatic organisms.

All construction work would be undertaken so as to minimise environmental disturbance and mitigate risks associated with such construction activities.

7.7.2. Construction Environmental Safeguards

To reduce potential water quality impacts of the site during construction, general measures to control erosion of soil and sedimentation would be implemented prior to construction works. Such measures would be documented in a Construction Phase Soil and Water Management Plan (SWMP) prepared in accordance with the principles and practices in *Soil and Construction, Managing Urban Stormwater Handbook* (Landcom 2004).

More specifically, environmental safeguards will include:

- Vehicles to travel on designated access roads;
- Management of runoff to waterways and ensure additional impacts on groundwater and surface water quality do not occur;
- Regular site maintenance to be undertaken to ensure frequent dust suppression so that pollution of waterways does not occur;
- Ensuring that chemicals and fuels are appropriately stored and bunded;
- Installing erosion and sediment controls such as sediment basins and sediment fences;
- Ensuring construction workers/staff understand and maintain sediment and erosion control measures;
- Preparation and implementation of revegetation and rehabilitation plans for sites once ash is placed and the site capped.

The in-stream monitoring described above should be undertaken during construction to determine if sediment and erosion control measures and surface water diversion techniques are working effectively.

Mt Piper Power Station Ash Placement Project

ENVIRONMENTAL ASSESSMENT

CHAPTER 8 – ECOLOGY

August 2010

Contents

8. Ecology

This chapter provides an assessment of the ecological impacts of the proposal. The Director-General's requirements are:

- *For the Neubecks Creek and Ivanhoe No 4 sites (concept plan application only), include an analysis of potential ecological constraints to the development of these sites including available mitigation and / or management options (including any offsets applying to the concept plan as a whole) that may be applied to achieve acceptable environmental outcomes, with consideration of cumulative impacts from the project and other existing or proposed activities in close proximity to the project sites. Key ecological risk factors and / or design criteria that would require further detailed investigation prior to the development of these sites must be identified;*
- *For the Lamberts North and Lamberts South sites (project application), must include an assessment of the likely impacts on native vegetation, threatened species, populations, ecological communities and their habitats (both terrestrial and aquatic as relevant), with particular reference to downstream aquatic habitats. The assessment, including field surveys and identification of any actions to avoid or mitigate impacts, must be prepared in accordance with the Draft Guidelines for Threatened Species Assessment (DEC & DPI, 2005).*

8.1. Introduction

This chapter provides a quantified assessment of the potential ecological impacts for the development of Lamberts North and Lamberts South as ash storage sites. Together these two sites are referred to as Lamberts Gully. An overview assessment for the sites at Neubecks Creek and Ivanhoe No 4 is also provided. A specialist study was undertaken for the assessment of ecological impacts and this is provided in **Appendix E**.

8.2. Review of Information

A review of previous ecological assessments undertaken within the Mt Piper Power Station perimeter lands and the surrounding locality was conducted for this assessment. These included:

- Vegetation of the Western Blue Mountains (DEC 2006);
- Ecotone Ecological Consultants (1996);
- International Environmental Consultants Pty Ltd (2006).

Broad-scale vegetation mapping of the study area is presented in the 'Vegetation of the Western Blue Mountains' (DEC 2006). These data describe vegetation map units in the study area.

The data presented in the Ecotone assessment (Ecotone 1996) documents the results of seasonal surveys conducted within the Mt Piper Power Station perimeter lands. Surveys for terrestrial flora

and fauna were undertaken over four seasons from autumn 1995 to the summer of 1995/1996. These surveys involved the identification and mapping of vegetation communities, transect and quadrat surveys for flora, and targeted surveys for threatened plant species. Fauna surveys included live-trapping using Elliott, cage and pit traps as well as mist nests and harp traps for microchiropteran bats. Additional techniques included spotlighting, ultrasonic bat detectors, owl call playback, scat collection and analysis and searches for scratch-marks, tracks and other signs.

The Ecotone (1996) surveys within the perimeter lands identified the presence of one vulnerable plant species, the Capertee Stringybark *Eucalyptus cannonii,* scheduled under the TSC Act and the EPBC Act.

Various ecological assessments have also recently been undertaken by SKM in the lands surrounding Mt Piper Power Station, including:

- Studies for the Western Rail Coal Unloader (SKM 2007; 2008);
- The EA for the Mt Piper Power Station Extension (SKM 2009).

Ecology field surveys were also undertaken for the proposed coal unloader to the south and east of the Mt Piper power station site (SKM 2007) and the proposed power station extension (SKM 2009). In these studies over 109 flora species were recorded within the two vegetation communities occurring in this area. *Eucalyptus cannonii* was found to be locally abundant in these areas.

The ecological assessment for Lamberts Gully Mine (International Environmental Consultants Pty Ltd 2006) identified five individual *Eucalyptus cannonii* trees.

Additional data sources used in this review included the:

- DECCW Atlas of NSW Wildlife Database (access April 2010);
- Database of the Royal Botanic Gardens PlantNET and Australian Museum FaunaNET;
- records published in scientific journals, reports and general flora and fauna distribution texts; and
- other relevant databases including the National Herbarium, Protected Matters Search Tool (EPBC Act accessed May 2010).

All of the threatened flora and fauna species, endangered populations and ecological communities known to occur within the study locality have been tabulated. This information was utilised in the preparation of lists of threatened species deemed potential inhabitants of the study area (i.e. potential subject species).

8.3. Survey Results from Lamberts North and Lamberts South

The following section documents the results of a site assessment to record the vegetation, fauna habitats and species diversity present within the proposed ash placement area. The majority of the land proposed for the ash placement has been previously cleared of natural vegetation for coal mining activities and currently comprise active mining areas, rehabilitation areas at various stages of regeneration, other highly disturbed areas and several sediment basins. Areas of remnant vegetation occur at the edges of the proposed ash placement areas, and at the southern end of the proposal area there are three patches of vegetation present totalling approximately 9 ha. Two of these areas are isolated from nearby vegetation in the State forest, while the third is connected by a narrow corridor.

8.3.1. Methods

The flora survey involved identification of the floristics and structure of the vegetation within the proposed ash placement areas and the type and distribution of any plant communities. Field surveys were concentrated within the naturally vegetated areas of the study area, comprising numerous traverses and plot based assessments to identify potentially occurring threatened species, populations and ecological communities listed under the TSC Act and EPBC Act. The overall condition of the site vegetation was noted, including the extent of modification and weed invasion.

The fauna field survey included a threatened species habitat assessment and fauna census. Surveys were conducted for threatened and common fauna species as well as an investigation of the presence of critical habitat requirements for threatened species. The location of field survey methods conducted is depicted in **Figure 8-1**. A combination of habitat assessment, spotlighting, Anabat detection, bird surveys, stag watching and call playback was used to survey fauna throughout the three remaining habitat patches. Given the relatively small area of the proposed ash placement and the lack of fauna habitat attributes, a detailed investigation using the full range of survey techniques was not considered necessary.

8.3.2. Vegetation Communities

The quality of the vegetation communities present within the proposed ash placement area is affected by the extent of previous clearing and disturbance from mining activities. The majority of the ash placement areas comprise highly disturbed areas that are currently being utilised for mining activities and rehabilitation areas where mining has been completed. These areas are devoid of vegetation. However, there are three patches of remnant vegetation in the southern-most proposed ash placement area. At this site four different vegetation communities including regenerating vegetation in rehabilitation areas were identified in the proposed ash placement lands (as shown in **Figure 8-2**) and these are described below.

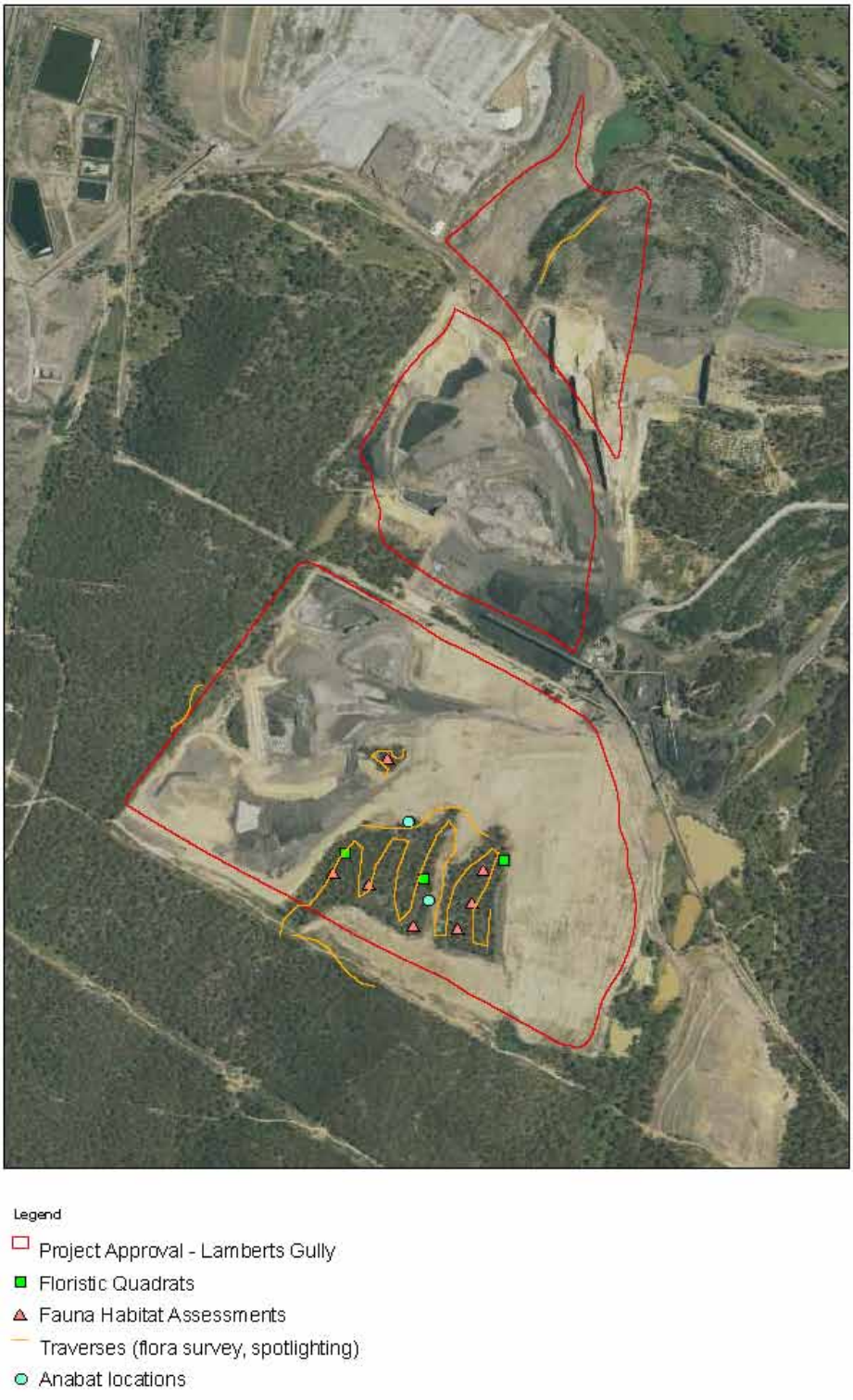


Figure 8-1 Survey Locations

Figure 8-2 Vegetation and Threatened Flora Species

Map Unit 1: Brittle Gum – Red Stringybark Woodland

Areas of intact remnant vegetation in the southern portion of the Lamberts Gully area are dominated by this map unit. Dominant canopy species comprise Brittle Gum (*Eucalyptus mannifera*) and Red Stringybark (*Eucalyptus macrorhyncha*) up to 15 m high. The understorey is dominated by grasses and forbs with scattered shrubs. Dominant shrub species include Silver Wattle (*Acacia dealbata*), Showy Parrot-pea (*Dillwynia sericea*) and Peach Heath (*Lissanthe strigosa*). Dominant groundcovers include Snowgrass (*Poa siebriana*), Raspwort (*Gonocarpus tetragynus*), Wattle Mat-rush (*Lomandra filiformis*) and Forest Goodenia (*Goodenia hederacea*).

Map Unit 2: Scribbly Gum Woodland

A small area of this vegetation community is present in areas of intact remnant vegetation in the southern portion of the Lamberts Gully area. The dominant canopy species is Inland Scribbly Gum (*Eucalyptus rossii*) occurring with Brittle Gum and Red Stringybark approximately to 15-17 m high. The understorey is dominated by a mix of shrubs and groundcovers grasses. Dominant shrub species include Box-leaf Wattle (*Acacia buxifolia*), Ploughshare Wattle (*Acacia gunnii*) and *Mirbelia platylobioides*. Dominant groundcovers include Snowgrass, Silky Purple-flag (*Patersonia sericea*), Variable Sword-sedge (*Lepidosperma laterale*) and Button Everlasting (*Coronidium scorpioides*).

Map Unit 3: Ribbon Gum Woodland

A small area of this vegetation community is present along the main drainage line within the area of intact remnant vegetation in the southern portion of the Lamberts Gully area. The dominant canopy species is Ribbon Gum (*Eucalyptus viminalis*) occurring with Broad-leaved Peppermint (*Eucalyptus dives*), Candlebark (*Eucalyptus rubida*), Brittle Gum and Red Stringybark approximately to 16-19 m high. The understorey is dominated by a mix of grasses and forbs, including Weeping Grass (*Microlaena stipoides*), Speargrass (*Austrostipa pubescens*), Raspwort, Maori Bedstraw (*Galium propinquum*), Yam Daisy (*Microseris lanceolata*), Narrow Plantain (*Plantago gaudichaudii*) and Bottle-daisy (*Solenogyne bellioides*). A sparse cover of shrub species are present including Silver Wattle, Sifton Bush (*Cassinia arcuata*) and Bracken (*Pteridium esculentum*).

Map Unit 4: Rehabilitation Areas

There are several areas within the study area that are being rehabilitated with native trees and shrubs including a large area at the northern end of Lamberts Gully and surrounding remnant vegetation at the southern end of the Lamberts Gully. These areas are dominated by various shrub species including Silver Wattle, Red-stemmed Wattle (*Acacia rubida*), Box-leaf Wattle, Black Wattle (*Acacia mearnsii*), Sifton Bush, Green Wattle (*Acacia parramattensis*) and Fine-leaf Green Wattle (*Acacia decurrens*). Eucalypt species are also interspersed within these areas including Ribbon Gum, Brittle Gum and Candlebark.

Much of the rehabilitation area is recently completed, with seedlings and low shrubs sparsely distributed throughout. However, there are two areas of well-established rehabilitated vegetation at

the site – in the narrow 'laneway' between the two largest remnant patches, and in-between the two largest remnant patches and Ben Bullen State Forest beyond the southern boundary of the site. These areas are taller and denser than other rehabilitated vegetation at the site.

The significance of the rehabilitated area is that it is comprised of species native to the area, is weed-free and, as it matures, will increase the area of hospitable habitat for flora and fauna at the site. The rehabilitated vegetation is also significant because it reconnects the two largest patches of remnant vegetation, with each other and with vegetation in Ben Bullen State Forest. For most fauna the rehabilitated vegetation (especially in the narrow laneway), is effectively connecting the two patches, providing sufficient refuge and cover to facilitate movement.

8.3.3. Results of Flora Surveys

In total, 147 different plant taxa from 39 families were represented. This total comprised 34 species of monocotyledons, 110 species of dicotyledons, 2 species of fern and 1 conifer. Of this total, 16 introduced species are present, consisting of approximately 11% of the total species recorded. A list of all flora species recorded on the site is presented in Appendix 5.

Of the introduced species three species declared as Noxious were recorded, comprising St John's Wort (*Hypericum perforatum*), Blackberry (*Rubus fruticosus*) and African Lovegrass (*Eragrostis curvula*). These species are listed as Class 4 noxious weeds meaning "the growth and spread of the plant must be controlled" according to the measures specified in a management plan published by the local control authority.

One threatened flora species was found to occur at the southern end of the proposed ash placement area within areas of remnant vegetation (**Figure 8-2**), namely Capertee Stringybark (*Eucalyptus cannonii*). The species is scheduled as Vulnerable under both the TSC Act (State listed species) and the EPBC Act (nationally threatened species). This species was found to be restricted to three individuals on the edge of a patch of remnant vegetation.

Studies in the surrounding areas indicate that Capertee Stringybark is widely dispersed. Ecotone (1996) recorded it as locally common throughout the Mt Piper perimeter lands, surveys in the Ben Bullen State Forest (SKM 2008) has determined the presence of this species between Baal Bone Mine and Mt Piper Power Station, where it was found to be relatively abundant, and it has been recorded as locally abundant within a proposed coal unloader site to the south and east of the Mt Piper power station (SKM 2007). This species is well represented within conservation reserves, and has limited potential threats other than land clearing.

No other threatened flora species were recorded despite targeted searches within areas of suitable habitat. It is unlikely that other threatened flora species are present considering the extent and type of habitats present and the degree of survey effort.

8.3.4. Fauna Habitats

Primary habitat for fauna within the proposed ash placement occurs at the three areas of remnant woodland remaining at the site. These are shown in **Figure 8-3**. The patches are characterised by low, open woodland with abundant hollows, fallen wood, overstorey tree species with decorticating bark, abundant groundcover, and mixed mid-storey vegetation. The two larger patches are also bordered by rehabilitation areas, comprising a range of understorey and tree species and sparse to dense vegetation cover to 2 m. This contributes to connecting them to each other and to larger woodland and forest areas bordering the study area, and provides alternative refuge and foraging habitat for fauna.

Despite the differences in remnant patch size, all three areas support similar habitat opportunities for a suite of fauna. These are:

- Tree hollows for arboreal mammals and birds;
- Log piles at the remnant perimeters providing refuge habitat for reptiles, small mammals and birds;
- Tree canopy cover providing refuge, breeding and foraging habitat for birds, and foraging habitat for arboreal mammals;
- Standing dead and fallen timber and logs providing foraging, refuge and breeding habitat for a suite of terrestrial species;
- Leaf litter and ground cover providing foraging, refuge and breeding habitat for a suite of terrestrial species;
- Decorticating bark providing refuge habitat for amphibians, reptiles, microchiropteran bats and invertebrates.

Remnant vegetation at the site also includes numerous small and one large ephemeral drainage line and an ephemeral wetland at the south-western edge of the largest remnant patch. These areas provide refuge, foraging and breeding habitat for amphibians, and provide an important water source for other fauna.

Figure 8-3 Fauna Habitat

8.3.5. Fauna Species

A total of 21 species were recorded within the proposed plant ash placement areas, comprising 14 birds, four mammals, one reptile and two frogs. This total represents a small proportion of the known species richness for the Mt Piper power station perimeter lands (Ecotone 1996). This is due to the brevity of the survey period imposed, and the relative isolation and size of the remnant vegetation. The full species list, along with a comparison with the Ecotone (1996) and SKM (2008) surveys is provided at **Appendix E**.

The majority of bird species present were common species of woodlands with the most abundant including the Crimson Rosella (*Platycercus elegans*), White-throated Treecreeper (*Cormobates leucophaeus*), Yellow-faced Honeyeater (*Lichenostomus chrysops*), Superb Fairy-Wren (*Malurus cyaneus*) and thornbills (*Acanthiza* spp.). Less commonly encountered species included Spotted Pardalote (*Pardalotus punctatus*), and Brown Goshawk (*Accipter fasciatus*). The diversity of guilds represented at the site is indicative of the range and quality of foraging habitats occurring in the remnant vegetation and adjacent rehabilitation areas.

The most common mammals observed were Common Brushtail and Ringtail Possums (*Trichosurus vulpecula* and *Pseudocheirus peregrinus* respectively), Eastern Grey Kangaroo (*Macropus giganteus*), and the introduced Rabbit (*Oryctolagus cuniculus*). Tracks and dung of the Wombat and Fox were also observed. Further native arboreal mammals such gliders were not detected at the remnant vegetation, however these are known to occur in the area, and habitat occurs at the site.

Previous surveys for insectivorous bats have detected several species, including threatened species (Ecotone 1996). Remnant vegetation at the study site includes abundant roosting sites and foraging opportunities. There is also abundant fallen hollow wood, ground cover and leaf litter at the site, providing habitat for terrestrial small mammals, such as Antechinus.

The ephemeral wetland and creekline with associated pond provide foraging, breeding and refuge habitat for frogs at the site. Two species were detected at the ephemeral wetland during the survey, and it is likely others encountered by Ecotone during their 1996 survey also occur at the study area. The ephemeral wetland is in particularly good condition, with abundant littoral vegetation and apparently good water quality. Both habitats offer abundant adjacent terrestrial and riparian refuge.

No threatened fauna species (TSC Act or EPBC Act) were identified from the field surveys, although several species are known from the Mt Piper power station perimeter lands (Ecotone 1996) and may occupy and utilise the site.

8.4. Impact Assessment for Lamberts North and Lamberts South

The proposed ash placement would comprise an area of approximately 108 ha in the Lamberts Gully area. The majority of this area comprises disturbed lands currently part of an active mine and areas rehabilitated following mining activities.

8.4.1. Vegetation and Fauna Habitat

Native vegetation within the proposal area is limited to three patches of vegetation at the southern end of the Lamberts Gully area. There will also be impacts to regenerating vegetation within rehabilitation areas at the northern and southern end of the Lamberts Gully area. The areas of vegetation potentially affected by the ash placement at Lamberts Gully are specified in **Table 8-1**.

- **Table 8-1: Areas of vegetation potentially impacted by the proposal**

Vegetation Community	Area (ha)
Map Unit 1: Brittle Gum - Red Stringybark Woodland	7.5
Map Unit 2: Scribbly Gum Woodland	1.1
Map Unit 3: Ribbon Gum Woodland	0.3
Map Unit 4: Rehabilitation Areas	31.4
Total	**40.3**

Habitat for fauna within the proposed ash placement areas is limited to the remnant vegetation patches in the southern-most area proposed for ash placement. The remnant vegetation is of high habitat value, supporting an abundance and diversity of foraging, refuge and breeding opportunities for fauna. Although there is vegetation adjacent to the ash storage areas, the loss of habitat (particularly the hollows, trees with decorticating bark and wetland) constitutes a net loss for the locality with consequences for local fauna, including reduced breeding and refuge habitat opportunities and disturbance to remaining habitats. However, impacts on local populations would not lead to an increased risk of extinction, and hence the loss of habitat is considered not significant. Remaining areas of the ash storage area are cleared and modified lands and there are no areas of conservation value for fauna.

8.4.2. Threatened Species Conservation Act, 1995

An assessment of the impacts of this proposal on species, populations and ecological communities listed under Schedules 1, 1A and 2 of the TSC Act has been undertaken. The proposal is to be assessed under Part 3A of the EP&A Act and consequently this impact assessment was undertaken in accordance with the Draft Guidelines for Threatened Species Assessment (DEC 2005). The assessment of significance is provided in **Appendix E**.

Critical habitat is defined as an area that is critical to the survival of an endangered species, population or ecological community. The proposal will not impact on critical habitat declared under the TSC Act.

The proposed ash placement areas do not contain remnant or regrowth vegetation that is considered characteristic of an endangered ecological community listed under the TSC Act.

One plant species listed as vulnerable under both the TSC Act and the EPBC Act, Capertee Stringybark (*Eucalyptus cannonii*) was observed in one location comprising 3 individuals. Previous study undertaken in the area by Ecotone (1996), SKM (2007, 2008) also recorded the presence of this species in the perimeter lands, and noted its widespread distribution.

Up to three individuals of the *Eucalyptus cannonii* will be removed to accommodate the proposed ash placement. No other threatened flora species were recorded despite targeted searches within areas of suitable habitat, and it is unlikely that other threatened flora species are present considering the extent and type of habitats present and the degree of survey effort undertaken. Hence, the results of the TSC Act and EPBC Act tests of significance indicate the loss of habitat would not significantly affect the viability of threatened species in the area.

The threatened fauna species recorded from the Mt Piper power station perimeter lands and the surrounding study area were analysed through an analysis of the known habitat requirements of these threatened species, in relation to the diversity of habitats present within the proposed ash placement area, a list of potential subject species has been compiled. Potential subject species are defined as those threatened species considered likely to occur in the habitats present within the study area (NPWS 1996).

No threatened fauna species (TSC Act or EPBC Act) were identified on the site during the field surveys. However, the remnant open forest and woodland vegetation likely provides habitat for threatened species including microbats and woodland bird species, and threatened species have previously been detected in the area (Ecotone 1996). The site may provide at least foraging and possibly roosting habitat for a suite of microbat species, and could form part of the territory of Spotted-tail Quoll, owl and glider species. However, the results of the TSC Act and EPBC Act tests of significance indicate the loss of habitat would not significantly affect the viability of threatened species in the area.

8.4.3. Environment Protection and Biodiversity Conservation Act, 1999

Actions that have the potential to significantly affect matters of national environmental significance (NES) are subject to assessment and approval under the provisions of this Act. The matters of NES identified in the Act that trigger the Commonwealth assessment and approval regime are:

- World Heritage Properties;
- Ramsar wetlands;
- Nationally threatened species and ecological communities;
- Migratory species;
- Commonwealth marine areas; and
- Nuclear actions (including uranium mining).

This assessment deals specifically with the significance of impacts from the proposed ash placement on nationally threatened species and endangered ecological communities in addition to commonwealth migratory species and world heritage properties.

The *Administrative Guidelines for determining whether an action has, will have, or is likely to have a significant impact on a matter of national environmental significance under the EPBC Act 1999*, was consulted and reviewed in relation to the findings of this study. This has enabled determination as to whether the project requires a referral to DEWHA for consideration as a Controlled Action.

This assessment indicates that listed matters of NES (in this instance nationally threatened species and Migratory species and World Heritage Areas) would not be significantly disrupted or affected as a result of the proposed works.

8.5. Management of Ecological Impacts

8.5.1. Avoidance

The majority of the proposed ash placement area is currently cleared and highly modified, although up to 9 ha of remnant vegetation cannot be avoided and will require removal. Considering this area of habitat cannot be avoided impacts to this area would need to be offset.

Where possible native vegetation would be retained including regenerating trees and shrubs in rehabilitation areas. During construction mitigation measures need to be implemented to protect areas of vegetation on adjacent lands surrounding the proposal area from accidental incursions and indirect impacts such as runoff and dust.

8.5.2. Offsetting

An area of up to 9 ha of remnant vegetation would be offset to ensure there is no net loss of flora and fauna values in the area. This would provide a habitat offset of 1:1. Although no threatened species or ecological communities would be affected by the loss of the 9ha of vegetation, the generally good habitat value would suggest that an offset would be appropriate. The remnant vegetation within the offset location should have similar habitat attributes as the remnant vegetation within the proposal area, comprising a relatively mature area of vegetation with an abundance of hollow trees and fallen

timber. Although only three specimens of Capertee Stringybark would be lost to the development, the proposed offset area should contain specimens of that species, if possible.

8.5.3. Mitigation

The following mitigation measures would be implemented to minimise direct impacts from the development:

- Pre-clearing survey to identify and flag any significant hollow-bearing habitat trees in areas of remnant vegetation in the proposal area, with the aim of identifying fauna occupying trees and other habitats;
- The removal of hollow-bearing trees and other habitat features (fallen timber, wombat burrows) needs to be supervised by an ecologist to ensure any fauna species are relocated safely to adjacent habitats or in the case of juvenile or injured fauna, these should be given to a qualified local wildlife carer for rehabilitation;
- Timber felled for clearing and existing fallen timber should be stockpiled for use in future rehabilitation activities on top of the ash placement to used on the ground as habitat for terrestrial fauna and erosion control;
- The native top soil within the areas of remnant vegetation would be salvaged and re-spread over existing ash placement sites ready to be rehabilitated, or other disturbed areas requiring rehabilitation. Topsoil in this area is likely to have a significant seed-bank and is a highly valuable resource for any rehabilitation activities.

Revegetation of the ash placement areas would use native species which occur in the local area and are adapted to the local conditions. A list of flora species suitable for revegetation of the various habitats of this area is provided in **Appendix E.**

In additional to the revegetation of the ash placement areas, augmentation of fauna habitats from within the remnant vegetation in the proposal area would be implemented. This would comprise stockpiling coarse woody debris including hollow limbs and logs and redistributing within the ash placement rehabilitation areas. Coarse woody debris could also be used to control water runoff from the ash placement mounds.

Introduced fauna are currently present within the study area. The construction would not be expected to increase populations or exacerbate the impacts of introduced fauna. The use of the construction machinery and exposure of the ground surface could potentially result in increased spread of weeds, including noxious species. Control measures would be implemented, however, to limit the spread of weed species.

Weed management principles would be implemented during construction such as the appropriate disposal of removed weed material including soil containing propagules and washing down machinery.

The use of best-practice sedimentation and erosion controls is required to limit contamination runoff leaving the proposal area. Controls need to be regularly maintained.

8.6. Neubecks Creek and Ivanhoe No 4

A desktop ecological assessment of the Neubecks Creek and Ivanhoe No. 4 areas was undertaken to identify the broad-scale vegetation communities and potential for threatened species habitat. Although the proposed ash placement areas have been cleared and disturbed by previous mining and agricultural activities, grassland and open forest and woodland communities occur throughout both areas. Vegetation communities in the areas are typical of those in the wider region.

8.6.1. Vegetation Communities

Vegetation communities at Ivanhoe No. 4 are a sub-set of those occurring at Neubecks Creek (DEC 2006) and include:

- Map Unit 61: Cleared land and severely disturbed lands;
- Map Unit 37: Cox's Permian Red Stringybark – Brittle Gum Woodland;
- Map Unit 11: Tablelands Gully Snow Gum – Ribbon Gum Grassy Forest.

A further two communities occur at Neubecks Creek. These are:

- Map Unit 33: Tableland Broad-leaved Peppermint – Brittle Gum – Red Stringybark Grassy Open Forest;
- Map Unit 35: Tableland Gully Mountain Gum – Broad-leaved Peppermint Grassy Forest.

Both study areas include creek systems with extensive vegetation clearing in the lower slopes. Vegetation largely occurs in the upper slopes where it is contiguous with open forest and woodland habitats outside the proposed impact areas. These areas are mapped in Figure 8-4.

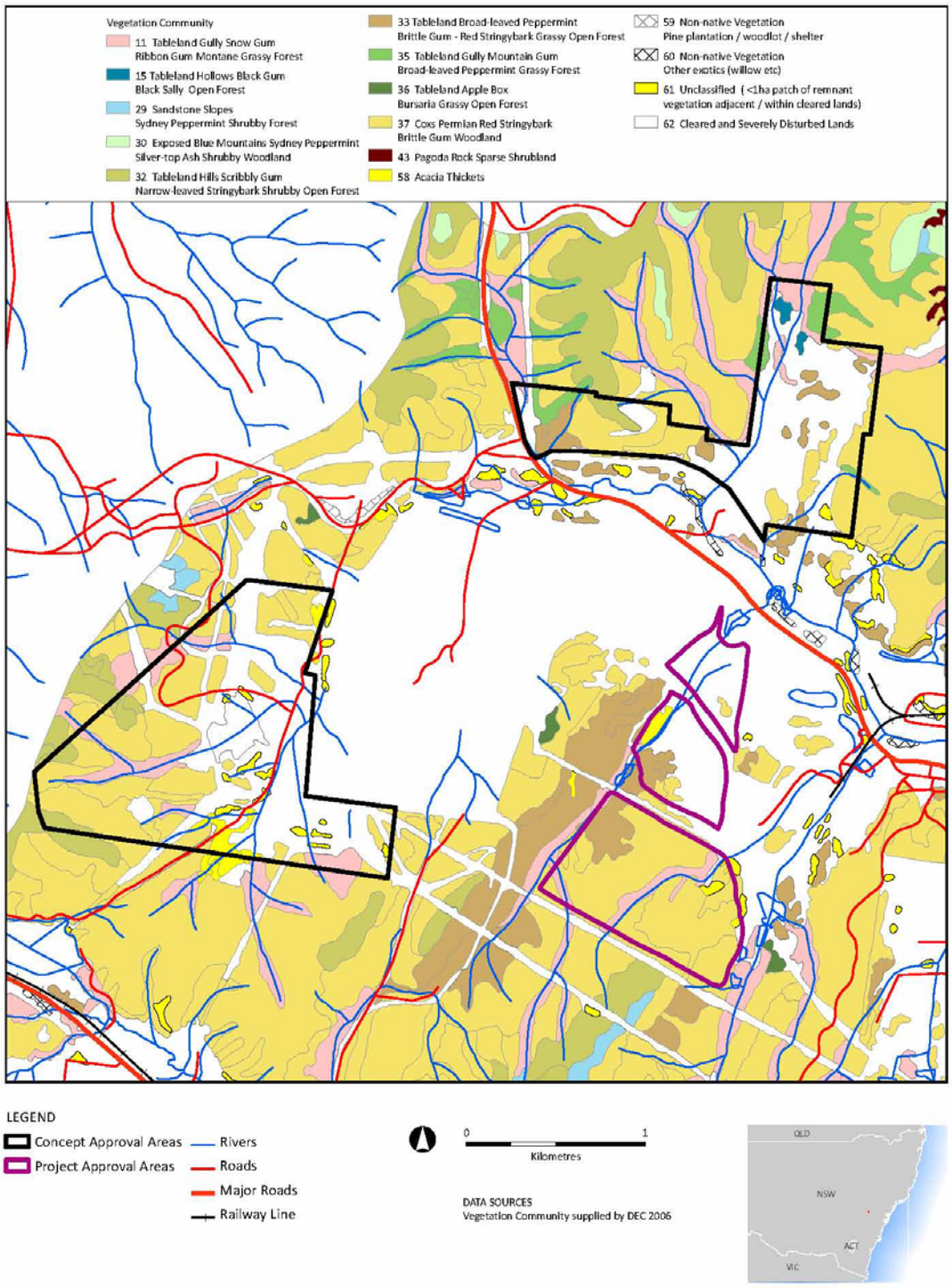


Figure 8-4 Concept Area Vegetation Communities

8.6.2. Threatened Species

The review of existing knowledge and wildlife databases undertaken to identify the documented locations of threatened flora and fauna species within a 10 km radius of the Mt Piper Power Station revealed 24 threatened flora and 25 threatened fauna are known to occur habitats throughout the area. Of these several threatened flora are known to occur in the specific vegetation communities occurring at the study areas (**Table 8-2**) (DEC 2006).

- **Table 8-2 Threatened flora species and their corresponding vegetation communities in the study areas.**

Map Unit	Description	Definite Species	Possible Species
11	Tableland Gully Snow Gum – Ribbon Gum Grassy Forest	■ *Trachymene scapigera*	■ *Baloskion longipes* ■ *Derwentia blakelyi* ■ *Diurus aequalis* ■ *Eucalyptus camphora* ■ *Eucalyptus macarthurii* ■ *Euphrasia scabra*
33	Tableland Broad-leaved Peppermint – Brittle Gum – Red Stringybark Grassy Open Forest		■ *Diurus aequalis* ■ *Diurus tricolor* ■ *Eucalyptus macarthurii* ■ *Eucalyptus robertsonii* subsp. *hemisphaerica* ■ *Thesium austral*
35	Tableland Gully Mountain Gum – Broad-leaved Peppermint Grassy Forest		■ *Baloskion longipes,* ■ *Derwentia blakelyi* ■ *Diuris aequalis,* ■ *Eucalyptus cannonii*
37	Cox's Permian Red Stringybark – Brittle Gum Woodland	■ *Eucalyptus cannonii* ■ *Derwentia blakelyi*	■ *Austrotricha crassifolia*

Open forest and woodland communities, creeks and grassy fields at Neubecks Creek and Ivanhoe No. 4 likely provide habitat for several threatened species known to occur in the area. Depending on their quality these areas may provide abundant hollows, fallen wood, overstorey tree species with decorticating bark, abundant groundcover, mixed mid-storey vegetation, instream and riparian habitats, and grassy fields suitable for foraging. These areas provide habitat for threatened woodland birds, Microchiropteran bats and other mammals, owls, amphibians, reptiles and invertebrates.

8.6.3. Further Studies

Several of the listed threatened flora and fauna species identified could potentially occur in the habitats occurring at the proposed ash placement areas. Although both areas have been subject to mining in the past, remnant vegetation is present and a flora and fauna assessment would need to be undertaken prior to project approval for ash placement.

These studies would need to assess potential impacts of the project on threatened species, populations and communities. They would include an updated review of relevant literature, legislation and databases to determine any new listing of threatened species, populations and communities, as well as field studies. The field studies should focus on vegetation, fauna habitats and species diversity occurring within the proposed ash placement areas and any additional areas potentially affected by the proposal. Further, the proposed methodology for the ecological assessment should be conducted in accordance with the DEC (2004) *Threatened Biodiversity Survey and Assessment: Guidelines for Development and Activities* and DEC & DPI (2005) *Draft Guidelines for Threatened Species Assessment.*

Mitigation measures for identified impacts would include:

- Avoidance of any areas of impact if practicable;
- The use of biodiversity offsets to manage impacts on valuable habitats which may not be able to be avoided;
- Appropriate management of any vegetation clearing; and
- Measures to control the spread of introduced flora and fauna.

Mt Piper Power Station
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ENVIRONMENTAL ASSESSMENT

CHAPTER 9 – INDIGENOUS HERITAGE

August 2010

Contents

9. Indigenous Heritage

The Director-General's requirements for indigenous heritage are:

For Neubecks Creek and Ivanhoe No 4 sites (concept plan application only), include an analysis of potential heritage constraints to the development of these sites including available mitigation measures and/or management options that may be applied to achieve acceptable environmental outcomes, with consideration of cumulative impacts from the project and other existing or proposed activities in close proximity to the project site. Key heritage constraints and/or design criteria that would require further detailed investigation prior to the development of these sites must be identified. For the Lamberts North and Lamberts South sites (project application), include a detailed assessment of indigenous heritage values (archaeological and cultural) that may be impacted by the project. Consideration should be given to the significance of the impacts of the project in the context of the surrounding indigenous heritage sites to the project site. The Environmental Assessment must describe the actions that will be taken to avoid, mitigate, manage and/or offset impacts.

The Environmental Assessment must demonstrate effective consultation with indigenous stakeholders regarding the potential impacts of the concept plan as a whole and the particular impacts of the project application sites, including developing mitigation options, consistent with the draft Guidelines for Aboriginal Cultural Impact Assessment and Community Consultation (DEC, July 2005).

9.1. Introduction

This chapter provides an analysis of potential indigenous heritage constraints associated with Neubecks Creek and Ivanhoe No 4 as well as a detailed assessment of the indigenous heritage values of Lamberts North and Lamberts South. It describes the existing environment, including the archaeological context of the sites and the methodology used to assess potential impacts to heritage values, including indigenous stakeholder consultation. The full indigenous heritage assessment undertaken by OzArk Environmental & Heritage Management Pty Limited (OzArk) is provided in **Appendix F**.

9.2. Methodology

OzArk EHM was commissioned to undertake an indigenous heritage assessment for the Lamberts North and Lamberts South sites as well as an analysis of likely indigenous heritage constraints associated with Neubecks Creek and Ivanhoe No. 4.

The heritage assessment comprised:

- A literature and database review for all proposed sites (Concept and Project Approval);
- A surface survey of the proposed Lamberts North and Lamberts South ash placement areas with particular focus on sites identified in previous studies and recorded with a DECC AHIMS number. The site visit was made in the company of a representative of the Bathurst Local Aboriginal Land Council (BLALC) on the 4th of March 2010.
- Consultation with the local indigenous stakeholders (see Chapter 4).

Prior knowledge of the site and aerial photography indicated the very high likelihood that the entire footprints for ash emplacement at Lamberts North and South had been completely destroyed through open cut mining. Further, desktop review of previous heritage assessment reports showed that the entirety of Lamberts North and South had been subject to several previous heritage assessments. These reports did, however, indicate that two Aboriginal sites were just outside previous impacts and remained protected through an active Cultural Heritage Management Plan (CHMP) relevant for the most recent mining phase.

Consequently, the heritage assessment methodology was designed to assess the levels of disturbance and check on the presence / condition of the two sites known to have remained and protected by the CHMP.

The study area within Lamberts North and Lamberts South was traversed using vehicle transects on tracks only. Both areas are still undergoing active open cut mining, and consequently the field team had to remain accompanied at all times and did not have full access to the site for occupational health and safety reasons. Through vehicle inspection as many accessible sections of Lamberts South and Lamberts North as feasible were assessed, although access to the previously recorded Aboriginal sites was not possible.

9.3. Existing Environment

9.3.1. Project Approval Sites

The proposed ash emplacement areas at Lamberts North and South have been subject to complete and total disturbance as a result of having been open cut mined over the past twenty years.

The current study area falls within the eastern limits of the lands occupied by the Wiradjuri tribe. However, due to the location of this area at the western base of the mountains it has often been referred to as zone of interaction between the Wiradjuri, the Dharug to the east and the Gundungurra to the south.

Few archival sources are available which give any great detail regarding local Aboriginal culture at the time of contact or even soon after. The Lithgow area seems to have undergone little study by professional or amateur ethnologists and anthropologists despite its close proximity to Sydney.

9.3.2. Regional Archaeological Context

There has been extensive archaeological research undertaken in the western Blue Mountains including survey and excavation of open sites, rock shelter deposits and recording of rock art, chiefly in association with rock shelters.

At a regional level, the current understanding of the types of sites present or likely to be present, within the Coxs River catchment remains sketchy. Data from excavated sites combined with information derived from surveys, points to a variable use of the valley, with some sites indicating ephemeral, casual or limited use, while other sites show more intensive or repeated use. A number of surveys have however been undertaken in the region since 1985 when a preliminary survey of the proposed conveyor and pipeline routes between Mount Piper Power Station and Angus Place colliery recorded a scarred tree and two open artefact scatters close to the Coxs River, and a small scatter of artefacts at Rydal Mount.

Further surveys in the region have been undertaken, including an assessment of the Mt Piper to Angus Place Colliery haul road which resulted in the recording of two open sites and one isolated find. In 1993 an extended corridor of land for the proposed 500 kV transmission line between Mount Piper and Marulan was assessed, recording twenty-six previously unrecorded Aboriginal sites. Only two of these sites were located within relatively close proximity of the current Study Area.

The above mentioned studies are discussed in more detail in **Appendix F.**

As may be expected, research into the known archaeological sites in the region surrounding the current Study Area has shown that the majority of sites are located on landforms close to water sources. Most recently, heritage assessment was undertaken for proposed extensions to the Mt Piper Power Station. This assessment recorded no Aboriginal sites, either new or previously recorded, within the impact footprint for the project and documented the previously high levels of disturbance as a result of former mining activities as being a contributing factor to the lack of sites.

9.3.3. Local Archaeological Context

As seen in **Table 9-1**, the search of the DECCW AHIMS (26th February, 2010) shows the presence of 36 recorded sites within a 5 x 5 km square area centred on the current Study Area. It is noteworthy that of the 36 sites, two sites (# 45-1-235 and # 45-1-0236) have been recorded twice on the register and hence there are in reality only 34 sites. Searches were conducted of relevant databases and the results are summarised in **Table 9-1**.

Table 9-1 – Desktop database search results

Name of database searched	Date of search	Type of search	Comment
Australian Heritage Database http://www.environment.gov.au/heritage/ahdb/	21.4.10	Lithgow LGA	14 items listed. No places on the search are within the Study Area.
Australian Heritage Inventory	21.4.10	Lithgow LGA	24 items listed. No places on the search are within the Study Area.
NSW Heritage Office State Heritage Register and State Heritage Inventory http://www.heritage.nsw.gov.au/	21.4.10	Lithgow LGA.	22 items listed under NSW Heritage Act.. No places on the search are within the Study Area.
National Native Title Claims Search http://www.nntt.gov.au/Applications-And-Determinations/Search-Applications/Pages/Search.aspx	21.4.10 Map published 31 March 2010.	NSW	No Native Title Claims cover the Study Area. Gundungurra Tribal Council Aboriginal Corporation #5 have a native Title claim to the east of the Study Area.
Department of Environment, Water Resources, Heritage and the Arts (DEWHA) Protected Matters (EPBC Act) Database; http://www.environment.gov.au/erin/ert/epbc/index.html	21.4.10	Lithgow LGA	None of the Aboriginal or Non-Indigenous places on the RNE occurs near the Study Area.
Department of Environment, Climate Change and Water (DECCW) Aboriginal Heritage Information Management System (AHIMS);	21.4.10	5 x 5 km centred on the Study Area	36 sites within the search area. The five within proximity have been discussed in this report.
Local Environment Plan	21.4.10	Lithgow LGA	None of the Aboriginal places noted occur near the Study Area.

The most frequent site type recorded in the vicinity of the current study area is the small open camp site, which is most often found on level, well drained terrain close to permanent water. Artefacts on these sites usually number less than 50, although it was noted that site size appears to be greatly affected by ground surface visibility conditions at the time of recording. The next most prevalent site type is isolated finds, which should really be seen as a sub-set of the open camp sites. Only one stone

arrangement site has been recorded in the vicinity of the study area, north in Ben Bullen State Forest. The lack of scarred trees within the AHIMS database results for this area is likely to be the result of the intensive clearing for the purposes of settlement. **Table 9-2** provides a breakdown of the types of recorded sites.

Table 9-2 Number, type and percentage frequency of sites within a 5 x 5 km^2 area centred on the Lamberts Gully area

Site type	Total	Percentage Frequency
Open camp site	28	82
Isolated finds	5	15
Stone arrangement	1	3
Total	34	100

Several investigations have been previously undertaken in the immediate vicinity of the existing Lamberts Gully mine and are outlined in detail in Appendix F. The most relevant, recent investigation was undertaken in 2005 and surveyed the Lamberts Gully ML1448, recording one additional open camp site, # 45-1-2601 (OzArk 2005).

In total, there have been nine (9) previously recorded sites within or in close vicinity of the Lamberts North and Lamberts South Study Areas (**Figure 9-1**). The fate of these sites is as follows and is summarised in **Table 9-3.**

In summary, it can be said that the entire current study areas of Lamberts North and Lamberts South have been completely surveyed in the past and all sites other than # 45-1-2601 and 45-1-0218 have been destroyed. These two sites are located outside the area proposed for ash placement and are currently protected under a CHMP and it is intended that they continue to be protected during the Mt Piper Ash Placement Project.

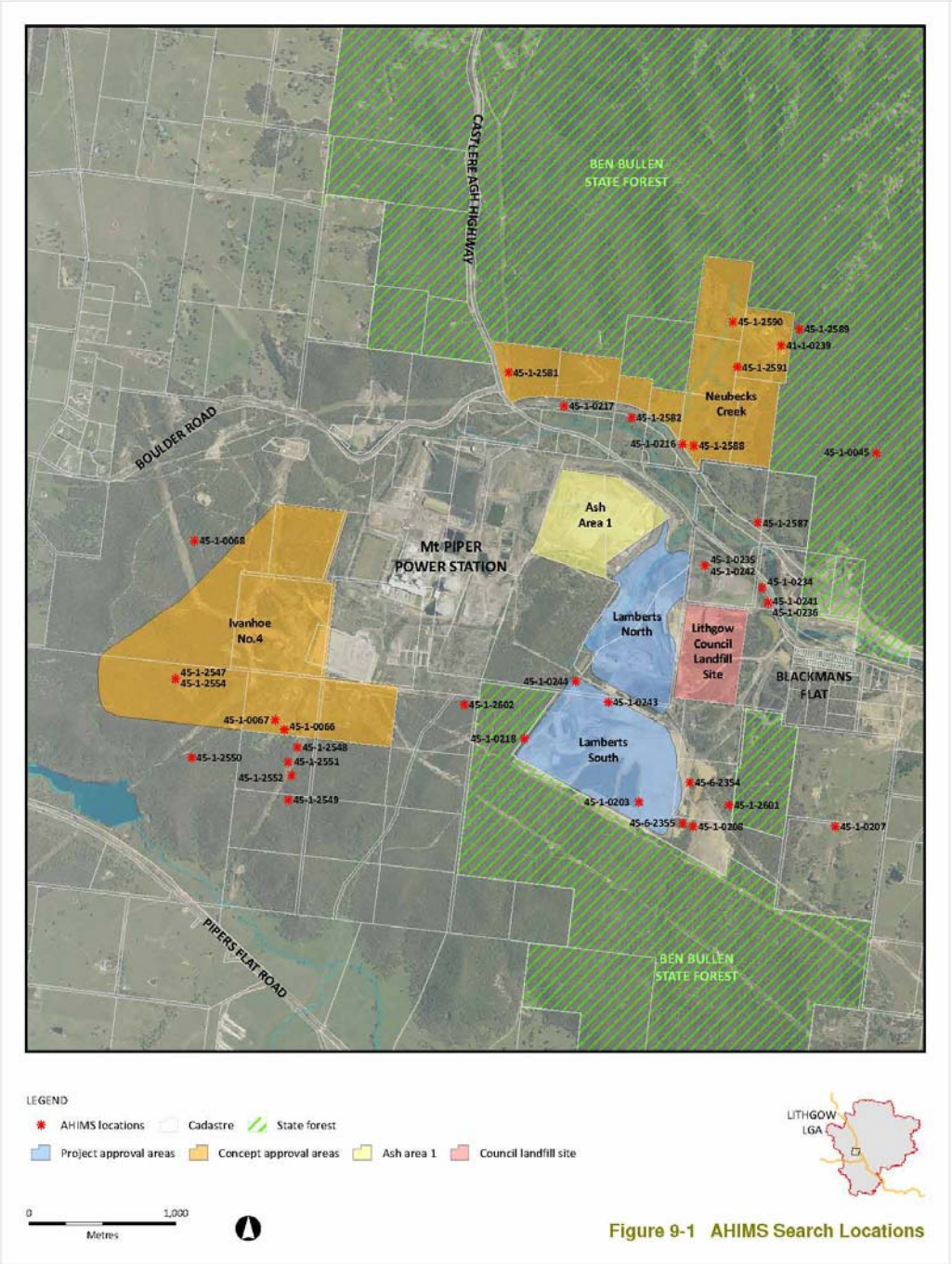

Figure 9-1 AHIMS Search Locations

Table 9-1 - Sites recorded during previous assessments over the Lamberts South and Lamberts North Study Areas

Site name	DECCW AHIMS #	Site type	Fate	Relocated 2006	Relationship to Ash Emplacement Project
Site 5	45-1-0208	OS: 2 Q flakes on a track	Still present. (Permit #361).	N/A	N/A
POS 2 (Lamberts Creek 6)	45-6-2355	PAD, became OS after test excavation.	Test excavated and destroyed for Lamberts Gully mine. (Permit #405).	N/A	N/A
Site 6	45-1-0203	Open site: 16 artefacts on a sloping spur above Lamberts Creek.	Section 90 recommended, but there is no certainty it was issued. The site has nonetheless been destroyed. (Permit #361 may be related to this site as well as 0208.	Not relocated. Site is within mine/ washery area. Destroyed	N/A
Site 7	45-1-0218	OS: 10 artefacts on an overgrown tracks on a slight spur above a small stream	Still present.	Yes, this site was relocated and assessed as having potential for limited, intact deposits.	Outside Impact Footprint, but close enough to require mitigation / management
Site 12	45-1-0243	Open site: 4 quartz artefacts along vehicle track.	Consent to Destroy issued (Permit #467)	N/A	N/A
Site 13	45-1-0244	Open site	Consent to Destroy issued (Permit #467)	N/A	N/A
POS A Lamberts Creek 7	45-6-2354	PAD, became OS after test excavation.	Test excavated and destroyed for Lamberts Gully mine. (Permit #405).	N/A	N/A
Western Main 3	45-1-0235	Open site	Consent to Destroy issued (Permit #428)	N/A	N/A
SVW – OS1 with PAD	45-1-2601	Open Site	Remains extant	First recorded.	Well outside Impact Footprint.

9.3.4. Neubecks Creek and Ivanhoe No 4 Sites

A desktop analysis of the potential indigenous heritage sites located within Neubecks Creek and Ivanhoe No. 4 has been undertaken. These results are outlined in this section with a detailed description of these studies provided in **Appendix F**.

The Neubecks Creek area has already undergone complete Aboriginal heritage assessment including survey of the proposed construction of a haul road between Angus Place Colliery and Mt Piper Power Station and a survey of the proposed Boulder Road coal mine, which comprises the western extent of the current Neubecks Creek area between the Castlereagh Highway and Ben Bullen State Forest. In 2005, a heritage survey of a proposed open cut coal mine was undertaken in the Neubecks valley (Benton, 2005).

A search of the DECCW AHIMS shows there are nine (9) recorded sites within the area proposed for ash placement at Neubecks Creek although it is believed that site # 45-1-0217 was destroyed during development of the nearby electricity easement. AHIMS sites known to have previously been recorded near Neubecks Creek are shown on **Figure 9-1.**

In 1982, Haglund undertook survey for Ivanhoe # 4. This assessment was a sample survey covering many areas between Portland Road and the Wallerawang railway line. Haglund (1982) recorded total of 7 open camps sites, of which two are within the current Ivanhoe No. 4 area, being Site 1, (DECCW # 45-1-0066) and Site 2 (DECCW # 45-1-0067). Artefacts of quartz and chert were recorded at both sites. Further survey for the proposed Stage 4 of the Ivanhoe Mine was undertaken by Mills in 1998. A total of six open camp sites, two isolated finds and eight Potential Archaeological Deposits (PADs) were recorded however these sites are to the south of the are identified for ash placement at Ivanhoe No. 4. AHIMS sites known to have previously been recorded near Ivanhoe No 4 are shown on **Figure 9-1.**

Further research and mapping of previously assessed locations at both Neubecks Creek and Ivanhoe No.4 would be required to identify any gaps, which should then be surveyed prior to any impacts occurring. Previously recorded sites would also require ground-truthing to determine whether they remain extant and then management recommendations be devised for their management. The understanding is that such work would precede future ash emplacement.

9.4. Survey Results

No Aboriginal sites were recorded as part of the current assessment. Further, the Study Area holds little potential for the existence of undetected Aboriginal sites due to the high levels of prior disturbance.

9.4.1. Previously recorded Aboriginal sites

Sites # 45-1-0218 and # 45 -1-2601 were not relocated during the field visit. Both are currently protected by a CHMP that remains in force and is relevant to the current mining operations. Site # 45-1-0218 (described below) is situated within a heavily wooded area adjacent to a waterway beyond the north-western boundary of the existing mined area. This vegetated area remains intact and hence the likelihood is high that site also remains intact. Conversations with the mine manager (March 4 2010) confirmed that this site has not been affected. Site # 45 -1-2601 is a significant distance away from the proposed impacts of Lamberts South and is not considered at threat from the ash placement project. This site is nonetheless described below, was discussed with the mine manager and is reported as being protected as required in the CHMP.

Site # 45-1-0218

This open camp site was recorded on a gently sloping spur leading down to a small creek line along the western edge of the ML 1448 Study Area (outside the current area of possible impact). Approximately ten artefacts were recorded here, all but one were made of quartz, while the last was of a fine grained white material, and included 8 flakes and 2 cores. Visibility was assessed as low and more artefacts were thought likely to be present with the further possibility of intact sub-surface deposit.

OzArk relocated this site in 2005 (OzArk 2005) using both co-ordinates and the maps provided. Not all the artefacts were relocatable, but several of the previously recorded artefacts were found as well as three artefacts not previously recorded. These were:

- Broken flake - Fine grained, creamy-grey material, flake scars on dorsal surface, measuring 5 x 4 x 1 cm;
- Flake – White quartz, 2 x 0.8 x 0.7 cm;
- Flake – Creamy chert, 2.5 x 1 x .6 cm.

Overall impacts to this site are potentially minimal in terms of disturbance, and there is limited potential for intact archaeological deposit.

Site # 45 -1-2601

This site is located on a slightly elevated flat, open landform near a minor ephemeral drainage line within the valley floor landscape east of Lamberts South. Six artefacts were recorded on an unsealed service track, four of which were diagnostic. Of these two were quartzite primary flakes and the remainder were broken flakes of quartzite and quartz.

This site was flagged in the field with a wooden marker post so that the proponent would be aware of its location and hence able to protect the site under the previous CHMP.

9.5. Predicted Impacts to Indigenous Heritage

9.5.1. Lamberts North and Lamberts South Sites

As no new sites were recorded in the study area and there is a demonstrated low potential for intact, undetected subsurface material, the significance assessment has been omitted.

The previously recorded sites were assessed in 2005. As a result a CHMP now governs the management of these sites and this document should be revised and updated to cover the protection of these sites into the future.

No Aboriginal sites would be affected at Lamberts North or Lamberts South study areas as part of the Mt Piper Ash Placement Project. The proximity of the two previously recorded sites will require the use of appropriate measures to avoid any inadvertent impact.

9.5.2. Neubecks Creek and Ivanhoe No 4 Sites

Future development of the Neubecks Creek and Ivanhoe No. 4 sites has the potential to affect indigenous heritage values of the sites. Previously recorded sites identified on AHIMS are present within both areas and can be seen on **Figure 9-1.** A detailed indigenous heritage impact assessment including detailed field surveys would need to be undertaken either before or as part of any project application for ash placement at these sites.

9.6. Management Options

With regards to the general results over the study area (all sites) the following general management would be implemented:

- Avoidance of impact - If this can be done, then a suitable curtilage around the recorded sites would be determined so as to ensure their protection both during the short term construction phase of development and in the long term use of the area;
- If impact is unavoidable - then an Aboriginal Heritage Impact Permit – (AHIP) may be applied for from the NSW DECCW and approval would depend on many factors including the assessed significance of the recorded sites. Sites of moderate to high significance and/or potential may require either test or salvage excavation, or more detailed recording, as part of the conditions of an AHIP being granted. Sites of low significance may have an AHIP approved with no further archaeological assessment being required, or with an approved monitoring programme. Once granted, the local Aboriginal communities may wish to collect or relocate artefacts, whether temporarily or permanently, if necessary. Consultation with the Indigenous community is required for all AHIP applications.

In reference to Neubecks Creek and Ivanhoe No. 4 Concept Approval areas:

- There is already known evidence of Aboriginal occupation over both the Neubecks Creek and Ivanhoe No. 4 Concept Areas and hence any proposed impacts would need to be assessed against known heritage values of these locations such that appropriate heritage management measures could be devised;
- A significant component of this process would be Aboriginal community consultation in relation to the assessment for sites, the cultural significance of any recorded locations and with regards to mitigation and management measures.

9.7. Conclusion

Previous surveys of the Lamberts North and South Study Areas demonstrate that this area was used in the past by Aboriginal people. However, as a result of the wholesale nature of the subsequent disturbance associated with open cut mining operations and the reshaping of the ground surface soils which has completely modified the entire local landscape, there is now very low / zero potential for intact archaeological deposits over the proposed ash placement study area.

The two previously identified sites, one just west of the Lamberts South (Sites # 45-1-0218) and one to the east of Lamberts South (# 45 -1-2601), remain intact and are currently protected by a CHMP. For the purpose of this project, these two previously registered sites remain as constraints and would be avoided by project impacts.

Surveys undertaken at both Neubecks Creek and Ivanhoe No. 4 also identify these areas as having been used in the past by indigenous groups with a number of sites known to occur in areas where ash placement could potentially occur. Further assessment and survey of the Ivanhoe No. 4 Concept Area would eventually be required to ensure all indigenous heritage has been adequately identified and documented.

Mt Piper Power Station
Ash Placement Project

ENVIRONMENTAL ASSESSMENT

CHAPTER 10 – VISUAL AMENITY

August 2010

Contents

10. Visual Amenity

This chapter addresses the key issue relating to visual amenity and addresses the Director-General's requirements for:

- *Neubecks Creek and Ivanhoe No 4 sites (concept plan) - provide a general screening of likely visual impacts (considering cumulative effects) should these sites be developed and available mitigation/ treatment options for minimising impact, including key constraints and design criteria that would require further investigation prior to site development.*
- *Lamberts North and Lamberts South sites (project application) - include an assessment on the potential visual impact of the sites (for both the finished profile of the sites and after the finished sites have been rehabilitated by treatments) on visual amenity with specific reference to the maximum height of the proposed ash placement areas from neighbouring residences, adjacent roads, watercourses and the public domain.*

10.1. Project Approval

10.1.1. Introduction

This section provides an assessment of the potential visual impacts of the proposed new ash placement areas at Lamberts North and Lamberts South. It considers the existing and proposed visual environment together with associated potential visual impacts to provide an assessment of the significance of impacts to sensitive receivers in the area.

10.1.2. Methodology

The following methodology was undertaken for the visual impact assessment:

- Line of sight analyses: where potentially visually sensitive sites in the study area were determined;
- Selection of representative sites: where locations from the line of sight analyses were chosen as being representative of the views from neighbouring residences and adjacent roads. There are no areas of public domain or watercourses used for public recreation purposes in the vicinity of the proposed ash placement areas. Digital photographs were taken at each of these locations during the field survey;
- Development of photomontages: where photomontages of key locations were produced to assist with the visualisation of the proposed development and assessment of visual impacts; and
- Development of mitigation measures: where mitigation measures were developed which would reduce the level of visual impact of the proposed ash disposal placement areas.

The visual impact assessment was by considering the degree of visual modification and the visual sensitivity of the surrounding areas.

Visual Modification

The degree of visual modification of the ash placement areas is the expression of the visual interaction between the development and the existing visual environment of the ash placement areas. It can also be expressed as a level of visual contrast of the development to the visual setting within which it is placed. The different levels of visual modification are described in **Table 10-1**. The degree of visual modification generally decreases as the distance between the proposed development and the viewer increases.

- **Table 10-1 Levels of Visual Modification**

Level of Visual Modification	Description
High	Proposed development is a major element that contrasts strongly with the existing environment. Little or no natural screening or integration with existing environment.
Medium	Proposed development is visible and contrasts with the surrounding environment but is integrated to some degree. Surrounding vegetation / topography provides some visual screening.
Low	Proposed development may be noticeable but does not markedly contrast with the existing environment. High level of integration in terms of form, shape, colour or texture.

Visual Sensitivity

Visual sensitivity is a measure of how critically a change to the existing landscape would be viewed from various areas. The visual sensitivity depends on a range of characteristics such as land use, the number of viewers, the viewing time and the distance between the proposed development and the viewer. These characteristics were all considered in developing the different levels of visual sensitivity from land uses surrounding the proposed ash placement areas (refer to **Table 10-2**).

- **Table 10-2 Levels of Visual Sensitivity**

Land Use	Foreground		Middleground		Background
	0 – 0.5 km	0.5 – 1 km	1-2 km	2-3 km	>3 km
Natural Area – recreation	H	H	H	M	L
Rural residential	H	H	H	M	L
Local roads	M	L	L	L	L
Main roads	M	L	L	L	L

Typically, residential areas are more sensitive to changes in the visual environment than roads. This is primarily due to the different lifestyle contexts associated with these land uses. Hence, rural residential areas have been rated quite highly in terms of their visual sensitivity. The main and local

roads have been given a low to medium visual sensitivity rating as there are some people that could view the development whilst travelling on these roads.

Visual Impact

The visual impact of the proposed development is determined by considering both the degree of visual modification and the visual sensitivity. A matrix has been developed to identify the level of impact for each combination of visual modification and visual sensitivity (refer to **Table 10-3**).

- **Table 10-3 Visual Impact Matrix**

		Visual Sensitivity		
		High	Medium	Low
Visual Modification	High	H	H	M
	Medium	H	M	L
	Low	M	L	L

10.1.3. Visual characteristics of the environment and proposed development

The site of the proposed ash placement areas is predominantly surrounded by rural and extractive industries (mining), Ben Bullen State Forest to the north and south, and some rural residential and village areas. The Mount Piper Power Station is located to the west of the proposed ash placement areas. The nearest township is located at Blackmans Flat, approximately 1 km from the eastern boundary of the proposed Lamberts North site. The townships of Portland and Lidsdale are also located approximately 5 km west and 3 km south-east, respectively, from the proposed ash placement areas.

The proposed ash placement areas are characterised by open cut mining operations in a region dominated by State Forest, power generation facilities and mining. The Lamberts North and Lamberts South sites are currently open cut mines which would be used for ash placement as part of this project. These sites would progressively be established over an approximate 30 year timeframe. The Lamberts South site would have a final maximum relative level (RL) of 1000 metres AHD, which is higher than the current RL of 960 metres being used for the existing ash placement Area 1. The Lamberts North site would have a final maximum RL of 980 metres, with the majority of the site at a RL of 950 metres. The current RL of the Lamberts North site is approximately 920 metres. The topographic character of the area is undulating. Thus due to the topography and vegetation screening, the placement areas would not be dominant visual features in the landscape as the majority of the ash placement areas would be hidden from view.

10.1.4. Visual Impact Assessment

Visual impacts were assessed by comparing the visual modification and visual sensitivity (using the matrix outlined in **Table 10-3)** and generally relate to the ability of the landscape to absorb visual modification. The degree to which the environment can absorb any visual impacts is influenced by topography (whether it can be screened) and vegetation (whether it can be concealed). In general, there are more opportunities to minimise the visual impact of a development from distant views and in varied and undulating landscapes than areas of flat terrain. For the purpose of this study, the views were developed by assuming a viewer height of two metres above ground and using a terrain model which included the typical height of existing vegetation. This represents the likelihood of a person being able to see the proposed ash placement areas from these viewpoints.

A line of sight analyses were undertaken to determine sites in the area which would be potentially visually affected by the proposed development. Fourteen sites were chosen within the study area to represent a variety of land uses (including neighbouring residences and adjacent roads), elevation and viewing angles (refer to **Figure 10-1**). A line of sight was determined between each site and the proposed ash placement areas. The red sections of the line indicate that the proposed development would not be visible from those locations, and the green sections indicate that the proposed development would be visible from those locations.

From the line of sight analyses, it was found that:

- Areas to the west, south -west and south were likely to be screened by topography and dense vegetation. As a result, sites in the west, south-west and south were not considered further as the proposed development would not be visible from these areas,
- The proposed development was likely to be screened by topography and dense vegetation when viewing from sites along the Castlereagh Highway and major roads to the north,
- The proposed development was likely to be viewed wholly or partially from sites located to the east and south-east of the proposed development.

Six representative sites were chosen from those sites identified in the line of sight analyses. The six representative sites were chosen to represent a variety of landforms, vegetation coverage, land use and proximity to the proposed development (foreground, middle ground, background) and are shown in **Figure 10-2**. They were also chosen to represent different directions from the development (ie from the north, south, east and west). The visual assessment in **Table 10-4** assesses these six representative sites.

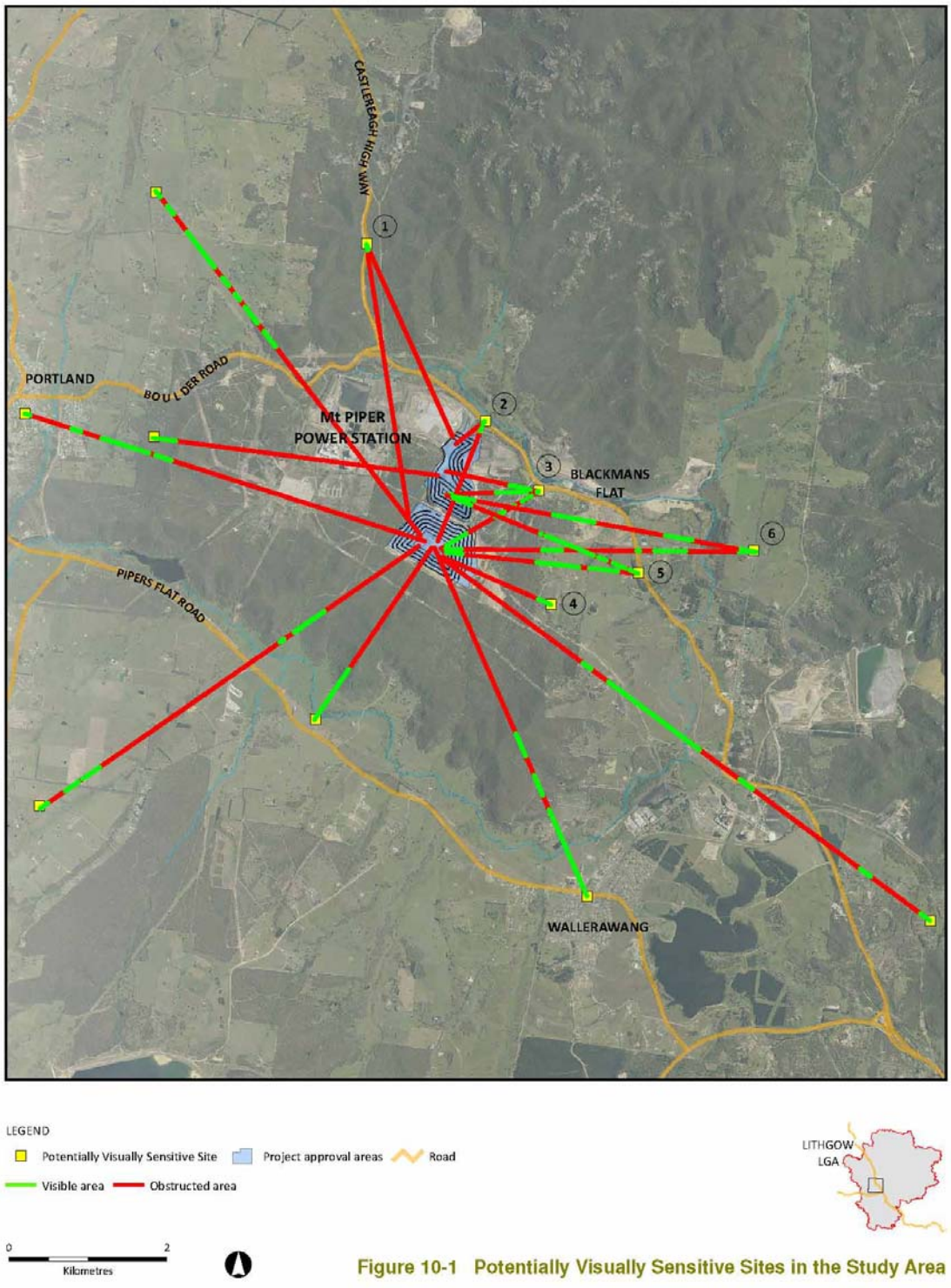

Figure 10-1 Potentially Visually Sensitive Sites in the Study Area

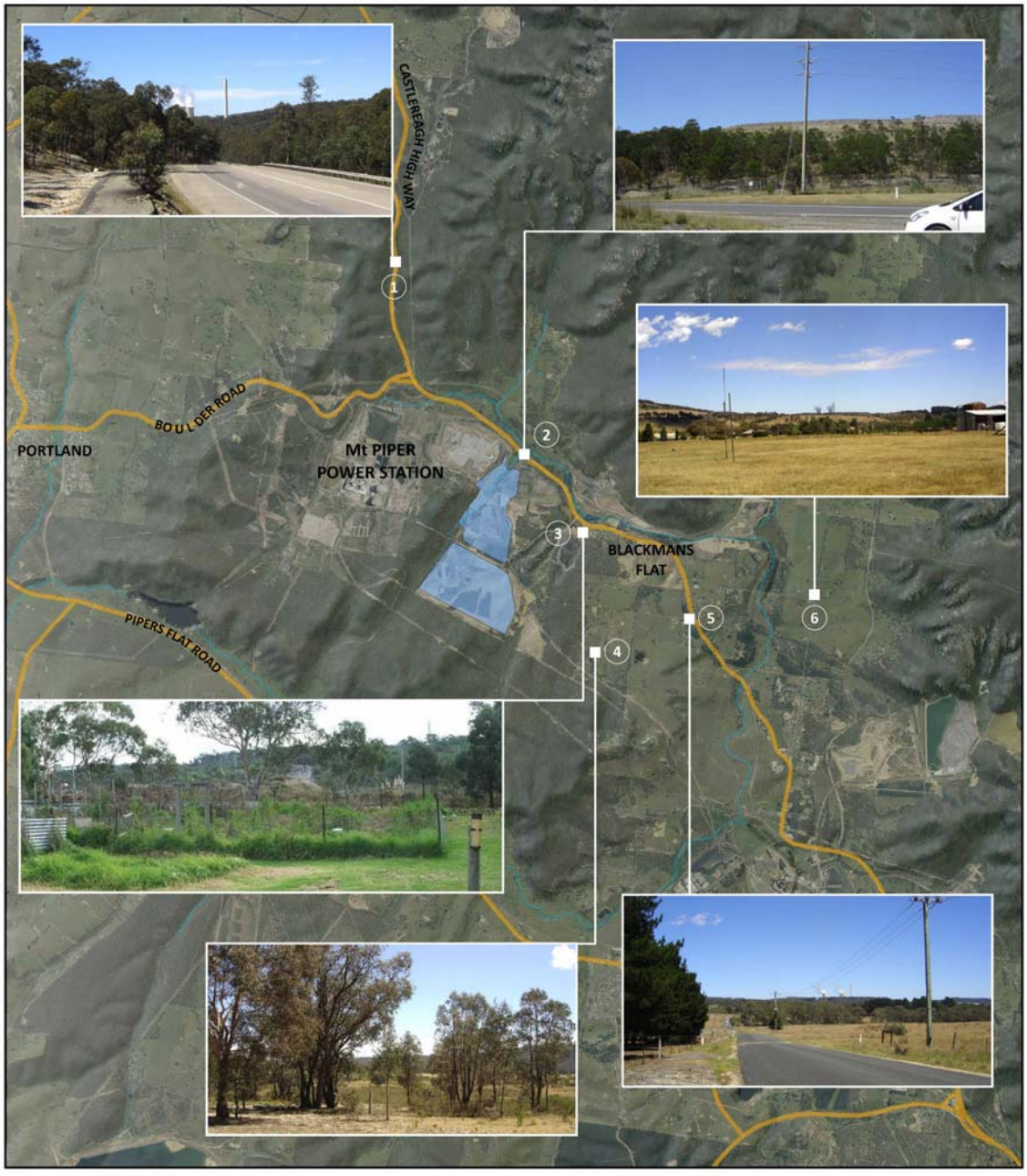

Figure 10-2 Representative Visually Sensitive Sites in the Study Area

- **Table 10-4 Visual Assessment**

Location	Distance from sensitive viewpoint to proposed ash placement areas	Level of visual modification	Viewer Sensitivity	Visual Impact	Comment
1	View from Castlereagh Highway 2.6 km from Lamberts North 3.5 km from Lamberts South	L	L	L	The ash placement areas would not be visible from the Castlereagh Highway as it would be screened by the topography and concealed by existing vegetation, and also due to the distance to the proposed area. These areas would therefore not be visible by drivers travelling down the highway. **Figure 10-1** shows that the line of sight from this location to the proposed ash placements is completely obstructed. As a result, this location has not been considered further as the proposed development would not be visible from this location.
2	View from Castlereagh Highway 0.5 km from Lamberts North 1.6 km from Lamberts South	L	L	L	The ash placement areas would not be visible from the Castlereagh Highway as it would be screened by the topography and existing vegetation. Therefore it would not be visible by drivers travelling down this section of the highway. The line of sight from this location to the proposed ash placements is completely obstructed (refer to **Figure 10-1**). As a result, this location has not been considered further as the proposed development would not be visible from this location.
3	Sensitive receiver 1.2 km from Lamberts North 1.6 km from Lamberts South	M	H	H	The ash placement areas would be visible for this sensitive receiver within 500 metres within the proposed development. This receiver currently has views of the existing Mt Piper Power Station. The topography is generally flat, with the proposed ash placement areas extending above the existing ground level. The maximum height of the proposed ash placement areas that would be visible from this location would be 10 metres of the Lamberts North ash placement and 50 metres of the Lamberts South ash placement. An indicative visualisation is provided in **Figure**

Location	Distance from sensitive viewpoint to proposed ash placement areas	Level of visual modification	Viewer Sensitivity	Visual Impact	Comment
					10-4. Existing vegetation shields the development from the sensitive receiver to some degree. There are areas, however, where existing vegetation does not provide adequate cover to shield views of the ash placement area. There are opportunities to further mitigate the views by planting new vegetation closer to the viewpoints. **Figure 10-5** shows the potential view from this receiver, following rehabilitation of the placements areas. Once the ash has been placed, the site would be rehabilitated and revegetated. The visual impact of the remediated site would therefore be minimised by blending with the existing rural and natural landscape.
4	Sensitive receiver 1.8 km from Lamberts North 1.5 km from Lamberts South	L	L	L	It is unlikely that the ash placement areas would be visible from this sensitive receiver. The area is shielded by the topography and existing vegetation. This location has not been considered further as the proposed development would not be visible from this location.
5	View from local road/Castlereagh Rd 2.6 km from Lamberts North 2.5 km from Lamberts South	M	M	M	The ash placement areas would be highly visible in the middle ground from the road. The area would protrude above the existing vegetation due to the undulating topography. Drivers traversing along Castlereagh Street near this location would observe views of the ash placement areas to the west, however, road usage for the local road is anticipated to be low. The Mount Piper Power Station is also currently highly visible in the middle ground from this location. As there is a small valley between the viewpoint and the ash placement area, there is limited opportunity for vegetation screening. The maximum height of the proposed ash placement areas that

Location	Distance from sensitive viewpoint to proposed ash placement areas	Level of visual modification	Viewer Sensitivity	Visual Impact	Comment
					would be visible at this location would be 30 metres of Lamberts North placement area and 40 metres of Lamberts South placement area. An indicative visualisation is provided in **Figure 10-7.** Once the ash has been placed, the site would be rehabilitated and revegetated. This would blend in better with the existing rural and natural landscape. An indicative visualisation of the rehabilitated area is provided in **Figure 10-8.**
6	View from Wolgan Road 4.0 km from Lamberts North 3.9 km from Lamberts South	M	L	L	The ash placement areas would be visible from this road. The topography of the existing environment of this location is undulating. The proposed development would blend into the existing environment due to the undulating nature of the ash placement area, and it is unlikely that the area would protrude above the existing topography. The maximum height of the proposed ash placement areas that would be visible at this location would be 30 metres of the Lamberts North ash placement and 40 metres of the Lamberts South ash placement. The Mount Piper Power Station is the dominant feature from this viewpoint. The proposed development would be above existing vegetation. Following completion of the ash placement, the site would be rehabilitated and revegetated. The visual impact of the remediated site would therefore be minimised by blending with the existing rural and natural landscape. Refer to **Figure 10-9** and **Figure 10-10** and **Figure 10-11** for existing views, the finished profile and following rehabilitation of the ash placement areas.

Photomontages were produced for key locations 3, 5 and 6 as these locations would have views of the proposed development. Locations 1, 2 and 4 were not considered further as the proposed development would not be visible from these locations.

The extent of modification and sensitivity for key locations 3, 5 and 6 can be identified from the photomontages in **Figure 10-3** to **Figure 10-11**, in which the new ash placement areas have been superimposed on photographs of existing viewpoints. The photomontages include the finished profile of the ash placement areas prior to rehabilitation of the sites, and also following rehabilitation of the sites.

The photomontages show that only the tops of the proposed ash placement areas would be visible from the surrounding areas. It follows that the beginning of the placement below ground would not be visible from these places.

It is evident that high visual impact would result on key location 3 due to the close proximity of the sensitive receiver to the proposed ash placement areas, although opportunities to mitigate this impact would include the planting of screening trees. Locations 1, 2 and 4 would experience no visual impact, given that the proposed ash placement areas would not be viewed from these locations. Visual impacts from locations 5 and 6 would be low to moderate, given their proximity to the proposed development and existing land use. For the finished profile of the sites, the ash placement areas are expected to appear greyish in colour from the viewpoint locations.

Following ash placement, the resultant ash mounds would be capped, revegetated and rehabilitated. Given that the rehabilitated and revegetated ash placement areas would be readily absorbed into the surrounding natural environment and the long distances between the sensitive viewing locations and the proposed ash areas, the visual impact of the proposed development would be low.

- **Figure 10-3 Existing view from Location 3 (foreground location)**

- **Figure 10-4 Photomontage of potential view (finished profile) from Location 3 (foreground location)**

- **Figure 10-5 Photomontage of potential view (after rehabilitation) from Location 3 (foreground location)**

- **Figure 10-6 Existing view from Location 5 (middle ground location)**

- **Figure 10-7 Photomontage of potential view (finished profile) from Location 5 (middle ground location)**

- **Figure 10-8 Photomontage of potential view (after rehabilitation) from Location 5 (middle ground location)**

- **Figure 10-9 Existing view from Location 6 (background location)**

- **Figure 10-10 Photomontage of potential view (finished profile) from Location 6 (background location)**

- **Figure 10-11 Photomontage of potential view (after rehabilitation) from Location 6 (background location)**

10.1.5. Mitigation of Visual Impacts

In areas where the topography does not conceal the development from surrounding areas, vegetation can be used to screen the development from sensitive viewpoints. In general, smaller trees with low canopies can be used effectively on gentle slopes or flat areas to screen developments, and taller trees with high canopies are more effective on steeper slopes.

The visual impacts of the new ash placement areas have been mitigated, as far as practicable, through its location and design.

Location

The location of the ash placement areas have been sited within open cut mines to utilise pre-disturbed land, reduce the need to use undisturbed land, and provide an opportunity to rehabilitate the mine site at the completion of mining activities. Utilisation of pre-existing mine sites also minimises the requirements for vegetation clearance. The ash placement sites are located in a region dominated by open cut mining operations, State Forest and power generation facilities such as the existing Mount Piper Power Station directly adjacent to the proposed development. The study area is not located in an area of high scenic value. The location of the ash placement areas within existing mines would minimise any impacts as far as practicable.

Design and landscaping

The ash placement areas would be progressively established over a number of years. Following the placement of the ash into the Lamberts South and Lamberts North sites, the ash placement areas would be capped with a layer of reclaimed overburden and rehabilitated/revegetated in accordance with the Site Rehabilitation Plan. This would ensure that the visual impact of the ash placement areas would be absorbed into the existing, surrounding natural and rural settings. A large amount of the ash would be placed below ground, thus minimising visual intrusion. The placement areas are anticipated to be about 50 metres above the existing ground level.

To further minimise the impacts on direct view of the new ash placement areas, landscape planting would be considered at key locations around the ash placement sites.

On the basis that these mitigation measures are implemented, residual visual impacts would be considered to be low.

10.2. Neubecks Creek and Ivanhoe No 4 Sites

This section provides a general outline of the potential visual impacts of the proposed ash placement areas at Neubecks Creek and Ivanhoe No 4 sites. Possible mitigation and treatment options for these sites, should they be developed, are also presented in this section, along with key constraints and design criteria requiring further investigation prior to the sites being developed.

10.2.1. Potential Visual Impacts of Sites

Development of ash placement areas of a similar scale to those proposed at the Lamberts North and South are likely to result in visual impacts to surrounding receivers. The following locations are those considered as likely to have potential visual amenity impacts from ash placement in the Concept Approval sites:

- Neubecks Creek
  - Blackmans Flat (approximately 1.2 kms south of the southern border of Neubecks creek),

- Lidsdale (approximately 4 kms south east of the southern border of Neubecks creek),
- Stretches of the Castlereagh Highway in proximity to Neubecks Creek,
- Some rural residences in elevated locations east of the current Centennial mine site

- Ivanhoe No. 4
  - Areas of the east of Portland (approximately 1.5 km west of the Ivanhoe No. 4),
  - Pipers Flat (approximately 2.5 km south west of Ivanhoe No. 4),
  - Residences to the north east of Ivanhoe No. 4,
  - Stretches of Boulder Road and Black Cullen Bullen Road.

A detailed visual impact assessment including line of sight analysis would be undertaken once preliminary design of ash placement area is completed. This would be used to identify potentially visually sensitive sites in the study area.

Depending on the requirement for volume at each site and the surrounding topography, the ash placement areas are likely to be similar in height to those at Lamberts North and South and are not expected to be higher than an RL of 1,000 m.

10.2.2. Visual Impact Assessment

At the time of seeking Project Approval for these sites, a visual impact assessment will be undertaken in accordance with the Concept Approval requirements. For the purposes of this study, it is anticipated that the methodology followed for the lamberts North and Lamberts South sites (Section 10.1.2) would form the basis of any assessment at a later date, and include:

- Line of sight analyses;
- Selection of representative sites;
- Development of photomontages; and
- Development of mitigation measures.

Development of a visual impact assessment methodology would also be undertaken in line with standards visual assessment practices at that time and based on a preliminary design of the ash placement areas.

10.2.3. Mitigation of Visual Impacts

All possible mitigation measures relevant to each site will be considered during assessment and development of the sites. Where possible, the siting of ash placement areas will be undertaken to maximise the use of surrounding topography as a visual shield. In this regard it is suggested that areas to the east of Neubecks Creek (such as Lidsdale) and the south of Ivanhoe No. 4 (Pipers Flat) may have reduced visual impact through prudent siting of ash placement areas to best utilise surrounding hills. The study area is not located in an area of high scenic value..

Cumulative impacts would also be minimised at this time due to the continued rehabilitation and revegetation of Lamberts North and Lamberts South.