Western Rail Coal Unloader

ENVIRONMENTAL ASSESSMENT

CHAPTER 5 – ASSESSMENT OF KEY ENVIRONMENTAL ISSUES

- April 2007

Contents

5. Assessment of Key Environmental Issues

This chapter provides an assessment of the key environmental issues identified in the Environmental Assessment requirements issued by the Department of Planning. The key environmental issues are air quality, noise, flora and fauna, hydrology and water quality, heritage and visual amenity. The assessment considers the impacts during both construction and operation (as appropriate), outlines any mitigation, monitoring and management measures which will be applied. An assessment of the effectiveness and reliability of the measures and any residual impact after the implementation of the measures is provided.

5.1 Hydrology and Water Quality

5.1.1 Geology and Soils

Geology

The 1:100,000 Geological series Sheet for Wallerawang (1993) indicates that most of the project site in underlain by Permian rocks of the Shoalhaven group, with occurrences of Early Triassic rocks of the Narrabeen Group on top of the ridges. To the north of the project site, in the vivinity of the Mt Piper Power Station, the Shaolhaven Group is overlain by the Illawarra Coal Measures. The Permian sediments unconformably overlie Carboniferous granite. Quaternary alluvium appears as accumulated surgical deposits along the northern end of the lake west of Wallerawang.

Soils

The site has landscapes as defined by the Department of Conservation and land Management in the Soil Landscapes of the Wallerawang 1:100,000 sheet.

Soils at Pipers Flat comprise alluvial landscape – moderately deep to deep (>100 cm) grey brown Alluvial Soils, Leached Loams, Soloths and Gleyed Podsolic Soils.

Existing erosion includes gulley erosion (<1.5 m) and severe stream bank erosion, particularly along drainage lines. Limitations and hazards include a high watertable and seasonal water logging, high run-on, high foundation hazard, high erodibility for non-concentrated and concentrated flows and low erodibility for wind.

Soils in the Pipers Flat Creek and Thompsons Creek catchments include the Bathurst Series Sunny Corner red/yellow soils of moderate permeability in the upper catchments, and Bathurst Series Capertee yellow soils of low permeability in the lower catchments.

Groundwater

At the project site, the uppermost geological unit is the Shoalhaven Group, which comprises silty sandstone, has low permeability and is greater than 50 meters thick. Approximately one metre of alluvial soils with high permeability overlies the sandstone on the floodplain. The depth to groundwater at the site is approximately 1-2 metres below ground surface, with surface soils being subject to seasonal water logging. Groundwater north of the project site, underlying the power station, ranges from 3-8 meters below ground surface (Pacific Power International, 2001). Groundwater flow direction mirrors the topography, and flows from higher elevations towards the creeks, flowing generally towards the southeast. The groundwater in the Shoalhaven Group contains small, but significant, amounts of fine sulphide minerals.

5.1.2 Hydrology and Flooding

The proposed rail loop for the Western Coal Unloader is located in the floodplains of Pipers Flat Creek and its tributaries Thompsons Creek and Irondale Creek and the rail loop has the potential to act as a significant obstruction to flood flows. The catchment areas are shown in **Figure 5-1a**. Peak flood flows along those waterways can back up behind the embankments, depending on the magnitude of the peak flood flows and the size of waterway structures through the embankments. Such potential restrictions may affect adjacent property or infrastructure, alter the morphology of the creek watercourses and floodplains, and determine the ability of the proposed rail loop to survive a large flood intact. This section addresses potential flood impacts and identifies design elements to minimise any such effect. The full details of the hydrologic and flood study are provided in **Appendix B**.

Hydrological Background

The Pipers Flat Creek catchment is located along the eastern edge of the Great Dividing Range, with a north-easterly aspect. The catchment is drained by several parallel gullies running from the Great Dividing Range towards the north-east. The northern edge of the catchment is bounded by Mount Piper, and at the foot of the mountain the gullies merge into an open floodplain at Pipers Flat, the site of the proposed rail loop. The four main creeks which run down these gullies are separate until they merge at Pipers Flat within a length of approximately 2 kilometres.

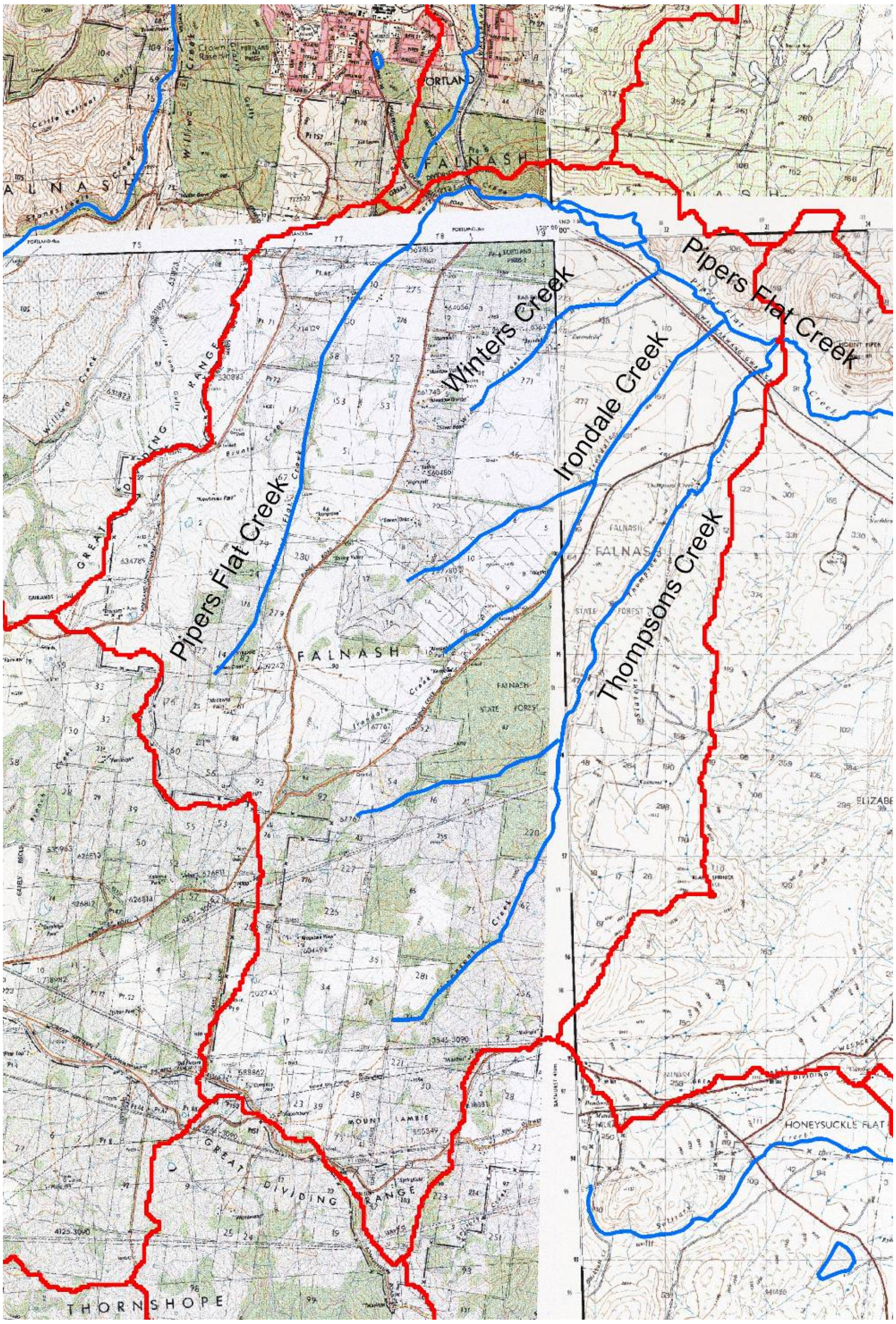


Figure 5-1a: Pipers Flat Creek Catchment and Major Tributary Creeks

Existing Creek Floodplain

At the site of the proposed loop, Pipers Flat Creek runs from north west to south east across a generally flat floodplain approximately 150 metres wide, bounded by steep soil and rock slopes on the northern side, and gentle hills and tributary gullies on the southern side (see Plate 3-1).

When not in flood, Pipers Flat Creek is confined to a shallow channel varying between two and three metres across, and typically one to two metres deep from the top of the stream bank edge (see Plate 3-2). The capacity of the creek channel is relatively low, and in most flood events flows will leave the creek channel, and spread out relatively evenly across the flat floodplain. As water spills out of the channel, the predominant flow direction will change from following the line of the creek, to following the slope of the wider floodplain. Consequently, the whole floodplain is important in conveying floodwater downstream.

- **Plate 5-1: Typical Floodplain View at Pipers Flat**

- **Plate 5-2: Typical Stream Channel at Pipers Flat**

Existing Floodplain Infrastructure

The proposed rail loop is being constructed adjacent to an existing railway line, and parallel to an existing road. This existing railway line and road cross both Thompsons and Irondale Creek. The embankments and structures associated with these crossings already affect the propagation of floods into Pipers Flat Creek, and water levels in the upstream creek floodplains.

The characteristics, dimensions and plan surveys of the waterway crossings are included in Appendix A. As a summary, the key existing structures of interest in this study are:

- The low bridge Portland to Wallerawang road crossing of Thompsons Creek;
- The high bridge railway crossing of Thompsons Creek;
- The semi-circular corrugated culvert road crossing of Irondale Creek;
- The brick elliptical culvert railway crossing of Irondale Creek.

Creek Morphology

At the site of the proposed loop, Pipers Flat Creek is confined to a shallow channel varying between two and three metres across, and typically one to two metres deep from the top of the stream bank edge. The creek runs from west to east across a generally flat floodplain approximately 150 metres wide, bounded by steep soil and rock slopes on the northern side, and gentle hills and tributary gullies on the southern side.

The creek banks are composed of fine, erodible alluvial material. The length of the creek through the site is grass-lined, and is within a paddock used for grazing. There is evidence of erosion caused by stock entering the waterway, and clumps of willows have been planted at some points to arrest bank erosion caused by this.

The capacity of the creek channel is relatively low, reflecting the morphology of the bed and bank material. This means the creek channel will be relatively insignificant as a means of conveying water in larger flood events. In such events flows will leave the creek channel, and spread out relatively evenly across the flat floodplain. As water spills out of the channel, the predominant flow direction will change from following the line of the creek, to following the slope of the wider floodplain. Consequently, the whole floodplain is important in conveying floodwater downstream.

The role of the wider floodplain therefore needs to be considered in developing the design of the openings through the embankment. The creek channel is relatively insignificant in conveying flood flows downstream, and the normal direction of flow of the creek is not generally the direction of flow of a large flood. Construction of an embankment across the floodplain has the potential to concentrate flood flows, increase water levels upstream, redirect water across the floodplain, and increase flood velocities. These effects can potentially affect both the morphology of the creek channel, and the stability of the wider floodplain. The floodplain is currently in grass, which can typically withstand flow velocities of up to 2 metres per second. Final design of the embankment would take this into account, seeking to minimise velocities around the embankment to prevent loss of protective vegetation and scouring of the fine soils underneath.

Hydrologic and Hydraulic Modelling

The proposed rail loop will cross the Pipers Creek Floodplain at two locations, as well as Thompsons Creek and Irondale Creek. Based on the current design of the loop and the existing railway crossings, the parameters of the additional crossings analysed in this report are:

- **Pipers Flat Creek – upstream embankment**: Bridge structure with three spans, each of 15 metres opening;
- **Pipers Flat Creek – downstream embankment**: Bridge structure with four spans, each of 15 metres opening;
- **Irondale Creek**: Extension of the elliptical shaped culvert underneath the existing railway line, using a culvert of similar area and shaped to minimise transition losses between the two structures;

- **Thompsons Creek**: Construction of a bridge of similar opening size and shape, as the existing railway line bridge. Construction of a smooth transition between the two structures, to minimise expansion and contraction losses from the existing to the new structure.

In addition, for the purposes of this study we have assumed:

- The proposed railway embankment will be at approximately the same level as the existing embankment at the Thompsons Creek and Irondale Creek crossings;
- The existing Winters Creek rail crossing is not affected by the proposed rail loop, and no extension of the existing culvert underneath the railway line at this point is required.

In order to determine the design inflows into the hydraulic model, a RORB hydrologic model of the catchment was built. RORB is a general runoff and streamflow routing program used to calculate flood hydrographs from rainfall and other channel inputs. The model is areally distributed, nonlinear, and applicable to both urban and rural catchments. It makes provision for temporal and areal variation of rainfall and losses and can model flows at any number of gauging stations. In addition to normal channel storage, specific modelling can be provided for retarding basins, storage reservoirs, lakes or large flood plain storages. Base flow and other channel inflow and outflow processes, both concentrated and distributed, can be modelled.

The catchment is ungauged so the RORB model parameters were determined by consulting Australian Rainfall & Runoff (AR&R) (1998) and recent technical papers.

The peak flows for each inflow point into the rail loop are shown in **Table 5-1**. The hydrographs for each of these inflow points are shown in **Appendix B**.

- **Table 5-1: Peak flows for different ARIs at different locations.**

ARI (years)	Pipers Flat u/s Irondale Creek	Irondale Creek	Thompsons Creek
5	30.3	17.6	34.1
10	36.9	21.2	41.5
20	45.9	26.1	51.6
50	58.4	32.9	65.7
100	67.6	38.0	75.8
200	77.9	43.6	87.5
500	92.3	51.6	103.6

The PMP Design Flood (PMPDF) is defined as the flood with the same annual exceedance probability as the Probable Maximum Precipitation (PMP). In the case of the catchment being investigated, this is an AEP of 1 in 10^7.

The MIKE21 hydraulic model of the proposal is based on the following data:

- 1m contours based on topographic survey of the Pipers Creek floodplain over the length of the proposed site;
- Survey of the existing Irondale Creek and Thompsons Creek waterway structures underneath the existing railway line and Wallerawang to Portland Road;
- 5 metre contour maps;
- Digital Elevation Model (DEM) of the proposed embankment.

Development of the model involved the following steps:

- Formation of a two dimensional ground elevation grid to represent both the existing ground profile, as well as the proposed rail loop embankment design;
- Development of suitable boundary conditions, to specify behaviour of flood flows coming into and leaving the site;
- Representation of the existing and proposed waterway openings through embankments; and
- Estimation of parameters controlling floodplain hydraulics, such as surface roughness.

The model grid was developed using detailed topographic survey of the site, and the 5 metre contour topographic dataset.

The boundary conditions for this hydraulic model include:

- Flood flows in Pipers Creek downstream of the confluence with Winters Creek;
- Flood flows in Irondale Creek upstream of the Wallerawang to Portland Road embankment;
- Flood flows in Thompsons Creek upstream of the Wallerawang to Portland Road embankment;
- Water level in the floodplain downstream of the proposed rail loop.

Flood-flow hydrographs have been calculated and have been inserted directly into the hydraulic model.

A fixed water level has been used as the downstream boundary of the hydraulic model. Model results may depend on the water level assumed at this boundary in some floods. However examination of the flood behaviour in the existing situation indicates that flood depths in the floodplain are typically close to uniform flow. This implies that if the downstream boundary is far enough away from the area of interest, it will not be overly sensitive to the assumed downstream water level at the boundary.

Waterway openings have been represented within the two-dimensional grid in the MIKE21 model. In order to correctly model the head loss through each of the waterway openings, each opening was modelled in HEC-RAS. The 1 in 100 year flood event was used to adjust the roughness in the MIKE21 model to reflect the losses from the HEC-RAS model.

A detailed assessment of the roughness of the floodplain has not been undertaken, and no data exists to confirm the selection of model roughness through verification of model results. For the existing conditions, a Mannings n of 0.050 has been assumed across the floodplain. This is considered to be somewhat conservative given the current use of the floodplain area as sheep and cattle grazing with minimal vegetation on the floodplain apart from short grass. For the proposed conditions, the river beds and adjacent 30m width of flood plain were modelled with a roughness of 0.06 as it is intended that these areas will be vegetated after the rail loop has been constructed.

No recorded data about past flooding is available for the study area. This includes anecdotal information about the frequency of floodplain inundation. The hydraulic model for this study is therefore uncalibrated. While a calibrated model would have been preferred, it is considered that the uncalibrated model will provide a reliable relative assessment of the effect of the rail loop on flood levels and velocities.

The hydraulic models representing existing (EC) and proposed (PC) conditions were used to simulate the 100 year design flood. The models produce a time series of grid based water level, flood depth, velocity and discharge. To reflect the impacts of the proposed conditions on the nature of flooding in the study area figures showing the peak water elevation and peak flow velocity estimated using the two models have been prepared.

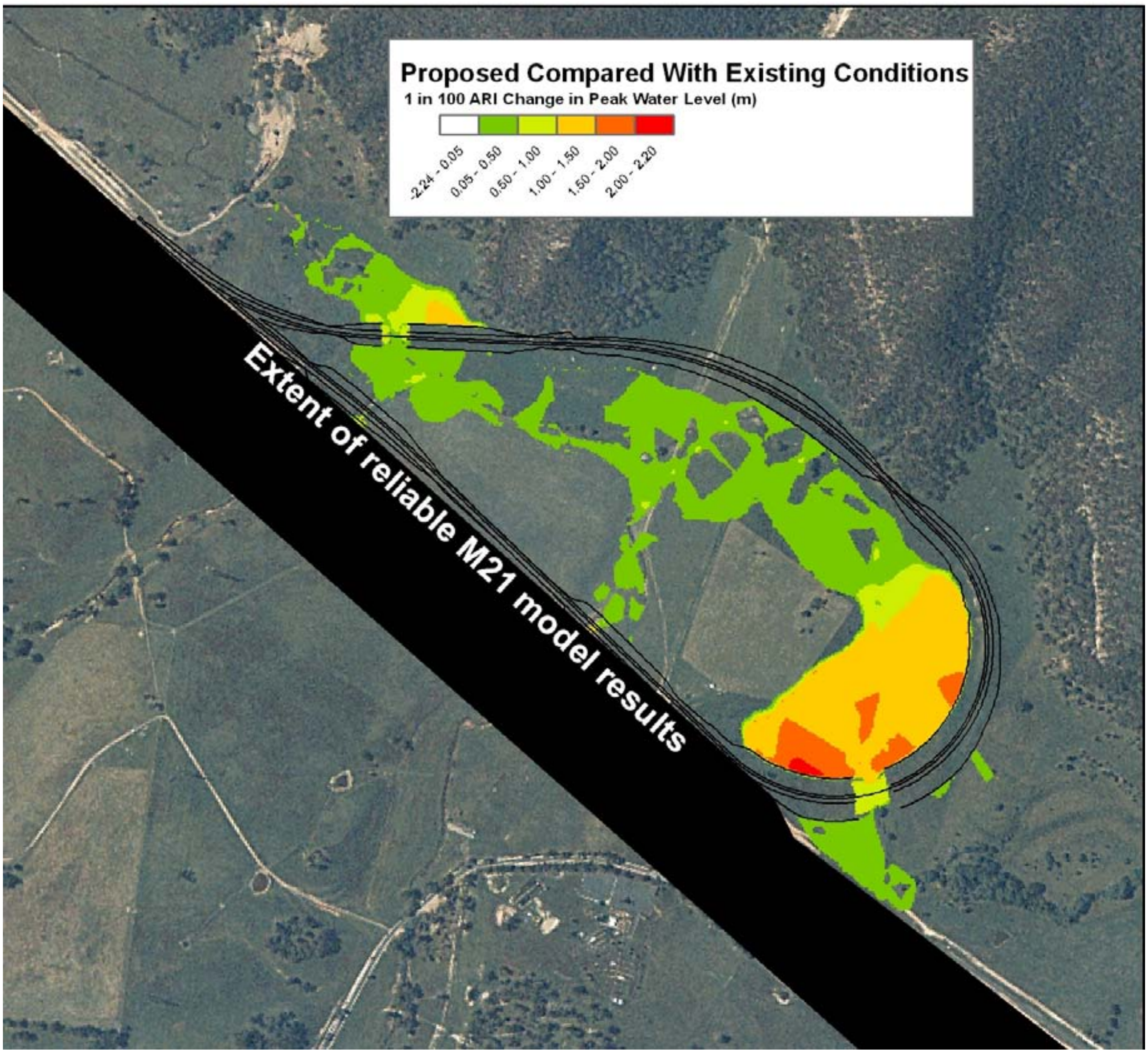
The peak water elevation for the EC model and PC model for the 100 year flood event are shown in **Appendix B**. To illustrate the impacts, the difference between the EC (existing conditions) and PC (proposed conditions) peak elevation was calculated. This is shown in **Figure 5-1b**.

The peak water level, speed and change in water level results for EC and PC under flood events up to the 100 year ARI and the PMPDF conditions are shown in **Appendix B**.

Assessment of Impacts and Mitigation Measures

The model results show an increase in 100 year flood levels at several locations, namely:

- upstream of the proposed embankment where Pipers Flat Creek enters the proposed rail loop. This remains on Delta's property;
- upstream of the existing rail embankment at the Thompsons and Irondale Creek crossings. This increase is between the existing rail embankment and the road, on Delta's property and is due to the provision of the new embankment constricting the movement across the floodplain; and
- upstream of the proposed embankment where Pipers Flat Creek exits from the proposed rail loop.



- **Figure 5-1b Impact of proposed conditions relative to existing conditions 100 year design flood peak water elevation.**

At locations 1) and 2) the increased flood levels are small and will remain on Delta's property. No changes are proposed for the design of the waterway openings at these locations. At location 3) the flood level increases are up to 2.2 m with regard to flood level. Although this appears to be a large increase in flood levels, the embankment height of the proposed rail line is more than 15 metres above the peak water elevation for the 100 year design flood. This would be expected to be manageable but consideration would be given to additional flood capacity through the embankment at the detailed design stage. This may be achieved either through the use of additional flood relief culverts, or through enlargement of the main opening.

Peak flood velocity provides an indication of the likelihood of scour occurring. The largest speed is found through the Thompsons Creek crossing of the proposed embankment where it reaches 4.9 m/s. Through the Irondale Creek crossing of the proposed embankment, the speed reaches 3.7 m/s. Upstream of the rail loop along Pipers Creek, the peak speed reaches 3.3 m/s and as Pipers Creek exits the rail loop, the speed reaches 3.7 m/s. Alternative designs to manage scour potential will be developed at the detailed design stage.

In the PMPDF event the proposed rail line embankment is overtopped at the Thompsons Creek crossing. The embankments at Irondale Creek and at the Pipers Flat Creek crossings are not overtopped in the PMPDF. However, the presence of the loop embankment does increase peak flood levels by 3.0 to 5.0 metres upstream of both of the Pipers Flat Creek crossings. The floodwater speeds through the proposed Irondale and Thompsons Creek rail crossings are approximately 9 and 10 m/s respectively. In Pipers Flat Creek at the outlet of the loop, the peak floodwater speed reaches 7 m/s. The implications of the effects of the PMPDF will be considered further during the detailed design of the project.

The design of the rail loop indicates that flooding can be managed adequately for the 100 year flood, and consequently for flood events up 100 years. Further consideration will be given during detailed design to ensure that the flood levels and peak flow resulting from the design of the bridge/culvert where Pipers Flat Creek leaves the rail loop are satisfactory. If increasing the area results in a more beneficial result in flood levels and flows, this will be considered in the design.

The potential impacts associated with the PMPDF will also be considered further at detailed design stage.

5.1.3 Water Quality

Existing Environment

No surface water quality data are available from the area of the proposed rail loop, although water quality in the Wallerawang area has been monitored at Pipers Flat Creek near the Wallerawang Sewage Treatment Plant (STP) and along the Coxs River. Pipers Flat Creek is a tributary of the Coxs River that inflows upstream of Lisdale and Wallerawang STP discharges to Pipers Flat Creek.

AWT (1992) reported on the water quality of the Coxs River and its tributaries. Poor water quality in the Coxs River at Wallerawang was attributed to acid mine drainage from nearby collieries, discharge of sewage effluent and urban runoff (AWT, 1992). Water quality in Coxs River between Wallerawang and Lisdale had very low pH values, high conductivity, sulphate concentrations and water hardness that maybe a result of acid mine drainage (AWT, 1992). Coal in the area of interest contains high levels of sulphide (pyrite) which readily oxidises in the presence of air and water to form sulphuric acid and sulphate (Kelly, 1988).

Effluent discharge was associated with elevated nutrient levels and algal blooms in Pipers Flat Creek and the Coxs River at Wallerawang (AWT ,1992; Lithgow City Council, 2005). Harris and Hillman (1991) proposed that high nutrient levels arising from discharge from Wallerawang STP may also be responsible for high biomass of macroinvertebrates and benthic algae compared to other reaches in the upper Coxs River. A recent report by Lithgow City Council concurred with the findings of these previous studies of algal blooms, indicating that during 2005/06 algae levels exceeded the criteria for health and recreation on numerous occasions (Geolyse, 2006).

Pipers Flat Creek and Thompsons Creek drain predominantly agricultural (grazing) land, with relatively low levels of residential development. The water quality impacts identified in Pipers Flat Creek in and around Wallerawang would be unlikely to occur on the site of the proposed coal unloader and the water quality draining from the upper catchment of the creek would be reasonably good. Site inspections during the ecological studies (refer to Section 5.2) showed no evidence of algal growth, although turbidity was evident. This would most likely be due to erosion caused by local creek disturbance and cattle grazing. The existing dam on Centennial's land would also provide an effectively water control structure and any water quality problems from within the creek catchment would be treated by settlement at the dam.

There are currently no registered bores at the project site and therefore no site-specific available groundwater quality data. However, there is an established monitoring well network at the Mt Piper Power Station. Logs of groundwater monitoring bores in and around the power station are described in Pacific Power International (2001). Groundwater in these bores is slightly acidic (pH 5-6) and of low salinity (<300mg/L TDS). Groundwater at the project site is likely to be more saline due to lower potential for rainwater infiltration into sandstone compared to the coal measures. The Shoalhaven Group contains fine sulphide minerals, which could generate acid if exposed to the surface.

Assessment of Impacts and Mitigation Measures

To manage the water quality in Pipers Flat Creek during both construction and operation of the rail unloader, appropriate water control devices would be required.

Construction

During the construction phase general measures to control erosion and sedimentation would be implemented prior to construction beginning. These measures would be documented within a Soil and Water Management Plan (SWMP), prepared as part of the Construction Environmental Management Plan. It would be prepared in accordance with the principles and practices in Soils and Construction (Landcom, 2004).

Appropriate soil erosion and sedimentation controls would need to be in place during the period of construction until all ground surfaces are stabilised and re-vegetated. The SWMP would include detail on all these measures, including locations.

Erosion control measures generally function by reducing the duration of soil exposure to erosive forces, either by holding the soil in place, or by shielding it. Carrying out earthworks in stages and the stabilising of haul roads would minimise the extent of land exposed to erosive forces. Proper management of surface runoff may be accomplished by interception, diversion and safe disposal of runoff in conjunction with staged construction activities.

Erosion control techniques are based upon effective use of construction practices, structural erosion controls, vegetative and sealing measures. Erosion control measures would be temporary for the construction phase of the project. The installation of appropriate erosion control measures would greatly reduce the quantity of soil eroded from a construction site. However, some erosion would inevitably occur, and measures are therefore required to ensure that eroded material is trapped and retained. Sediment controls that can be applied to the construction site include the following:

A key component of the SWMP would be the collection of runoff from disturbed areas and filled ground into suitably sized sedimentation basins. A sedimentation basin is a barrier or dam designed to intercept sediment-laden runoff and retain the sediment. Sedimentation basins would be installed prior to development or construction activity on a site, and would remain in place until such activity has been completed and the land stabilised.

Sedimentation traps are temporary sediment control structures formed by excavation and/or an embankment to intercept sediment-laden runoff and retain the sediment. They function by trapping sediment in runoff before it enters stormwater pipes or channels, and are usually located at inlets that receive runoff from only a small catchment. Sedimentation traps have similar functions to sedimentation basins, but differ in that, generally, they are smaller, simpler to construct, relatively inexpensive, and more easily moved as the development proceeds. Sediment filters function by intercepting and filtering small volumes of runoff, which mainly occur as sheet flow. These structures are used below small areas of disturbance, along the boundaries of a development, or at the beginning of vegetative filter or buffer strips. Sediment filters would usually be in the form of straw bale sediment filters, sediment fences, straw bale-geotextile fabric or vegetative filter strips.

Operation

The key operational water quality measure and environmental safeguard would be the capture and treatment of the water discharged from the washdown areas and the dust control areas at the unloader. It is proposed to contain this runoff within a water quality detention basin that would be located adjacent to the unloader site. Following settlement in the basin, the water would be used for irrigation on the site or discharged directly to the creek.

All exposed surface areas would be revegetated as soon as practicable and these areas maintained during the life of the project. The vegetation program would include grassing of the railway embankments to stabilise the batters against erosion. To assist in managing runoff from the grassed embankments, cut drains and toe drains will be installed along the foot of the embankment). Runoff from these areas will be directed through flow retardation areas and into the creek at specified locations.

Although spills of diesel or coal are very unlikely to occur, some risk of the accidental spillage of hazardous materials would always remain. Diesel would be stored according to requirements (discussed in detail in Chapter 3 and in Section 6.2) and clean up provisions provided. Coal spillage would be contained, barriers in place between spillage and the creek system, manual clean up processes put in place.

The alluvial soils overlying the Permian sandstone at the site have high permeability and could facilitate contaminants reaching groundwater. A coal spill does not pose a significant threat to groundwater as long as it is manually removed prior to a rain event. The major threat to groundwater quality at the site is hydrocarbon spillage/leakage from storage tanks, fuel lines and the bowser. Preventative measures for this scenario, including bunding, pipe welding, and double-walled storage tanks are described in Section 6.2 of this report. Refuelling and fuel transfer should not take place during significant rain events so as to minimise the risk of overflow of bunded areas, should a leak/spill occur. An emergency response plan will be prepared for the unlikely event of a hydrocarbon spill/leak that reaches groundwater. Depending on the volume of hydrocarbons released into the groundwater, the remedial actions may include removal of overlying soils and surface water treatment.

Surface water quality monitoring would be undertaken to ensure that the water quality management devices on site are functioning as expected. The surface water quality monitoring program would comprise samples in Pipers Flat Creek upstream and downstream of the likely discharge from the detention basin. Parameters sampled would comprise dissolved oxygen (DO), pH, conductivity (EC) and suspended solids (TDS), with sampling to be undertaken quarterly. The frequency of maintenance of water management devices would be determined from the water quality monitoring.

A groundwater monitoring network will be installed at the project site, consisting of three bores. One bore should be located upgradient of the hydrocarbon storage areas, and two bores should be located downgradient of the hydrocarbon storage locations. These bores should be monitored on at least two separate occasions spaced at least 3 months apart prior to commencement of construction. After construction is complete, annual monitoring is proposed. The purpose of this groundwater monitoring program is to establish the baseline groundwater quality which will include impacts from existing upgradient operations, and to compare groundwater quality during rail loop operation with baseline data. Parameters to be monitored include: water levels, standard field parameters including TDS, DO, pH, and EC, sulphate, nitrate, chloride, sodium, magnesium, potassium, iron, polyaromatic hydrocarbons (PAHs), and all petroleum hydrocarbons that will be stored on-site.

Conclusions

The provisions of water treatment processes in the context of a SWMP would ensure that residual impacts associated with water runoff would be low. Emergency procedures to manage spillage problems would be installed and surface and groundwater would be protected by the establishment of monitoring programs.

5.2 Flora and Fauna

This section outlines the results of a flora and fauna assessment to investigate the impacts of the proposed coal conveyor and rail loop. A detailed working paper on flora and fauna was prepared for the assessment, and the report is provided in **Appendix C**. The information presented in the report is based on a review of available data and site investigations to assess the potential impacts of the proposal in relation to relevant State and Commonwealth environmental and threatened species legislation. The study sought to:

- Identify species, ecological communities and populations of local, regional, state and national conservation significance, and their habitats, which are known or considered likely to occur within lands affected by the proposal;
- Describe the biological environment of the study area in relation to terrestrial and aquatic flora and fauna species;
- Assess the potential impacts of the proposed coal conveyor and rail loop on the ecological values of the study area;
- Detail measures to avoid or mitigate any impacts on threatened species associated with the proposal, and asses the effectiveness of the measures.

5.2.1 Records of Threatened Flora and Fauna

A total of 34 threatened flora species have some habitat attributes within the study area (**Table 5-2**). Of these species at least 6 have marginal habitat qualities and 28 have good habitat qualities. The total list of threatened flora species considered are listed in **Appendix C,** along with the distribution and preferred habitat conditions for each species.

- **Table 5-2 Threatened Flora Species of the Study Locality.**

Threatened Flora	**Status**			**Habitat quality in Study Area**
	Cwlth	NSW	RoTAP	
Acacia baueri subsp. *aspera*	-	V	2RC	Marginal
Acacia clunies-rossiae	-	V	2RC-t	Marginal
Acacia flocktoniae	V	V	2VC-	Marginal
Calotis glandulosa	V	V	3VC-	Good
Darwinia peduncularis	-	V	3RCi	Good
Dillwynia tenuifolia	V	V	2RCa	Marginal
Derwentia blakelyi	-	V	2K	Good
Diuris aequalis	E	V	3VC-	Good
Eucalyptus cannonii	V	V	2VCi	Good
Eucalyptus pulverulenta	V	V	3V	Good
Grevillea evansiana	V	V	2VC	Good
Grevillea obtusifolia	E	E	-	Good
Hibbertia puberula	-	E	-	Marginal
Lepidium hyssopifolium	E	E	3ECi+	Good
Persoonia acerosa	V	V	2VC-	Marginal
Persoonia hindii	-	E	2V	Good
Persoonia hirsuta	E	E	3KCi	Good
Persoonia marginata	V	V	2V	Good
Prostanthera stricta	V	V	2V	Good
Pultenaea glabra	V	V	3VCa	Good
Zieria citriodora	V	E	-	Good
Zieria murphyi	V	V	2VC-	Good

Twenty-nine threatened fauna species have been recorded in the wider locality (10-kilometre radius) of the site and these species are listed below in **Table 5-3**.

Table 5-3 Threatened fauna species of the study locality

Common name	Species	Status		Recorded from Mt Piper perimeter lands*
		C'wlth	*NSW*	
Brush-tailed Rock Wallaby	*Petrogale penicillilata*	E	E	
Regent Honeyeater	*Xanthomyza phrygia*	E	E	
Spotted-tailed Quoll	*Dasyurus maculatus*	V	V	✓
Green and Golden Bell Frog	*Litoria aurea*	V	E	
Bathurst Copper Butterfly	*Paralucia spinifera*	V	E	
Large-eared Pied Bat	*Chalinolobus dwyeri*	V	V	
Blue Mountains Water Skink	*Eulamprus leuraensis*		E	
Giant Dragonfly	*Petalura gigantea*		E	
Stuttering Frog	*Mixophyes balbus*		E	
Booroolong Frog	*Litoria booroolongensis*		E	
Koala	*Phascolarctos cinereus*		V	
Gang-gang Cockatoo	*Callocephalon fimbriatum*		V	✓
Powerful Owl	*Ninox strenua*		V	✓
Eastern Bent-wing Bat	*Miniopterus schreibersii*		V	✓
Glossy Black-Cockatoo	*Calyptorhynchus lathami*		V	✓
Yellow-bellied Glider	*Petaurus australis*		V	
Brown Treecreeper	*Climacteris picumnus*		V	✓
Grey-crowned Babbler	*Pomatostomus temporalis temporalis*		V	
Black-chinned Honeyeater	*Melithreptus gularis gularis*		V	
Hooded Robin	*Melanodryas cucullata*		V	
Eastern False Pipistrelle	*Falsistrellus tasmaniensis*		V	✓
Barking Owl	*Ninox connivens*		V	
Diamond Firetail	*Stagonopleura guttata*		V	
Greater Broad-nosed Bat	*Scoteanax rueppellii*		V	✓
Squirrel Glider	*Petaurus norfolcensis*		V	
Square-tailed Kite	*Lophoictinia isura*		V	
Speckled Warbler	*Pyrrholaemus sagittata*		V	
Pink-tailed Legless Lizard	*Aprasia parapulchella*		V	
Turquoise Parrot	*Neophema pulchella*		V	

Searches for threatened aquatic species records from the regional area have been sourced from databases (CANRI) and previous investigations. Records of Macquarie Perch (*Macquaria australasica*) a species listed under the EPBC Act and TSC Act have been recorded from the Coxs River catchment. Such records have occurred from tributaries in the lower catchment such as Little River which are considered to be in relatively pristine condition. Given the condition of the waterways in the study area (lack of riparian cover, high turbidity and bank erosion) populations of this species are unlikely to occur.

5.2.2 Field Surveys and Survey Results

Detailed flora field surveys were undertaken within the study area from 14-17 August 2006 and following design changes on 13 February 2007. The survey effort is described in detail in **Appendix C**. It was concentrated primarily on the sections of the proposed works site containing remnant native vegetation, particularly the proposed route for the coal loader conveyor. Land proposed for the rail loop is dominated by a modified and heavily grazed pasture and therefore was not surveyed as intensively. The survey effort in this area targeted creek crossings and isolated remnant trees.

Identification of plant communities was undertaken including an assessment of the presence of Endangered Ecological Communities (EECs) as listed under the *Threatened Species Conservation Act 1995* (TSC Act). A search was made for any threatened flora species (listed under the TSC Act and the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) considered potential subject species and any additional rare or significant plant species.

Field surveys for fauna were aimed at assessing the species richness of the site and investigating the fauna habitats present and the potential for local threatened fauna species to occur. The survey incorporated a range of techniques to target species from all fauna groups including mammals, birds, reptiles and amphibians. These are described in **Appendix C**.

Native floral species richness was moderately low within the naturally vegetated portions of the study area. A total of 100 flora species from 35 families was identified. A comprehensive list of the flora species present within the study area at the time of the survey has been included as **Appendix C**. Considering the flora survey was conducted in late winter, a number of annual species may not have been detected.

The study area comprises three vegetation communities.

- Map Unit 1: Ribbon Gum – Apple Box – Snow Gum Woodland;
- Map Unit 2: Brittle Gum – Scribbly Gum – Stringybark Woodland;
- Map Unit 3: Regenerating Vegetation.

The distribution of the vegetation communities, as illustrated in **Figure 5-2**, is related to environmental variables and disturbance history.

Map unit 1 is associated with the gully areas and lower elevated east-facing slopes along the proposed coal conveyor route. The dominant tree species comprise Ribbon Gum *Eucalyptus viminalis,* Apple Box *Eucalyptus bridgesiana* and Snow Gum *Eucalyptus pauciflora*. Other tree species in this community include Candlebark *Eucalyptus rubida* and Broad-leaved Peppermint *Eucalyptus dives*.

A small area of Map unit 1 is on the northern side of the proposed rail loop at Pipers Flat, which is relatively disturbed from agricultural activities comprising smaller trees with a grazed understorey. This community contains a tree canopy projective foliage cover of approximately 20 -35% and is approximately15–18 metres high. There is a sparse shrub layer of Silver Wattle varying between 5-20% foliage cover and 1-5 metres in height. The ground cover contains combinations of grass and herb species with a foliage cover between 50 and 85%, with areas of bare earth and leaf litter present in some sections.

Map unit 2 occurs on the ridges and west facing slopes of the study area adjacent to the proposed coal conveyor route. The dominant tree species comprise Brittle Gum, Scribbly Gum *Eucalyptus rossii*, Red Stringybark and Capertee Stringybark. Other common tree species include Broad-leaved Peppermint, Thin-leaved Stringybark *Eucalyptus eugenioides* and Narrow-leaved Stringybark *Eucalyptus sparsifolia*, which are generally restricted to the northern end of the proposed conveyor route.

This community contains a tree canopy projective foliage cover of approximately 20-35%, approximately10-15 metres high. There is a sparse shrub layer varying between 5-30% foliage cover and 1-3 metres in height. The ground cover contains combinations of grasses and herb species with a foliage cover between 50 and 85% with areas of bare earth and leaf litter present in some sections.

Map unit 3 occupies several locations in the study area including areas of the communications easement along the proposed coal conveyor route adjacent to the service trail, areas surrounding the power station and areas within the power line easement and disused easements.

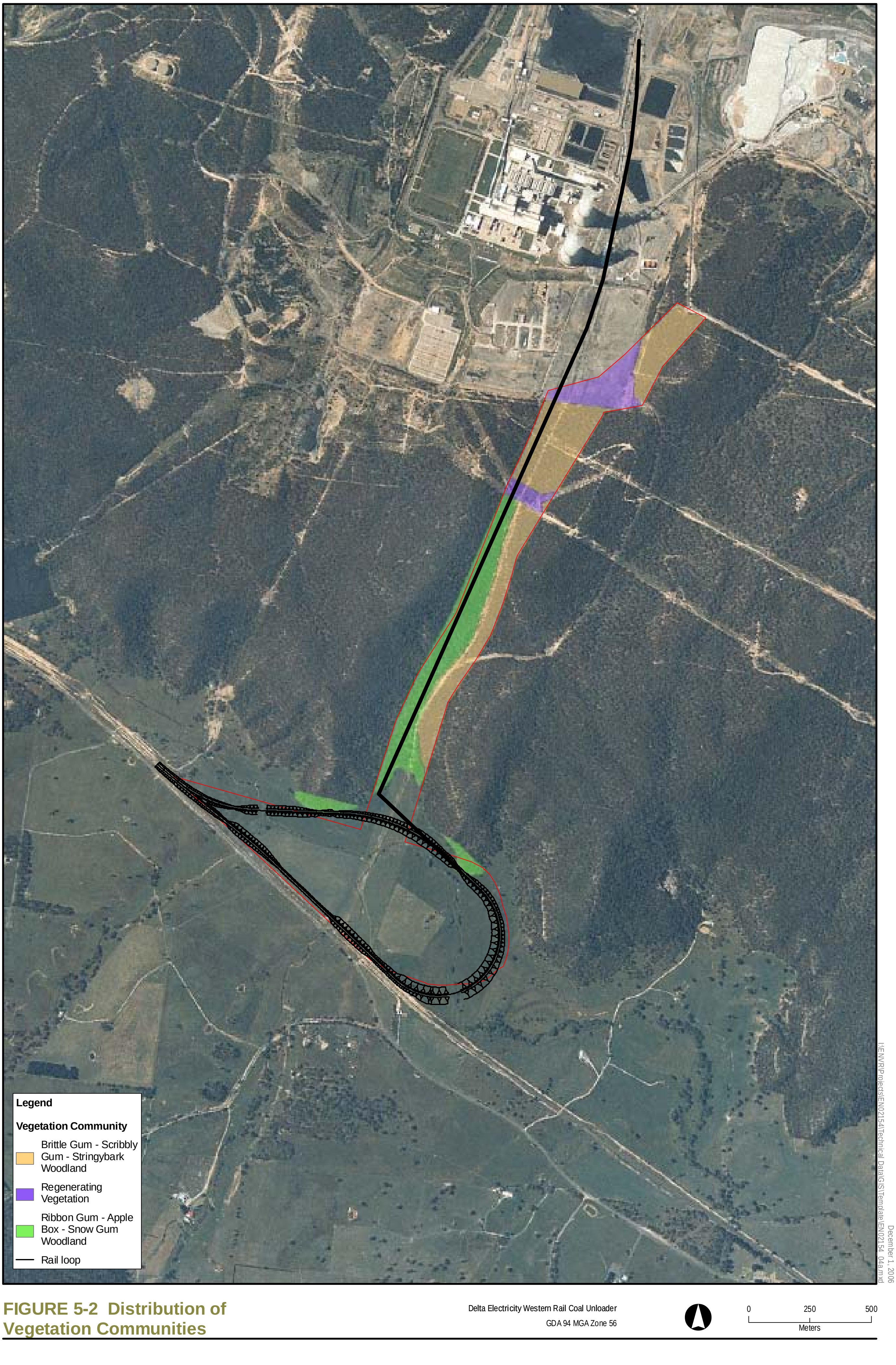


FIGURE 5-2 Distribution of Vegetation Communities

5.2.3 Threatened Flora

One flora species the Capertee Stringybark *Eucalyptus cannonii* was recorded in the study area. The species is scheduled as Vulnerable under both the TSC Act (State listed species) and the EPBC Act (nationally threatened species). The distribution of Capertee Stringybark was found to occur in 3 distinct groups adjacent to the proposed coal loader conveyor route (see **Figure 5-3**). This species was generally confined to areas of Map Unit 2, however in some areas where Map Unit 1 and 2 merge it was also found in Map Unit 1. The population of Capertee Stringybark within the study area is estimated to be approximately 500 individuals. A similar species Red Stringybark *Eucalyptus macrorhyncha* was also relatively common along the proposed coal loader conveyor route. General observations from the surrounding area indicate that Capertee Stringybark is widely dispersed and Ecotone (1996) recorded it as locally common throughout the Mt Piper area.

Other threatened flora species could potentially be present within the study area, but were undetectable during the August survey period due to their cryptic nature when not in flower. Threatened flora that are difficult to detect outside their flowering period that have been identified as potentially occurring in the study area include Doubletail Buttercup *Diuris aequalis, Derwentia blakelyi* and Hairy Geebung *Persoonia hirsuta*. Surveys conducted during February 2007 (late summer) did not detect the presence of any of these species.

5.2.4 Fauna and Fauna Habitats

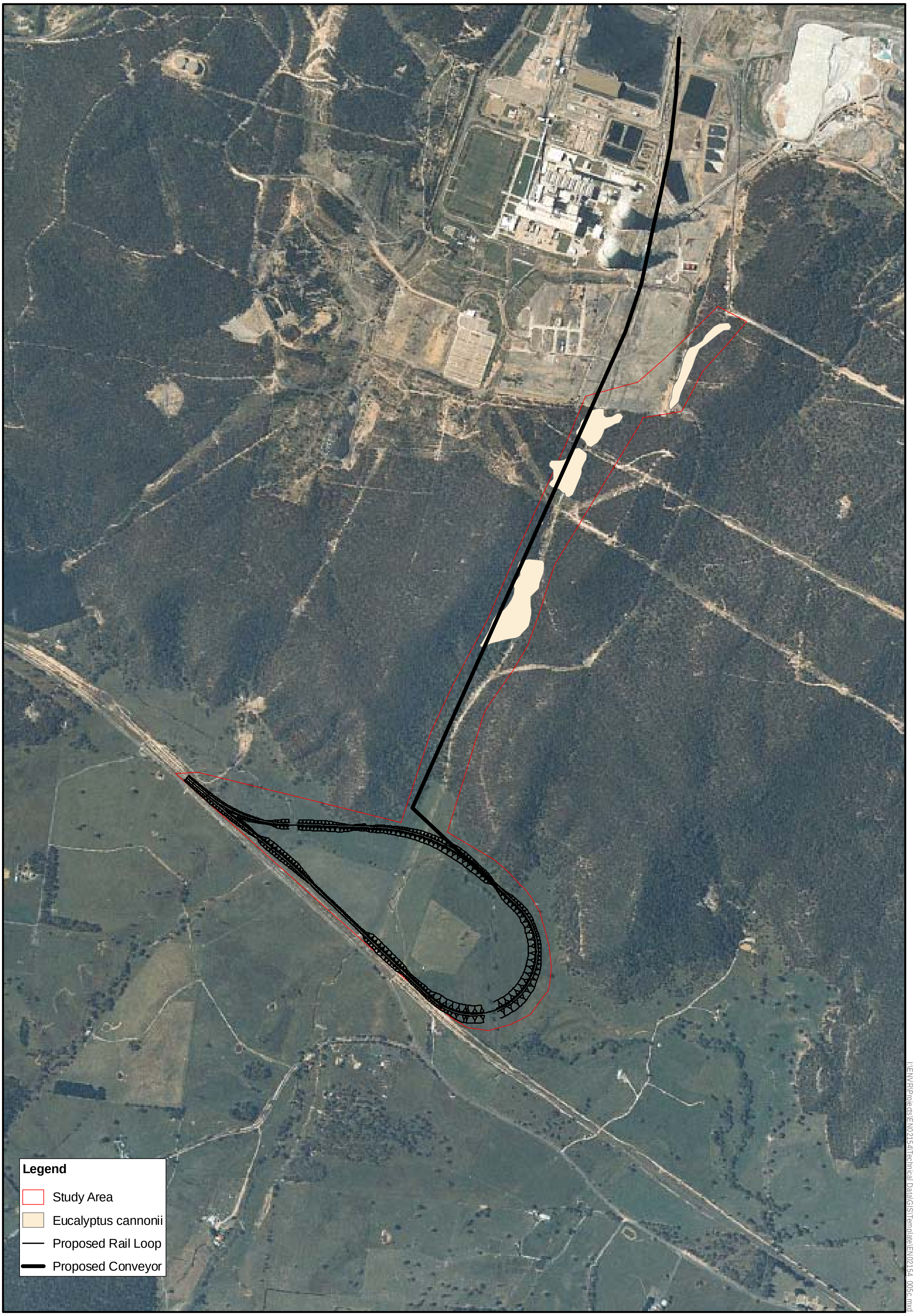
Fauna habitats in the area comprise:

- Modified Grassland habitats (grazing land)

Grassland is a common feature of the Pipers Flat area selected for the rail loop infrastructure. This habitat supports a diversity of fauna adapted to open and modified landscapes such as grazing macropods, some reptiles, raptors, granivorous and insectivorous birds. Occasional isolated mature trees are scattered throughout the grasslands and these provide perching, nesting and refuge habitat for birds as well as potential roosting and breeding hollows for microbats and birds.

- Open forest and woodland habitats

Open forest and woodland covers the majority of the elevated lands surrounding the proposed conveyor route. These habitats generally comprise a sparse to open understorey and low shrub diversity. Some areas have been selectively cleared or grazed and subsequently relatively young regrowth is present. Large mature trees and dead stags are scattered throughout woodland habitats in low densities and are absent from many areas of regrowth. Small to medium sized tree hollows are well represented in the forest / woodland areas which support the best quality habitats for arboreal and hollow-dependent fauna on the property. The presence of sandstone rocky slopes provides sheltering opportunities for native small mammals.



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December 1, 2006

FIGURE 5-3
Distribution of Capertee Stringybark

Delta Electricity Western Rail Coal Unloader

GDA 94 MGA Zone 56

0 250 500
Meters

- Dams and creeks

Dams and creeks provide open water with some reed and sedge habitats that are locally significant for dependent fauna. The dam habitats are characterised by both relatively deep and shallow water areas and occasionally exhibit dense inundated and fringing vegetation comprising reeds and sedges.

A total of 45 fauna species were recorded from the study area during the field survey. This list comprised 29 bird species, 13 mammal species, and two frog species. The list of species and the respective habitat types from which they were recorded are provided in **Appendix C.**

The fauna assemblage encountered is considered generally low and may be the result of the small area surveyed as well as the degree of past disturbance of the habitats, in particular the modified pasture and creek areas. The bird species assemblage was dominated by honeyeaters (Meliphagidae), with several insectivores and granivorous species also present.

Of the 13 mammal species recorded 7 of these were microchiropteran bats. Additional bat species are likely to occur and would require several survey periods to detect. These species roost in tree hollows and are all common and widespread species in both forest and woodland habitats in eastern NSW.

The frog fauna identified during the survey was low, although this may be a reflection of cold conditions during the survey and general lack of freshwater habitats present. Few additional species would be expected.

No reptiles were recorded despite intensive searches and this is related to the cool conditions during the survey and lack of microhabitat features (rocks and logs).

No threatened fauna species (TSC Act or EPBC Act) were identified from the study area as a result of the field surveys. However several species are known from the Mt Piper power station perimeter lands (Ecotone 1996) and may occasionally utilise the site based on the habitat assessment.

5.2.5 Aquatic Ecology

A number of freshwater streams have the potential to be directly or indirectly impacted by the proposal and as such an assessment of the condition of these streams and the potential for each to provide habitat for threatened aquatic species was conducted. The methodology used to assess aquatic habitats within the study area is outlined in **Appendix C**.

The proposed rail loop at Pipers Flat includes crossings of Pipers Flat Creek. The following field assessment results shown in **Table 5-4** were collected at Pipers Flat Creek.

Table 5-4 Aquatic Field Assessment Results

Criteria	Site 1 – Pipers Flat Creek (west of proposed conveyor)	Site 2 – Pipers Flat Creek (east of proposed conveyor creek diversion area)
Flow Regime:	Flowing creek with permanent pools to about 2 metres depth	Slow flowing permanent to semi permanent creek
Stream Substrate:	Gravel and Clay	Gravel
Water Quality (visual assessment):	Clear, absence of algal scum and no/little odour	Relatively turbid
Adjoining Landuse:	Grazed pasture	
Riparian Vegetation:	No remnant riparian vegetation present. Weeping Willows are the dominant tree species along the channel occurring with pasture grasses.	
In-stream Vegetation:	Mainly exotic grasses, however some native species are present including Common Rush *Juncus usitatus*, Tall Sedge *Carex appressa* and Austral Mudwort *Limosella australis.*	Mainly exotic grasses, however some native species are present including Common Rush *Juncus usitatus*.
Nearby Wetlands:	Thompsons Creek Dam occurs up stream of Thompsons Creek to the south of the study area and an un-named dam occurs up stream of Pipers Flat Creek. There are also larger dams downstream including Warragamba Dam.	
Refuge Areas:	There are some deep pools to 2 metres depth which may provide refuge	Little to none
Spawning Areas:	Deep pools, gravel beds, snags, boulders and riffles	Shallow pools, gravel beds
Barriers to Fish Passage:	No Barriers in study area, however dams up stream and downstream of this area provide barriers to movement.	
Disturbances	Unrestricted stock access to creek. Moderate to high bank erosion and subsequent sedimentation of creek. High level exotic vegetation cover.	
Threatened Species Habitat:	Unlikely habitat for local threatened fish species due to the high level of disturbance and lack of adequate habitat attributes.	
Migratory Species:	Small and large dams up stream and downstream of this area limit movements of migratory fish and are therefore unlikely to be present.	
Introduced Fish:	Likely to be present, none apparent during visual surveys	
Waterway Class (Fairfull and Witheridge 2003):	Class 2 – Moderate Fish Habitat	
Riparian corridor classification (c.f. DIPNR 2004)	Category 1 Riparian corridor	

Macquarie Perch (*Macquaria australasica*) are listed as Endangered under the EPBC Act and in NSW they are listed as Vulnerable under the *Fisheries Management Act 1994*. Records of the species are known from the Coxs River (Sydney Water 2005) of which Pipers Flat Creek is a tributary.

The Macquarie Perch is a riverine, schooling species and prefers deep, rocky holes with considerable vegetation cover and areas of shallow running water for spawning (DEH 2006a). Macquarie Perch are especially sensitive to degradation and are essentially restricted to pristine streams preferring clear, cool water with riffles (McDowelll 1996). There are recent records from tributaries with the Warragamba protected area which are examples of relatively pristine waterways with few degrading processes. Although some habitat elements are present within Pipers Flat Creek the highly degraded nature of the creek and the barriers provided by dams up and downstream, makes habitats of the study area unsuitable for this species, and therefore it is unlikely to be present.

Pipers Flat Creek is considered to provide moderate to low value fish habitat. The NSW Fisheries classification scheme for watercourse crossings (Fairfull and Witheridge 2003) has been applied to Pipers Flat Creek within the vicinity of the proposed works.

Discussions with DNR during the course of the assessment identified a preference by the Department to categorise Pipers Flat Creek according to the habitat value criteria outlined in DIPNR (2004). In this regard DNR suggested the creek should be classified as a category 1 environmental corridor. The overall objective of this environmental corridor category is to '*maintain connectivity between one destination to another for the movement of aquatic and terrestrial fauna and flora'* (DIPNR 2004).

At present lands surrounding Pipers Creek, in the vicinity of the rail loop, are completely modified and cleared of vegetation with a long-history of cattle grazing. As any existing habitat connectivity for terrestrial flora and fauna along the creek is absent there is essentially no scope to '*maintain connectivity*' as an outcome of the project. The project would therefore concentrate on the restoration of creek areas in accordance with the guidelines of DIPNR (2004). Riparian vegetation protection or restoration under this category should concentrate on an area of 50 m width along the creek bank (i.e. 40 m from the top of the bank plus 10 m buffer).

5.2.6 Assessment of Impacts

Conveyor Route

The proposed conveyor traverses a generally straight route with a disturbance area of approximately 15 metres wide by 1.7 km in length through areas of remnant vegetation. Assuming vegetation clearance will be required along this entire length approximately 2.5 ha of remnant vegetation will require removal. However, the placement of the conveyor within disturbed /regenerating areas will reduce the amount of clearing required.

The route traverses predominantly disturbed land along an existing easement and service trail with high quality vegetation situated on either side. The easement contains regenerating vegetation from an area formerly cleared for communications infrastructure. The resulting young-aged vegetation is of a lower quality than the surrounding remnant vegetation with reduced habitat value for threatened fauna.

Capertee Stringybark was recorded as a common component of the vegetation surrounding and within the conveyor route. Generally this species occurs in clusters along the proposed conveyor route comprising approximately 500 individuals with all age classes represented. The total number of

Capertee Stringybarks within the perimeter lands of the Mt Piper Power Station is likely to be much larger than the extent within the study area given the presence of comparable habitat throughout. The closely related Red Stringybark also occurs within and surrounding the proposed conveyor route, generally occurring separately from the clusters of Capertee Stringybark. However these two species do intergrade in places and hybrids are often found in these areas. It is anticipated that up to 50 Capertee Stringybark may have to be removed for the proposed conveyor, although this number may be smaller depending upon the exact placement of the conveyor.

No threatened fauna were recorded in the disturbance areas and the habitat contained within the works area is considered of relatively low value due to the lack of critical habitat features (vegetation structure, logs, hollows and rocks) compared to the surrounding slopes. No threatened fauna area expected to occur.

The proposed conveyor and associated maintenance track and infrastructure would create a physical barrier to fauna dependent on ground movements, such as small and medium sized terrestrial mammals, some frog species, particularly ground dwelling species and possibly reptiles. Many species could be expected to traverse the conveyor and track including arboreal mammals and there will be no barrier to mobile species such as birds and bats.

Rail Loop Infrastructure

The site for the proposed rail loop is located on former cleared agricultural land and comprises a grazed pasture and disturbed riparian zones of Pipers Flat Creek. There is also a small area of low quality remnant vegetation on the northern side of the proposed rail loop comprising younger remnant trees with a pasture understorey.

As part of the rail loop construction, low-lying lands will be filled to raise the level of the track above the floodplain. Spoil for the embankments will be trucked from the Lamberts Gully mine or other sites to the rail loop site along the conveyor easement. This proposal will involve construction of a 20 m wide vehicle track adjacent to the conveyor, most of which will follow the existing track in this location which would be widened up to 8 m. A new section of track will traverse through uncleared vegetation at the southern end of the route before entering onto the cleared lands adjacent to Pipers Flat Creek. No Capertee Stringybarks were recorded in this location.

Threatened Species Assessment

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 and Schedules 4, 4A and 5A of the FM Act was undertaken. The impact assessment was undertaken in accordance with the Draft Guidelines for Threatened Species Assessment (DEC 2005).

The assessment of nationally threatened species present within or known to utilise the study area has been undertaken in accordance with the significant impact criteria for endangered and vulnerable species as outlined in the Significant Impact Guidelines relating to matters of national environmental significance (Department of Environment and Heritage 2006) to determine whether the proposal would have a significant impact on any of these species, and hence on a matter of national environmental significance.

The listed Capertee Stringybark *Eucalyptus cannonii* (Schedule 2 TSC Act) was recorded as locally common within remnant vegetation surrounding the proposed coal conveyor. The location of trees surveyed within a 50 metre corridor is shown in **Figure 5-3**. General observations from the surrounding area indicate that Capertee Stringybark is widely dispersed and Ecotone (1996) recorded it as locally common throughout the Mt Piper perimeter lands.

This assessment deals specifically with the significance of impacts from the proposed development on the nationally vulnerable Capertee Stringybark. Appropriate placement of the proposed coal conveyor will minimise the removal of this species in the study area. However, a small number of individuals of this species are expected to be removed by the proposed activity. Of the 500 individuals recorded in the study area, potentially 50 specimens may require removal depending upon the exact alignment of the coal conveyor. This species is well represented within conservation reserves, and has limited potential threats other than land clearing. Hunter and White (1999) consider the listing of this species as Vulnerable under the TSC Act as no longer appropriate due to the variation and size of populations within the current reserve network and non-productive private land.

Records of Macquarie Perch (*Macquaria australasica*) have been recorded from the Cox's River catchment (Sydney Water 2005) of which Thompson's Creek and Piper Flat Creek are included in. These records have occurred from tributaries in the lower catchment such as Little River which are considered to be in relatively pristine condition. Given the condition of the waterways in the study area (i.e. lack of riparian cover, high turbidity and bank erosion) populations of this species are unlikely to occur.

The threatened fauna assessment dealt specifically with the significance of impacts from the proposed development on the nationally vulnerable Grey-headed Flying-fox and Spotted-tailed Quoll and Bathurst Copper Butterfly. The first two species are expected to utilise habitat that may be affected by the proposed activity. The habitat is considered only very marginal for the Bathurst Copper Butterfly and certainly not preferred habitat. All remaining threatened fauna species are considered either not to occur in the study area, or the habitat is only very marginal in extent and quality and there would be no impacts on suitable habitat resulting from the proposed activities.

The assessment of nationally threatened species present within or known to utilise the study area has been undertaken in accordance with the significant impact criteria for endangered and vulnerable

species as outlined in the Significant Impact Guidelines relating to matters of national environmental significance to determine whether the proposal would have a significant impact on any of these species, and hence on a matter of national environmental significance.

5.2.7 Mitigation

Mitigation strategies are described in the sections below.

Natural Vegetation

The proposed location of the coal conveyor and truck access track is surrounded by areas of remnant vegetation. To limit impacts in this area, the proposed disturbance footprint would be clearly defined on-ground, using temporary fencing, to avoid unnecessary vegetation and habitat removal. A pre-clearing survey would be undertaken to identify and flag any significant hollow-bearing habitat trees and Capertee Stringybarks within the works corridor, with the aim of avoiding these features in the final design and construction phases of the project where possible.

Pre-clearance surveys for other threatened flora species potentially occurring in the study area would be undertaken during their flowering times from late spring to summer, including but not limited to Doubletail Buttercup, *Derwentia blakelyi* and Hairy Geebung. To offset potential impacts to Capertee Stringybark, this species would be propagated from seed collected from the study area and plantings established and maintained within existing disturbed areas surrounding the power station or areas disturbed from the proposed construction activities.

Other mitigation measures to be undertaken are:

- Storage of equipment and stockpiling of resources would be restricted to designated areas in cleared and degraded land to minimise the overall impact of the construction and avoid unnecessary vegetation and habitat removal;
- Restoration would be undertaken of riparian areas disturbed from the proposed rail loop at Pipers Flat, to assist in maintaining fauna movements;
- Appropriate weed management strategies would be implemented during construction to ensure they are not spread throughout the study area and particularly into areas of remnant vegetation adjacent to the proposal area;
- Appropriate sediment and erosion controls would be provided;
- Fallen logs encountered within the proposed disturbance footprint would be relocated to areas of retained remnant vegetation; and
- Timber felled for clearing would be retained on the ground in the area as habitat for terrestrial fauna.

Water Quality

The preservation of water quality is an important construction issue particularly for the proposed rail loop which will involves crossings over Pipers Flat Creek. As a result strict sediment and erosion controls would be adopted to prevent impacts on water quality. Appropriate measures to store and manage fuels and oils are to be adopted and spill containment equipment would be carried at all times to prevent and contain accidental spills in the creek.

Creek Crossing Structures

Pipers Flat Creek is considered to provide moderate to low value fish habitat being classified as a Class 2 waterway (as classified by NSW Department of Primary Industries - Fisheries (Fairfull and Witheridge 2003)) indicating a clearly defined drainage channel with semi-permanent pools. As a Class 2 waterway the proposed crossing of Pipers Flat Creek by the rail loop would need to be a large box culvert or bridge with the cross sectional areas of the structure equal to the cross-sectional area of the watercourse in order to facilitate safe fish passage. The crossing structure would be designed so as not to impede fish passage by ensuring that the base of the culvert is positioned below the bed of the creek.

Creek Restoration and Revegetation

The proposal would be designed to be consistent with the objectives of the identified values of this waterway (Pipers Flat Creek classed as Category 1 and Thompsons Creek and Irondale Creek identified as Category 2 status by the Department of Natural Resources) (refer DIPNR 2004), by reinstating riparian vegetation and providing connectivity along the creek for movement by terrestrial and aquatic flora and fauna. The following mitigation measures would be provided:

- Continuous fish passage is to be maintained;
- Restore degraded riparian zones on Irondale Creek, Thompsons Creek and Pipers Flat Creek in proximity to new infrastructure to improve the current level of degradation;
- During construction of creek crossings application of jute matting or similar would be conducted to stabilise soil while construction is being undertaken to prevent sedimentation of creeks. Any woody debris which is required to be removed for the proposal would be relocated to other areas of the creek or placed within the new creek section. Care would be taken not to obstruct potential fish passage.

Revegetation of Pipers Flat Creek and surrounding areas would use native species which occur locally 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 **Table 5-5**. The species listed in **Table 5-5** reflect plants which occur within Ribbon Gum / Apple Box / Snow Gum Grassy Woodland which is likely to have naturally occurred in this area in the past. The shrub cover of this vegetation community type is generally sparse, although Silver Wattle *Acacia dealbata* usually occurs at low densities. Wattle species are fast growing and therefore would be suitable for providing a temporary sight screen surrounding infrastructure relatively quickly until tree species become well established. Sedge/rush species should be planted within creek lines and wetland areas, with Tall Spike Rush *Eleocharis sphacelata* planted within areas of deeper water in creeklines and wetlands. Grass species are suitable for planting on higher ground the surrounding Pipers Flat Creek.

- **Table 5-5 Native flora species suitable for revegetation of Pipers Flat Creek and surrounding areas.**

Species	Within Creeklines	Wetlands	Riparian	Sight screens	Higher ground
Trees					
Ribbon Gum *Eucalyptus viminalis*			X	X	X
Apple Box *Eucalyptus bridgesiana*			X	X	X
Candlebark *Eucalyptus rubida*			X	X	X
Snow Gum *Eucalyptus pauciflora*			X	X	X
Shrubs					
Silver Wattle *Acacia dealbata*			X	X	X
Tea-tree *Leptospermum squarrosum*			X	X	X
Grasses					
Kangaroo Grass *Themeda australis*			X		X
Snowgrass *Poa sieberiana*			X		X
Sedges/Rushes					
Tall Sedge *Carex appressa*	X	X			
Common Rush *Juncus usitatus*	X	X			
Tall Spike-rush *Eleocharis sphacelata*		X			

Fauna Movement

There may be minor impacts on fauna movements as a result of the clearing and construction of the conveyor and new infrastructure. As a result provisions should be made to allow for several fauna crossing points along the conveyor. These would simply need to include a clearance of at least 900mm below the structure at designated locations to allow small and medium sized mammals such as macropods and wombats to pass beneath.

5.2.8 Conclusion

The implementation of the mitigation measures described above would result in a low residual impact on the flora and fauna of the study area.

5.3 Heritage

A heritage study addressing both indigenous and European history was undertaken by Navin Officer Heritage Consultants Pty Ltd. Their full report is attached in **Appendix D**, and the results summarised below.

5.3.1 Existing Environment

Review of Literature and Registers

A range of documentation was used in assessing archaeological and historical knowledge for the Pipers Flat study area and its surrounds. This background research was used to determine if known Aboriginal and historical sites were located within the area under investigation, to facilitate site prediction on the basis of known regional and local site patterns, and to place the area within an archaeological and heritage management context. The review of written and documentary sources included heritage registers, local histories and archaeological reports.

Aboriginal literature sources included the NSW Department of Environment and Conservation (DEC) Aboriginal Heritage Information Management System (AHIMS) and associated files and catalogue of archaeological reports. Sources of historic information included published monographs and parish maps.

The following heritage registers and schedules were searched:

- The National Heritage List (Australian Heritage Council);
- The Commonwealth Heritage List (Australian Heritage Council);
- The Register of the National Estate (Australian Heritage Council);
- The State Heritage Register (NSW Heritage Office);
- The State Heritage Inventory (NSW Heritage Office);
- Heritage Schedule(s) from the Lithgow Local Environmental Plan 1994;
- Register of the National Trust of Australia (NSW).

Field Work

Fieldwork was conducted by two people over a period of two days in August 2006. Areas subject to survey included the proposed location of the rail loop and a 50 m wide corridor of the proposed alignment for the conveyor. Other areas within the loop were also inspected, including the creek lines. The survey also sampled areas outside the immediate impact areas and attempted to identify the location of previously recorded sites within and near the study area.

The archaeological survey aimed to identify material evidence of Aboriginal and historical occupation as revealed by surface artefacts and areas of archaeological potential not associated with surface artefacts. An assessment of landscape disturbance and archaeological sensitivity/potential was made for all subject areas. The field surveys were accompanied by a representative from the Bathurst Local Aboriginal Land Council.

Results of Previous Studies

A number of archaeological surveys have included sections of the Pipers Flat study area. Three Aboriginal sites (Nos. 45-1-0018, 45-1-0075 and 45-1-0076) and an area of archaeological potential (PAD7) have been previously recorded as occurring in the Pipers Flat study area. Sites identified close to the rail and conveyor alignments are shown in **Figure 5-4**.

Register searches conducted for this investigation indicate that no historic sites are listed as occurring in the Pipers Flat study area.

5.3.2 Results

A single isolated find (WCU 1) and seven areas of potential archaeological deposit[1] (WCU PAD1-7) were identified in the course of the field survey of the Pipers Flat study area. The site and the PADs have been given the prefix WCU (Western Coal Unloader) and are described below.

The survey relocated the two previously recorded rockshelters, Site Nos. 45-1-0018 and 45-1-0075, and identified the location of the artefact scatter, Site No. 45-1-0076 although no artefacts were visible at this latter site area. PAD7 was also inspected during the survey but no artefacts were identified. Previously recorded sites are discussed below. Site and PAD locations are shown on **Figure 5-5**.

Previously Recorded Sites

45-1-0018 Rockshelter with artefacts

This site was recorded in 1977 and was potentially within the current study area. The site location was confirmed in the 2006 survey and the site is outside the boundary of the rail loop study area. It is located approximately 160 m east of the eastern section of the rail loop. The site consists of a long shelter at the base of a sandstone escarpment of Mount Piper. The shelter is approximately 20 m long and about 6 m deep, with a maximum height to the dripline of about 4 m.

The floor of the shelter is mostly flat sandstone but the main alcove contains a light coloured sandy deposit. The light colour of the deposit does not show any evidence of hearths.

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[1] A potential archaeological deposit or PAD is defined as any location where the potential for subsurface archaeological material is considered to be moderate or high, relative to the surrounding study area landscape. The potential for subsurface material to be present is assessed using criteria developed from the results of previous surveys and excavations relevant to the region.

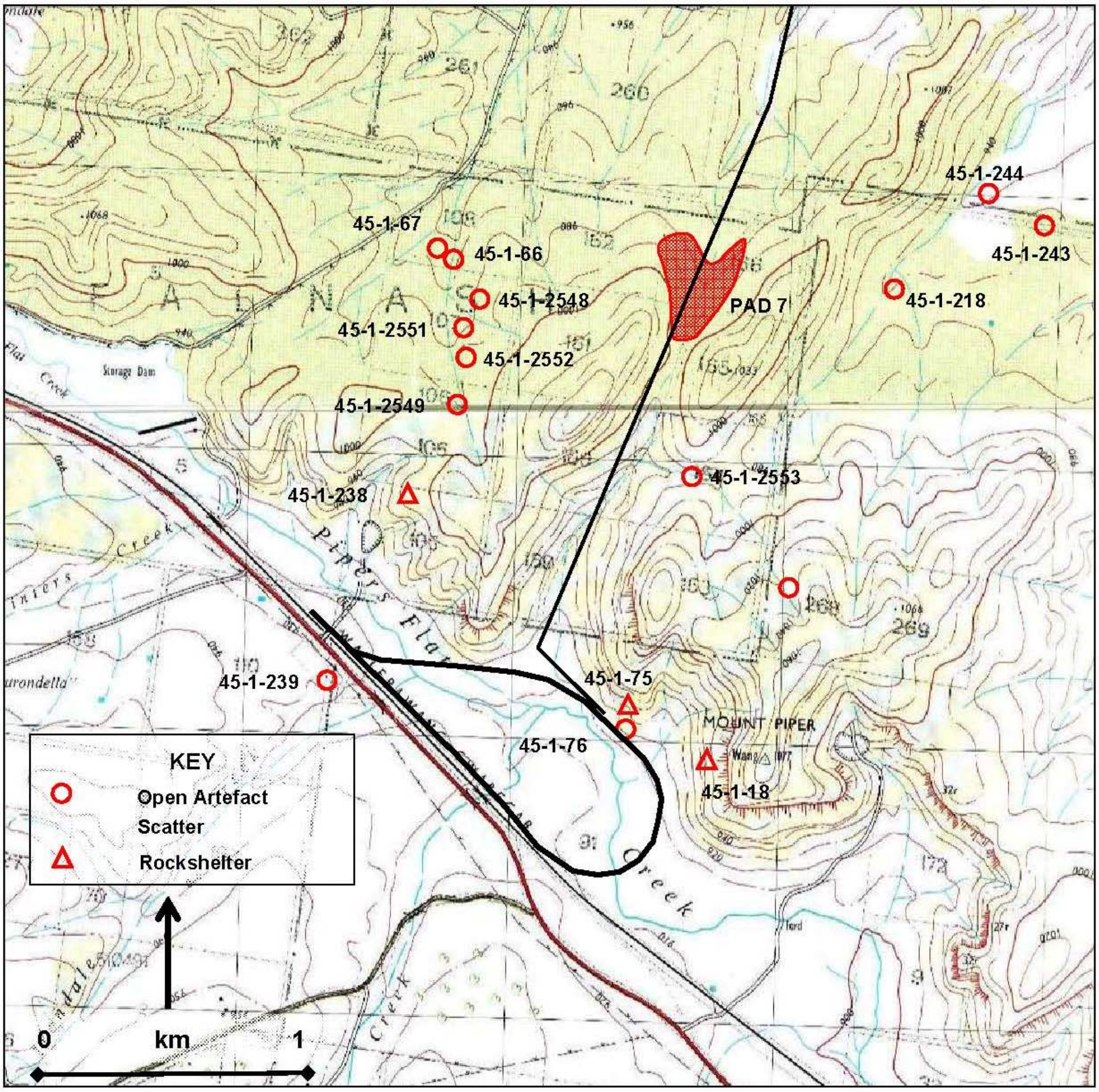


Figure 5.4 Previously recorded Aboriginal sites in proximity to rail loop and conveyor. (Compilation of Cullen Bullen and Lithgow 1:25,000 topographic maps)

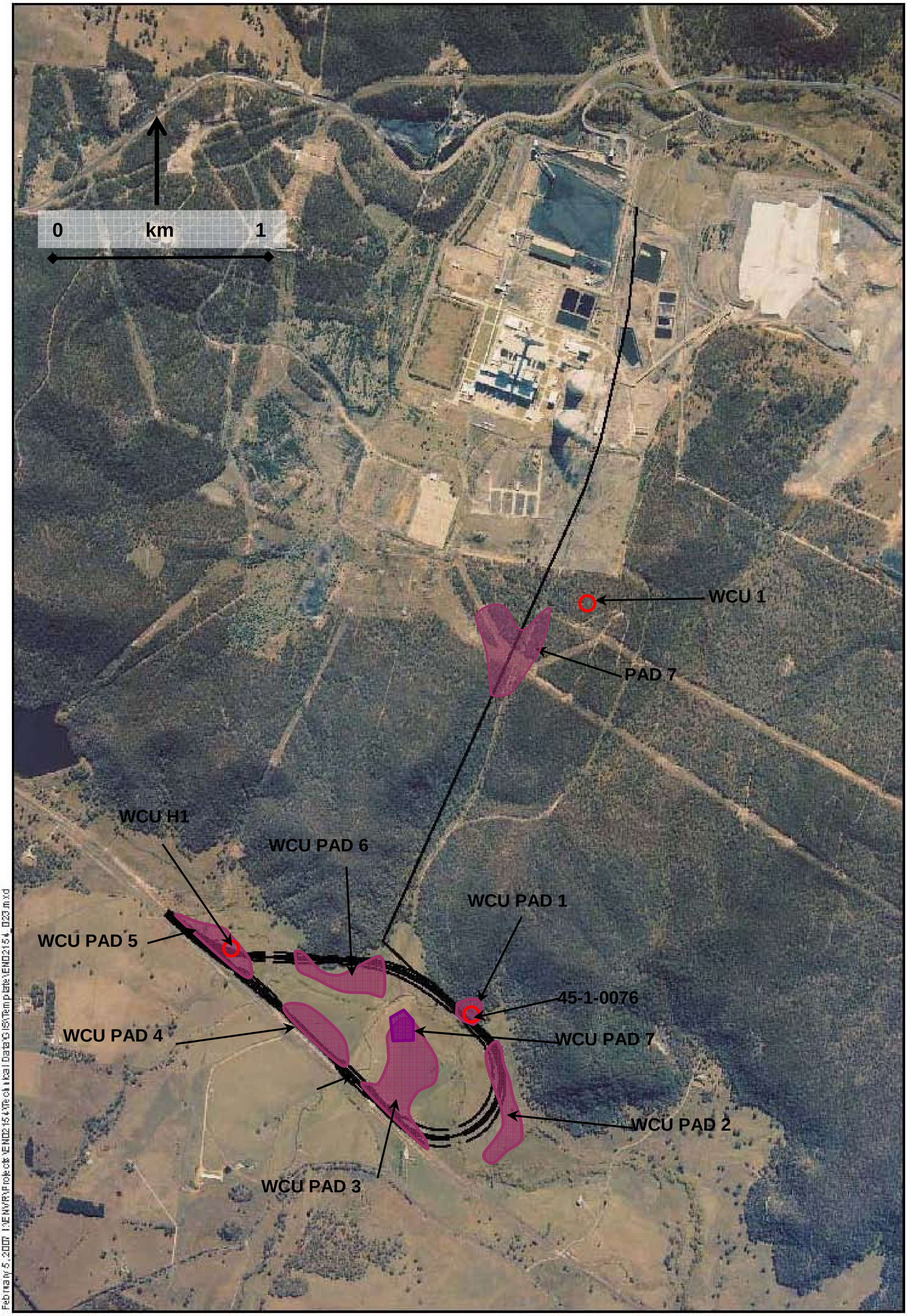


Figure 5-5 Location of sites and PADs recorded

There is a ledge of compacted, sandy clay deposit at the front of the shelter. One particular feature was an exposed bank of deposit which was semi-circular in shape and appeared to have been built up behind either a tree of rock (probably a tree). The tree since fallen or rotted away (no obvious evidence remains) leaving the deposit. Aboriginal artefacts were observed exposed in the deposit, which is about 1.2 m deep. Aboriginal artefacts were observed inside and outside the shelter. No evidence of art or grinding grooves was noted.

45-1-0075 Rockshelter with artefacts

This site was identified in 1982 and was relocated during the current survey. It is located approximately 60 m north of the eastern section of the rail loop The shelter is very small with no headroom (height <1 m) and a rock platform floor with only recent, shallow sandy deposit. It is considered that there is no potential for archaeological deposit to be present within the shelter. Although the area outside the shelter is mostly level and offered good visibility (25%), no artefacts were found. Some natural pieces of quartz were observed in this area. There may be moderate potential for artefacts to occur based on the generally level area and the presence of a scatter of artefacts further down the slope.

45-1-0076 Artefact Scatter

This site was identified by Haglund in 1982 and is approximately 60 m downslope from rockshelter Site No. 45-1-0075. The site was identified on a flat spur crest elevated about 12 m above Pipers Flat Creek. The flat is localised, about 80 x 20 m in area, and has gravelly loam deposit.

Haglund found 12 artefacts on stock tracks but visibility during the present survey was poor (15%) and these artefacts were no longer visible. The alignment of the rail loop crosses this spur and the coal unloading facility is also located on part of this spur. The development is therefore likely to impact upon the site.

PAD 7

PAD7 was identified by Mills in 1998 and is crossed by the proposed conveyor from the rail loop and unloader facility. The eastern side of the PAD was noted by Mills to be disturbed and she indicated that the western side of the PAD was more intact, intimating that this was more likely to contain undisturbed deposits.

An assessment of the PAD 7 area and the ground surrounding the isolated find (WCU 1) during the current survey found that the area was a mostly gentle basal slope, elevated above the head of an ephemeral drainage line. It is considered that the drainage line was not likely to carry water except after a heavy storm and therefore was a poor source of water. Although an artefact was identified in the general area, the soil profile was very shallow, and offered little in the way of stratigraphic profile.

The PAD is assessed as having only low to moderate potential to contain artefacts and the significance of any site found is likely to be low. The PAD does not therefore meet the threshold to require additional investigation.

Sites Recorded in the Current Survey

WCU 1 Isolated Find

This site was found on a flat bench on a gentle side slope of a ridgeline, elevated above the head of a shallow, ephemeral drainage line. It is approximately 200 m east of the proposed conveyor from the rail loop and unloader facility and about the same distance north-east of PAD7. The artefact is a quartz flake which was found embedded in the soil at the base of a fallen tree. The exposure showed a predominantly clayey deposit which is likely to be shallow. Ground surface visibility in the general area was poor (10%) due to thick leaf litter.

WCU PAD 1

This PAD comprises a flat spur crest, approximately 80 x 20 m, elevated about 12 m above Pipers Flat Creek. It is located on a section of the proposed rail loop. The area is considered to have high archaeological potential. Any site found would likely to be of low to moderate significance. The PAD therefore meets the threshold for conducting additional investigation.

WCU PAD 2

This PAD is located on a section of the proposed rail loop. It extends across the gentle to flat basal slopes of Mount Piper, which are elevated on a terrace-like feature about 5-8 m above the creek flats. Overall, the PAD extends for about 450 m around the base of the mountain, parallel to the meander of the creekline. Visibility was generally low at about 10%.

Soil was generally fine brown loam. A small peninsula of sandy deposit was identified on the southeastern end of the terrace feature. This area was only elevated about 2-3 m above the creek flats. Despite wombat burrows offering increased visibility in this area, no artefacts were located in this area.

The sandy area is considered to have high archaeological potential. Any site found is likely to be assessed as low to moderate significance. The PAD therefore meets the threshold for conducting additional investigation.

WCU PAD 3

This PAD is situated on the southern side of Pipers Flat Creek on a section of the proposed rail loop. The PAD comprises a high, flat terrace elevated well above the creek flats with a steep bank dropping down to the creek flats. The PAD extends over an area of approximately 200 x 250 m, north towards the confluence of Thompsons Creek and Pipers Flat Creek. It gradually descends towards this junction until it is only a localised elevated, low spur crest. This area was recorded separately as WCU PAD 7 (see below).

The deposit mostly consists of sandy loam. Some disturbance has occurred through construction of a shed and cattle yards but most of the flat is relatively undisturbed. Visibility was generally poor, at only about 15%.

It was concluded that the flat area was of moderate to high archaeological potential. Any site found is likely to be assessed as low to moderate significance. The PAD therefore meets the threshold for conducting additional investigation.

WCU PAD 4

This PAD comprises a high, relatively flat, elevated terrace situated south of Pipers Flat Creek, between Thompsons Creek and Irondale Creek. It is located on a section of the proposed rail loop. The elevated area extends for approximately 400 m between the creeks and from the existing rail line fence for about 100 m towards Pipers Flat Creek. A steep creek bank forms an obvious boundary to the area of potential. Soil was fine silty loam. Visibility was generally poor at about 15%.

It was concluded that the flat area was of moderate to high archaeological potential. Any site found is likely to be assessed as low to moderate significance. The PAD therefore meets the threshold for conducting additional investigation.

WCU PAD 5

This PAD is situated on an elevated flat terrace between Irondale Creek and Winters Creek, south of Pipers Flat Creek, on a section of the proposed rail loop. The PAD is elevated well above the flood-prone creek flats and extends over an area of about 380 x 80 m. The deposit is silty loam. Visibility was poor at about 10%.

The western end of the terrace feature has been partly disturbed. There is a vehicle track accessing a former borrow pit from the main road, and there are small earth mounds noted that may be the result of rabbit warren ripping. Some of these mounds contain European rubbish such as corrugated iron and fencing wire. There is also what appears to be a drain excavated from a culvert under the existing rail line to Pipers Flat Creek. Part of the PAD area had also been disturbed as a result of the presence of a European historic site, comprising a small farm complex.

The archaeological potential within this disturbed area is reduced by this landscape disruption. The area is nevertheless considered to have moderate to high archaeological potential. Any site found is likely to be assessed as low to moderate significance. The PAD therefore meets the threshold for conducting additional investigation.

WCU PAD 6

This PAD comprises the gentle basal hillslopes on the northern side of Pipers Flat Creek, on a section of the proposed rail loop. The PAD is quite extensive, incorporating a large topographic feature. The most sensitive areas of the basal slopes are, however, the low gradient elevated areas above the creek flats. These areas extend from the steeper break of slope out into the floodplain. These characteristics are not common across the entire basal slope area.

One area of particular potential was noted where the rail loop crosses a small micro-spur with a flat crest which is elevated above the creek flats. The GPS reading provided above is taken from this feature. Deposit in the PAD area is loam. Visibility was generally poor, at only about 10%.

The low gradient to level areas are considered to have moderate to high archaeological potential. Any site found is likely to be assessed as low to moderate significance. The PAD therefore meets the threshold for conducting additional investigation.

WCU PAD 7

This PAD is an extension of WCU PAD 3 on the southern side of Pipers Flat Creek. It is a micro-topographic spur feature situated below the main high terrace of WCU PAD 3. The feature is elevated above the creek flats and contains loam deposit. Visibility of 30% was afforded by a farm track but no artefacts were observed, while visibility off the track was only 10%.

The area is considered to have high archaeological potential. Any site found is likely to be assessed as low to moderate significance. The PAD therefore meets the threshold for conducting additional investigation.

WCU H1 - Former Farm complex

One historic site complex, a former farm site, was identified during the field survey of the Pipers Flat study area. The location of this site, on a section of the proposed rail loop, is shown on **Figure 5-5.** This site consists of eight archaeological features most likely representing a former farm complex comprising a house and outbuildings. The site is on the flat, elevated ground between Irondale and Winters Creeks, immediately north of the railway line.

5.3.3 Significance assessment

Isolated finds are not normally considered significant based on any of the criteria defined above. Site WCU 1 is considered to be of low significance based on the above criteria.

Haglund identified rockshelter site 45-1-0075 and noted that there were quartz artefacts in front of the shelter. No artefacts were identified when the site was re-inspected for the current survey. The shelter is considered too small to have been extensively occupied and as it has a rock floor it does not contain archaeological deposit. There is only limited archaeological research potential outside the shelter. A number of other shelters which contain cultural material have been identified within the local area, so this shelter is not classed as rare or representative. The site is assessed as having low archaeological significance.

The artefact scatter 45-1-0076 was identified by Haglund as containing 12 artefacts and the current survey identified an area of associated PAD (WCU PAD 1). The scatter is the largest that is known within the current study area but is small compared to other recorded sites in the wider region. The site is likely to be limited in terms of its research value, as the artefacts noted by Haglund are typical quartz artefacts of the region. The site is assessed as having low archaeological significance.

The large rockshelter 45-1-0018 lies outside the study area and will not be directly impacted by the proposals. The shelter contains artefacts and potential archaeological deposit, although the deposit is probably shallow. The research potential would be moderate and the shelter site type is not rare for this region. The site is assessed as having moderate archaeological significance in a local context.

The historic site complex WCU H1 contains a number of elements that would be typical of farm complexes in the region and across the State. The features that comprise the complex are in poor condition due to the demolition of all above ground structures and removal of the debris. There is no known association with particular people or groups from the local area. The lack of artefacts at the complex suggests that there is little potential for excavation of archaeological remains. The site does not fulfil any of the Heritage Office criteria and has little relative value. It therefore does not meet the threshold for State or local listing.

5.3.4 Site Impacts

The proposed Pipers Flat rail loop would directly impact upon one Aboriginal site (45-1-0076 – an artefact scatter) and directly impact on six areas of Aboriginal Potential Archaeological Deposit (WCU PAD 1-6).

The rail loop will also directly impact on one potentially historic site (WCU H1).

The proposed conveyor would directly impact upon one area of Aboriginal Potential Archaeological Deposit (PAD 7). It is not considered that PAD 7 meets the threshold required for testing.

The potential impact to the identified Aboriginal sites and areas of archaeological potential cannot be avoided by realignment of the rail line and conveyor. Some form of assessment of the presence and significance of sites within the PADs is therefore required. The potential impact of the development proposals on the archaeological record could then be defined and informed management and mitigation measures could be provided for these areas.

The most effective method for assessing the presence of Aboriginal archaeological sites in the current proposal area is through conduct of a subsurface testing program. This would involve excavation of a series of test pits across the proposed disturbance area of each PAD and sieving the deposit. Any cultural material recovered would then be examined and the significance of the site assessed. Although it is likely that any sites identified would be of low to moderate significance, the need for testing is high as the true archaeological record within the study area, and therefore the impacts from development is unknown.

The historic site (WCU H1) has been assessed as having low significance and does not meet the threshold for listing on the State Heritage Register or Inventory. However, some form of archival recording is considered warranted for the site. The recording should include preparation of a detailed map of the complex and to allow for investigation into the age of the site.

5.3.5 Mitigation and Management

Based on an assessment of the possible impacts of the development proposal on the known and potential archaeological resource, the results of the data review and field survey documented in this report, and an assessment of the significance of the identified sites, the following measures would be followed:

- A program of archaeological subsurface testing in accordance with guidelines agreed with DEC would be conducted for the PADs. Testing should aim to determine the nature and significance of any Aboriginal cultural material present at each location;
- If direct impact to the site 45-1-0076 cannot be avoided then approval would be required to record and remove the site;
- Consultation has been initiated with relevant Aboriginal community groups and representatives and they would be invited to participate in any further archaeological assessments that are conducted in relation to the Pipers Flat project; and
- Historic site WCU H1 would be subject to an archival level recording prior to its removal from the site.

It is standard archaeological procedure to conduct subsurface investigations where it is considered that Aboriginal may sites exist but where the visibility and other environmental factors prevent their detection. Once the testing is completed, the true significance of any site present can be established and the development impacts assessed.

Subsurface investigations are routinely undertaken by archaeological consultants and a variety of techniques have been shown to be reliable in identifying the presence and patterns of Aboriginal sites within the landscape. Subsurface investigations are a suitable method for assessing the presence and significance of Aboriginal sites on the Pipers Flat Rail Loop. This is based on the open and cleared nature of the terrain and the type of sites (artefact scatters) likely to be present.

As with all such investigations, the subsurface testing would be undertaken in consultation with the relevant Aboriginal community. This would ensure that the Aboriginal community have the opportunity to identify the cultural significance of any sites found. Consultation would also ensure Aboriginal community input to any further management measures required for the sites.

If the subsurface investigations find that the PADs contain sites of low significance, then there are unlikely to be any additional mitigative measures required. In this instance, the results of the subsurface investigation would be an adequate record of the archaeological remains from the site.

If the testing shows the presence of more significant finds, then additional recommendations for their management may be required. Recommendations would be made in consultation with the relevant Aboriginal community.

The recommendation for archival recording for the historic site (WCU H1) is considered a suitable measure to ensure some record is preserved of the site. The significance of the site is low and as such further mitigative measures are not considered warranted. The residual impact would be nil as there would be a public record of the site.

5.4 Air Quality

An air quality assessment was undertaken for the project by Sinclair Knight Merz. The report is attached as **Appendix E**. The report details the:

- existing meteorology and air quality of the study area;
- air quality issues and air quality criteria applicable to the proposal;
- assessment of air quality impacts during construction and operation; and
- provision for recommendations and conclusions

The results of the study are summarised below.

5.4.1 Air Pollution Sources and Receivers

The main air pollutants associated with the proposed development would be from:

- Earth works during construction of the rail line, rail coal unloading facility and access road along the conveyor;
- Emissions from locomotives, the unloading of coal from train wagons into the dump hopper and transport of coal to Mt Piper power station via an overland conveyor during operation; and
- Refuelling and sanding of trains at a locomotive Provisioning Area.

Dust emissions from coal stockpiles are not expected as stockpiles will not be used at the site. If the conveyors are out of operation, trains would not deliver coal, and any trains present will leave the site. When working to specification the overland conveyors would transport the coal from the train unloading facility to the receivable bin at Mt Piper power station stockpile.

Figure 5-6 shows the location of the proposed option relative to residences. The proposed site of the coal unloader and the sensitive receivers are marked in blue and red respectively.

During the construction of the rail unloading facility the main environmental impacts would be from dust and diesel fumes generated during earth works. The construction of the facility would require about 600 000 m^3 of new fill material.

Dust impacts may also be expected from the following activities (but not limited to):

- Construction of the coal dump hopper, approximately 15m below rail level, and associated train unloader facility infrastructure;
- Foundation works for the overland conveyor system;
- Installation of conveyor infrastructure;
- Earthworks for new access roads and the rail loop; and
- Construction of the connection to existing rail lines for the new rail loop.

It is expected that it will take 18 months to construct the rail unloading facility, and all major earthworks will be completed within a 6 month period.

During operation the main air emissions would be from locomotives transporting coal to the facility and the processes involved in unloading the coal. The main pollutants associated with locomotives are particulates and oxides of nitrogen (NO_x). The main pollutants from the coal transfer processes would be dust and could be generated from the:

- Dumping of coal from wagons into the dump hopper;
- Discharge of coal from the dump hopper to a belt feeder, which will feed the overland conveyor system;
- Overland conveyor system where coal is transferred from one belt to another; and
- Dumping of coal from conveyors onto stockpiles.

The coal unloading station will be enclosed with an opening at either end for the train to enter and depart. A spray dust suppression system will be strategically positioned at the train wagon and bin opening interface to minimise coal dust. A dust extraction system would be installed to prevent the accumulation of coal dust and a ventilation system for dust control in the facility will be incorporated into the design.

It is considered that during the construction phase the importing and placement of soil material poses the greatest risk to air quality. During operations, it will be the dumping of coal from wagons that will pose the greatest air quality risk. As such, these impacts are assessed quantitatively with the AUSPLUME dispersion model. Other impacts, including locomotive emissions, are assessed qualitatively with a focus on air quality management measures.

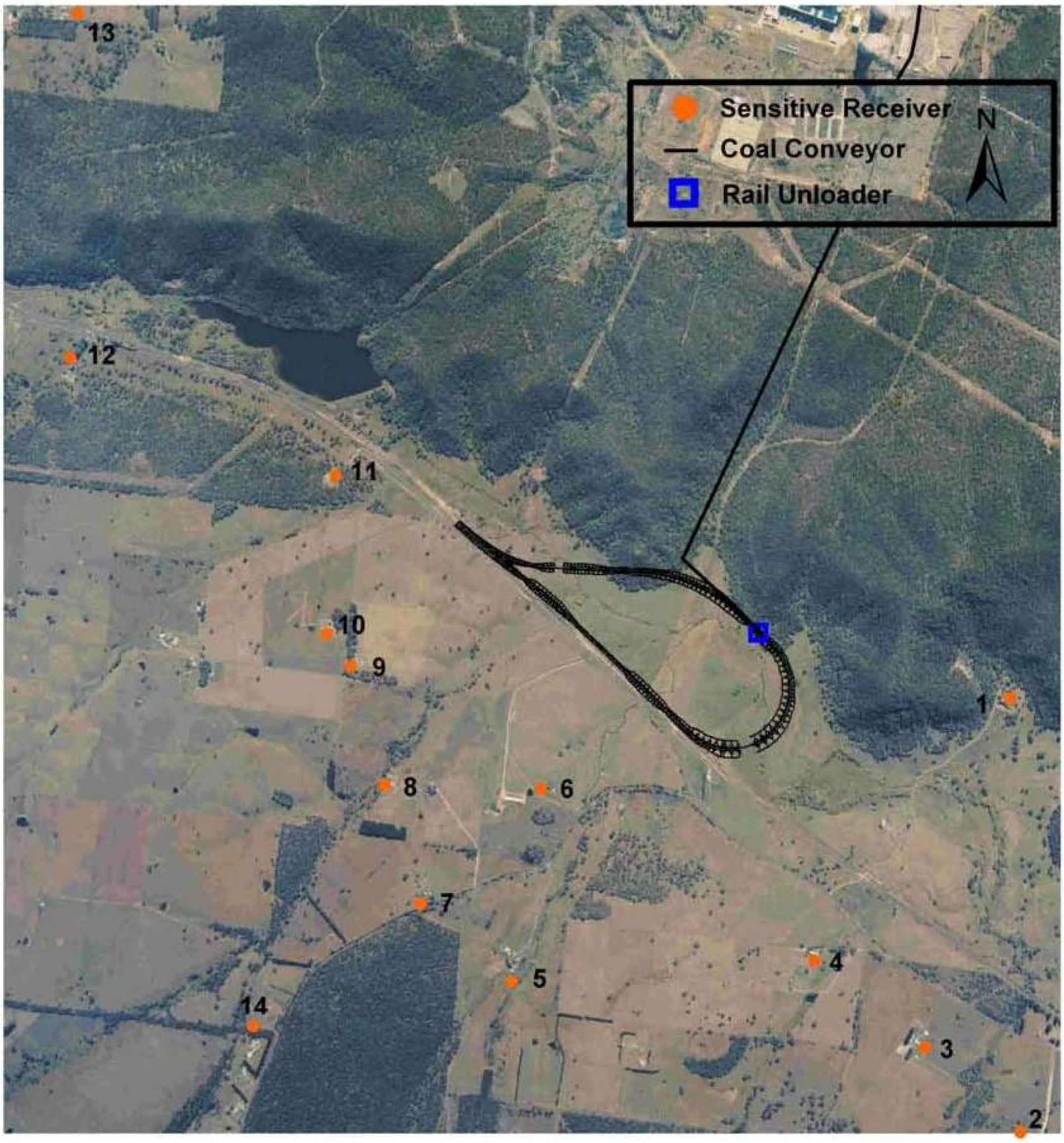


Figure 5-6 Air Quality – Sensitive Receivers

5.4.2 Air Quality Criteria

The criteria for the assessment of air quality impacts are described in this section, with the focus to determine criteria for assessment of particulate impacts.

Particulate Matter and Dust

Airborne particulate matter is any material, except uncombined water, that exists in the solid or liquid state in the atmosphere or gas stream in standard conditions. Airborne particles generally range in size from 0·001 to 500 μm, with the most significant particulate mass in the atmosphere ranging from 0·1 to 10 μm.

Common size related terms are the classes Total Suspended Particulate Matter (TSP), PM_{10} and $PM_{2·5}$. TSP refers to the mass concentration of all suspended particles in the atmosphere. PM_{10} refers to all particles with aerodynamic sizes less than 10 μm, and $PM_{2·5}$ is all particles with aerodynamic sizes less than 2·5 μm.

Dust deposition rates are used to assess the effects of coarse particulate matter on amenity.

The concentration based air quality criteria for PM_{10} in NSW are:

Averaging Period	Concentration (μg/m^3)
24-hour	50
Annual	30

The maximum allowable increases in PM_{10} associated with the project are:

Estimate of Background Level	Project Criterion – Maximum Allowable Increase
Maximum 24-hour PM_{10}, 27 μg/m^3	23 μg/m^3
Annual average 14 μg/m^3	16 μg/m^3

The concentration based air quality criteria for Total Suspended Particles (TSP) in NSW are:

Averaging Period	Concentration (μg/m^3)
Annual	90

The maximum allowable increase in TSP associated with the project is:

Estimate of Background Level	Project Criterion – Maximum Allowable Increase
Annual average 54 μg/m^3	46 μg/m^3

Deposited dust, (from particles of any size), if present at sufficiently high levels, can reduce the amenity of an area. In NSW the EPA set limits on acceptable dust deposition levels. The maximum acceptable increases in dust deposition over the existing dust levels are:

Existing background over existing dust deposition levels (g/m2/month)	Maximum acceptable increase
2	2
3	1
4	0

Dust deposition rates are assessed against these criteria over an annual averaging period at the nearest off-site sensitive receiver. Based on an estimated background dust deposition level of 2 g/m^2/month, the maximum allowable increase associated with the project is 2 g/m^2/month.

5.4.3 Construction Phase Impacts

Emission Estimation

The construction phase of the rail unloading facility is expected to take place over a period of approximately 18 months. Construction of the facility would involve the following activities with the potential to generate dust, diesel and fumes from welding:

- Earthworks associated with dumping landfill for the rail line foundation (600 000 m^3 loose form);
- Construction of the dump hopper to a depth of approximately 15m below the rail line;
- Foundation works for overland conveyor system;
- Installation of conveyor infrastructure between the dump station and stockpiles;
- Earthworks and paving for new access road and rail loop; and
- Construction and modifications to existing rail lines.

Based on an analysis of the above activities, it is considered that fugitive particulate emissions sourced from importing landfill material present the highest risk to air quality. The 600 000 m^3 of landfill material required for site preparation would be sourced off site and transported for dumping via truck. It is estimated that 27 000 truck loads will be required to deliver the material. As well as truck movements, wind erosion and excavation/grading equipment would also contribute significantly to fugitive emissions associated with the delivery of the landfill material.

Particulate emissions were modelled, using AUSPLUME v6.0. The emissions modelled were PM_{10} (as 24 hour maximum and annual averages), TSP and dust deposition. Model scenarios were developed based on a construction phase of 6 months duration and a volume of 600,000m^3 of imported landfill material. Average estimated particulate emissions (based on USEPA and NPI emission factors for bulk earthworks activities) are:

Particle Size	Emission Rate (g/s/m^2)
PM_{10}	0.0002
TSP	0.0007

Predicted Impacts

Particulate emissions were modelled for the identified scenario of importing 600 000m^3 of fill material to Pipers Flat. Modelled outputs for the construction phase of the coal unloader facility were estimated and presented as contour plots.

Figure 5-7a shows predicted monthly dust deposition. Orange symbols indicate receiver locations. Results show the greatest rate of dust deposition at an identified receiver is 1.2 g/m^2/month. The rate of dust deposition is within allowable project criteria of 2 g/m^2/month.

Figure 5-7b shows predicted concentrations for 24hr PM_{10}. For 24 hour PM_{10} there are no expected exceedances of project criteria (23 $\mu g/m^3$) at identified receiver locations. The maximum increase at an identified receiver is 11 $\mu g/m^3$

Plots showing other results are provided in the working paper in **Appendix E**. These results show:

- For annual average PM_{10} the concentrations at identified receivers are within allowable limits. The maximum concentration at an identified receiver is approximately 5 $\mu g/m^3$, compared with project criteria of 16 $\mu g/m^3$;
- TSP concentration increases associated with the fill placement operations show there is no exceedance of project criteria (46 $\mu g/m^3$). The maximum increase in TSP concentration at an identified receiver is 20 $\mu g/m^3$.

5.4.4 Operational Phase Impacts

During operation the main air emissions would be from locomotives transporting coal to the facility and the processes involved in the transfer of coal.

Locomotives

At any point along the line emissions during operation would depend on:

- how many trains use the rail loop;
- the speed that trains pass through the area which directly relates to fuel consumption; and
- the type of train, e.g. single, double or triple locomotives.

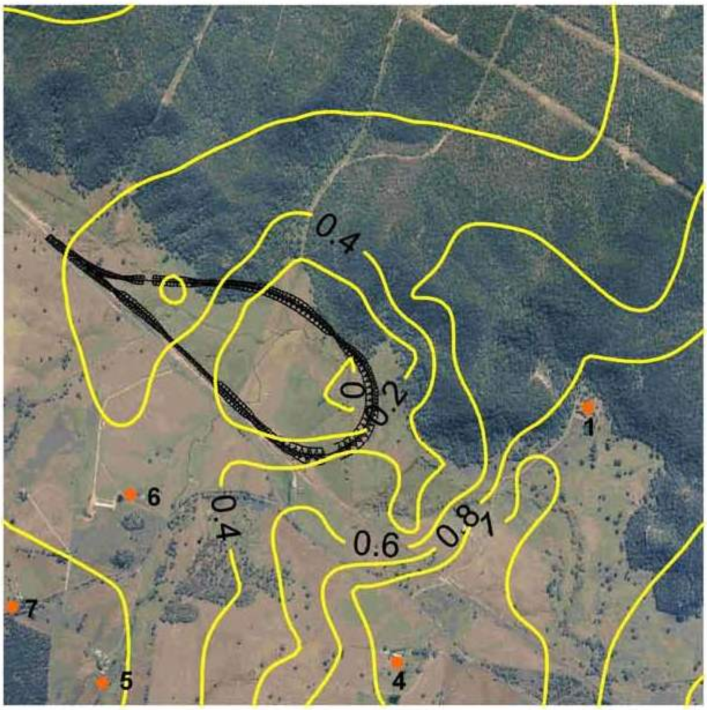


Figure 5-7a Dust Deposition – Fill Placement Operations (g/m^2/month)

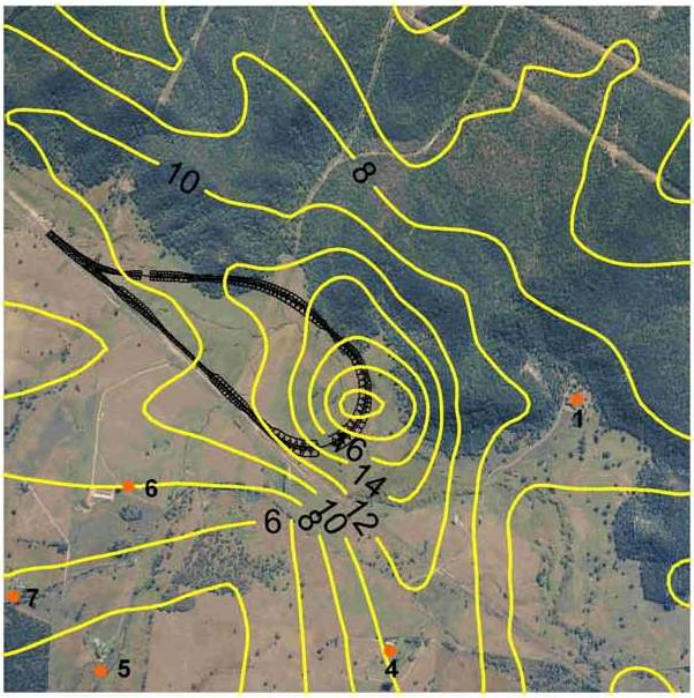


Figure 5-7b 24 hour PM_{10} – Fill Placement Operations (µg/m^3)

It is expected that the train unloading facility would unload a train consisting of (typically) four 81/82 class locomotives with 55 wagons in approximately 1 hour. Initially the facility would be required to unload 2 trains per day and operate for approximately 2 hours per day. When the throughput is increased to 8 million tonnes per annum the facility would unload 7 trains per day and operate for approximately 7 hrs per day.

The following data was used to calculate emissions from current and proposed operations for the locomotives:

- percentage total of trains (e.g. single, double and triple locomotives);
- average train speed;
- current and projected train numbers; and
- emissions factors from the *Emission Estimation Technique Manual for Aggregated Emissions From Railways*, November 1999.

Table 5-6 details the inputs used to calculate air emissions from the trains operating on the rail loop that deliver coal to the unloading facility based on initial proposed operations at 2 million tonnes and projected operations at 8 million tonnes. The emissions calculated are for the initial and future throughput. **Table 5-7** provides annual tonnages of these pollutants from the nearby Mt Piper and Wallerawang Power Stations.

- **Table 5-6 Summary of Emissions Inputs and Power Station Inputs**

Locomotive Emission Inputs	2 Million Tonnes	8 Million Tonnes
No. of locomotives	4	4
Average Fuel Consumption (Total L/Locomotive km)	6#	6#
Unloading Speed (km/hr)	0.9	0.9
Number of trains per day	2	7
Hours of Operation (hr/day)	2	7
Length of Rail Loop (km)	2	2
Days of Operation	365	365

Table 5-7 Estimated Locomotive Emissions vs Power Station Emissions

Emission	2 Million Tonnes (tonnes/annum)	8 Million Tonnes (tonnes/annum)	Power Station Emissions NPI, 2006 (tonnes/annum)
Carbon Monoxide	0.263	0.920	1540
Oxides of Nitrogen	2.071	7.248	40000
PM_{10}	0.049	0.170	1171
Sulfur Dioxide	0.091	0.318	66000
Total VOCs	0.089	0.312	190

Provided by Pacific National in discussions

The emissions calculated for the initial and future throughput are detailed **Appendix E**. Based on these estimates, emissions of NO_x are larger in magnitude than any other pollutant emission. This result is expected for diesel locomotives.

By comparing expected locomotive emissions with power station emissions it can be seen that locomotive emissions are two to three orders of magnitude lower than emissions of the same pollutants from Mt Piper and Wallerawang Power Stations. The impact of existing power stations emissions on local air quality, as measured at Wallerwang and Blackmans Flat, is not significant and does not result in exceedances of air quality criteria in the local area. As such it can be deduced that the very small increase in emissions from locomotive exhausts will have no significant effect on air quality in the receiver area. As such it is not considered necessary to assess the air quality impact of locomotive emissions quantitatively (e.g. dispersion modelling).

It is not considered necessary to assess the air quality impact of locomotive emissions quantitatively (e.g. dispersion modelling). In general it can be stated, however, that the level of rail traffic on the loop is relatively low. Even under the 8 million tonne scenario, there would be no adverse air quality impacts in the local area.

Coal Transfer Processes

The coal unloading facility will be designed to unload a train with up to 55 wagons. It is envisaged that each train will take 1 hour to unload, and at its ultimate capacity, the facility would unload 7 trains per day. The unloader would consist of an automatic bottom dump, triggered by a striking trigger located at the entry and exist of the dumping station. The effective dump rate was assumed to be 3500 tonnes per hour into the dump hopper which would be located below ground level and include forced air ventilation.

A spray dust suppression system will be strategically positioned at the train wagon and bin opening interface to minimise coal dust. It is envisaged that a dust extraction system would be installed to prevent the accumulation of coal dust. A ventilation system for dust control in the facility will be incorporated into the design.

The proposed development is expected to have tight dust emission controls, as outlined above. Any dust emissions during this phase would be likely to occur where dust controls break down. The points selected as the most likely for this to happen are:

- Dumping of coal from train wagons into the dump hopper;
- Discharge of coal from the dump hopper to a belt feeder, which feeds the overland conveyor system;
- Overland conveyor system where coal is transferred from one belt to another; and

- Dumping of coal from conveyors onto stockpiles.

Dumping of coal from the train wagons to the hopper was selected for detailed investigation. **Table 5-8** summarises the emission estimates for the process of dumping coal at the unloader facility, where maximum dust emissions were assumed to occur.

Table 5-8 Total Annual Particulate Emissions

Coal dumped per year (Million tonnes)	TSP (kg/ year)	TSP (g/s)	PM_{10} (kg/year)	PM10 (g/s)
2	2939	0.16	1390	0.07
8	117551	0.65	5560	0.31

Fugitive particulate emissions were modelled for the process of dumping coal from train wagons to the hopper. It is reasonable to assume that if emission levels from 8 million tonne scenarios are below site specific criteria, then 2 million tonne levels would also be acceptable.

Figure 5-8a shows modelled increases in dust deposition. All increases are expected to be below project criteria. The greatest increase in dust deposition at an identified receiver in 0.1 g/m^2/month. This is below the project criteria of 2 g/m^2/month.

Figure 5-8b shows the increases in 24 hour PM_{10} concentrations. The maximum increase at an identified receiver is 9 $\mu g/m^3$. This is below project criteria, which is identified as 23 $\mu g/m^3$.

Plots showing other results are provided in the working paper in **Appendix E**. These results show:

- the increase in annual average PM_{10} concentrations. All concentration increases are below project criteria (16 µg/m3). The maximum increase predicted at an identified receiver in 0.6 µg/m3;
- increases in TSP concentrations. The results show a no exceedance of project criteria at identified receiver locations. The maximum expected increase in TSP concentration at an identified receiver is 1 $\mu g/m^3$.

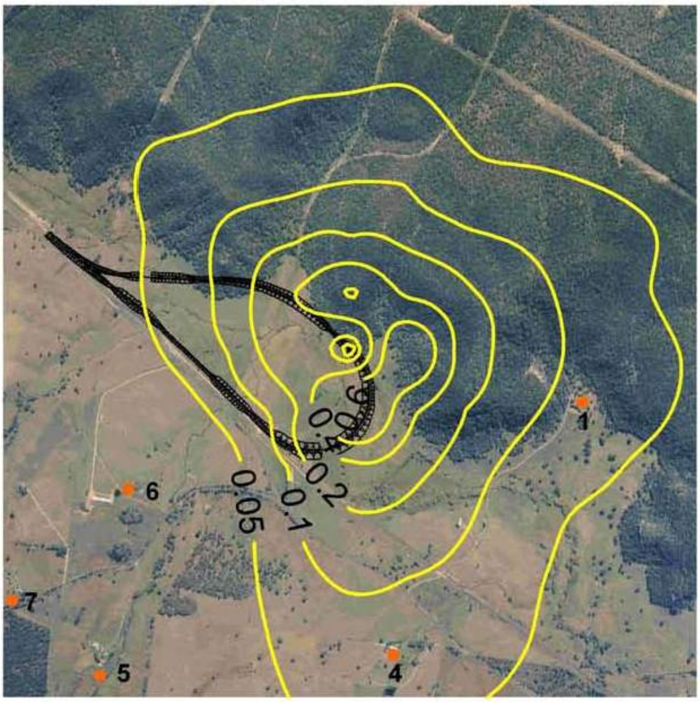


Figure 5-8a Monthly Dust Deposition Contours (g/m^2/month)

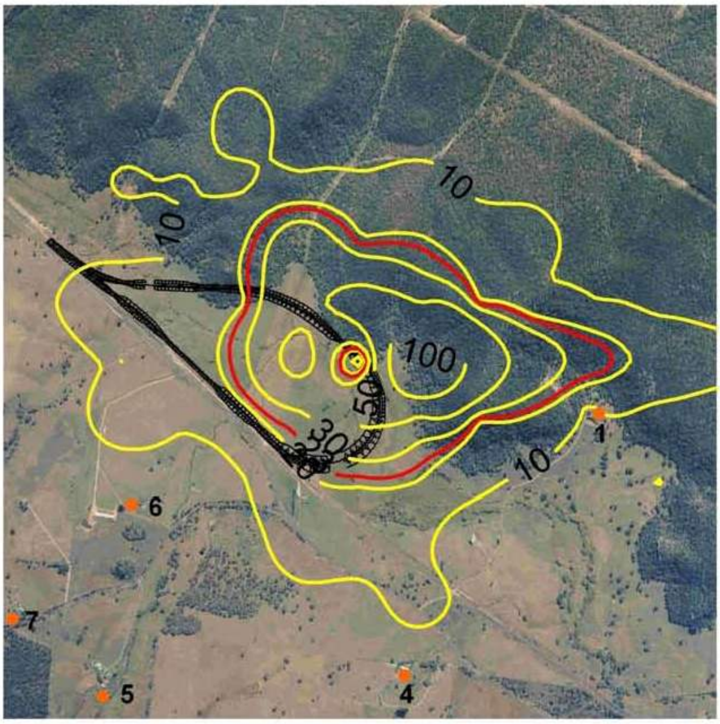


Figure 5-8b 24 Hour PM_{10} Contours (ug/m^3)

5.4.5 Management of Fugitive Particulates – Operation and Construction

During construction and operation of the rail unloading facility, fugitive dust can be generated from dumping of coal from train wagons to the hopper, the movement of coal by conveyors systems, transfer points, wind erosion from spoil stockpiles, trucks and truck dumping and earth moving equipment. Measures for dust control to be implemented during operation and construction of the proposed development are outlined in **Table 5-9**.

Table 5-9 Dust Mitigation Measures

Potential Adverse Effects	Mitigation Methods
Dust	▪ Restrict traffic to defined roads. ▪ Maintain low vehicle speeds on unsealed roads (e.g. 40km/h). ▪ Trucks transporting material to and from the premises on public roads would be covered with tailgates securely fixed to prevent wind blown emissions and spillage. The covering would be maintained until immediately before unloading. ▪ Ensure trucks exit the site via a wheel cleaning facility established at the exit of the site to prevent any dirt/soil being transported onto external public roads. ▪ Ensure no incineration or burning of any material on the premises. Prompt action would be taken to extinguish any fire. ▪ Record and action all air quality complaints ▪ Floor sweep system for rail unloader, driven by a booster fan, which would deliver the dust to the nearest collection system ▪ Ensure onsite conveyor systems remain covered by the overhead gantry to ensure wind blown dust is kept to a minimum. ▪ Ensure the spray dust suppression system strategically positioned at the train wagon and bin opening interface to minimise coal dust is maintained and working to specification. ▪ Maintain the dust extraction and ventilation system to prevent the accumulation of coal dust. ▪ Install and maintain dust deposition gauges at key locations during construction and first year of operations.

The modelling assessment for operational impacts did not include the dust reducing effects of the proposed mitigation measures such as enclosing the rail unloader in a building and the provision of an enclosed conveyor system. The model results therefore show that under worst case conditions, ie no dust suppressions system, impacts are acceptable and air quality criteria would be met.

To ensure the air quality criteria are met, all of the mitigation measures identified in **Table 5-9** would be incorporated into standard operating procedures and would form part of the operating environmental management program for the Western Rail Coal Unloader facility. The implementation of these measures would ensure that the residual impact would be low.

5.4.6 Conclusions

Impacts during construction would comprise mainly of particulate matter, with earth works taking approximately 6 months to complete. Particulate emissions associated with the import of approximately 600,000m^3 of bulk material, would present the greatest risk to air quality in the area. Model results from the air quality assessment show that it is possible to manage impacts within the identified site specific criteria. It is considered that provided the dust mitigation measures, as outlined, are included with the construction works then the adverse air quality impacts which would result from the works would be low.

With respect to operational phase air quality impacts, locomotives transporting the coal to the facility, the coal transfer process and coal stockpiles would be the primary sources of emissions. PM_{10} and TSP emissions were modelled to simulate emissions from the coal transfer process at the unloading site. Model results estimate that there would be no exceedance of project specific air quality criteria at nearby receiver locations and the impacts would be low.

In order to minimise dust impacts at the nearest receptors the construction contractor would be required to ensure that the following dust controls are implemented:

- Spray water with watercarts and/or hand held hoses on a regular basis, particularly during dry or windy conditions;
- Stabilise worked areas as soon as possible after earth works have been completed eg re-vegetation;
- Construct and maintain cloth fencing around work sites;
- Spray trafficable areas with water using a water cart;
- Cover all materials transported on and off site;
- Remove mud from truck wheels;
- Sweep-up mud or soil tracked onto public roads at the site entrance;
- Ensure adequate water supply is maintained on site for dust suppression; and
- Minimising machinery speeds on site.

5.5 Noise

An assessment of noise associated with the construction and operation of the project was made. The results of the noise study are provided in **Appendix F**, and are summarised below.

5.5.1 Existing Environment

Existing noise influences in the area of the proposal are mainly from road traffic along Pipers Flat Road. Occasional rail noise from the existing Mudgee to Wallerawang line is also a feature of the area. This line carries predominantly coal trains as well as daily freight trains.

Background noise levels were measured at locations near the proposed coal unloading facility between July and August 2006. The purpose of long term noise monitoring is to provide noise level data to help characterise the influence of the existing noise sources in the vicinity of the proposed unloader.

The sites selected for logging were based on availability of residents and their proximity to the proposed coal unloader. The locations of the noise loggers are shown in **Figure 5-9**. The location and description of where the loggers were located on the properties is given below.

Location ID	Location	
C	Irondale Road, Pipers Flat	Along the fence line near cattle yards
D	Residence, Pipers Flat	40m from house along the access road

The unattended monitoring noise data results are summarised in **Table 5-10** and the daily graphs are provided in **Appendix F.** The location of noise sensitive receivers is shown in **Figure 5-9**.

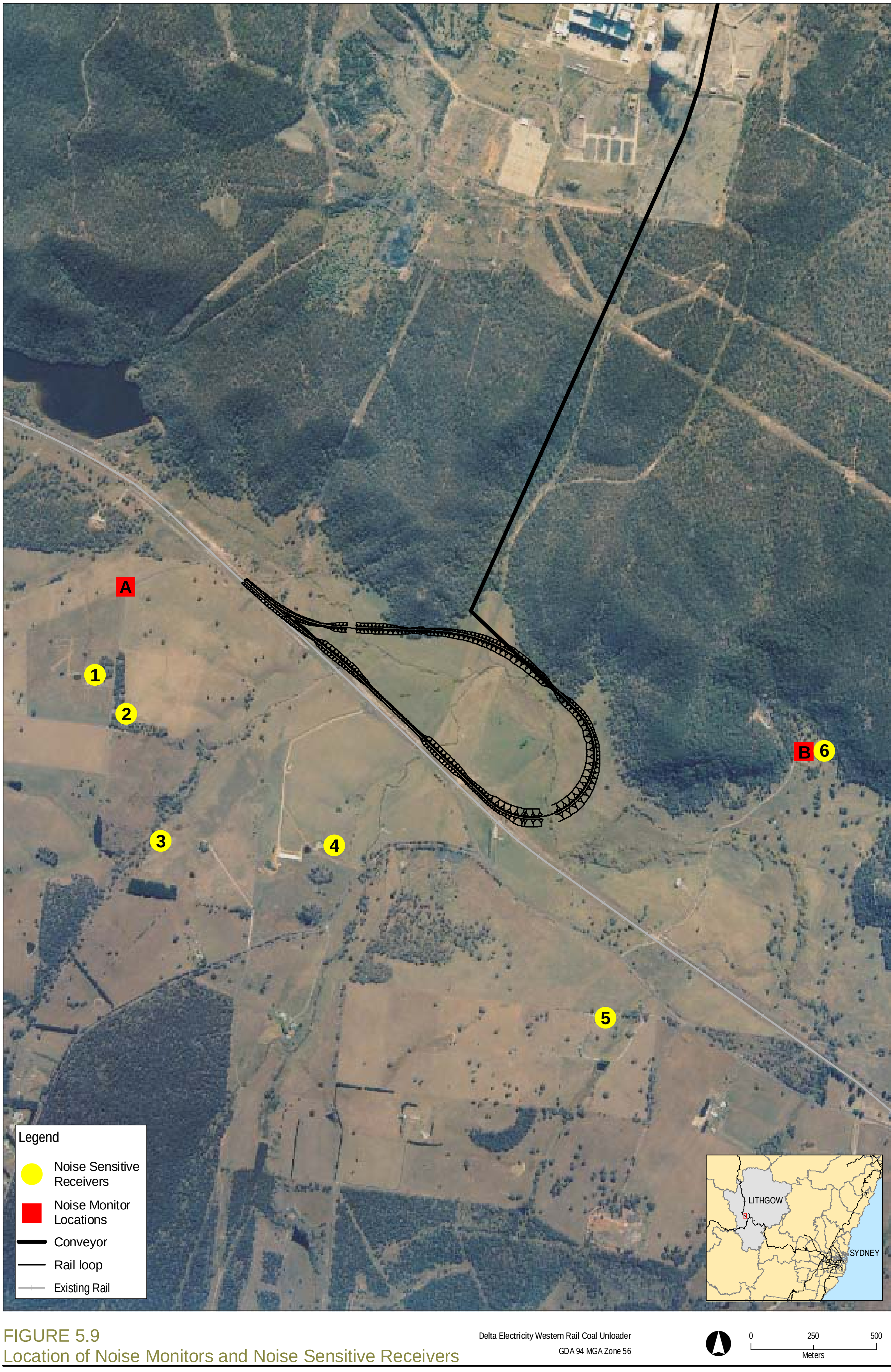
- **Table 5-10 Summary of Unattended Noise Survey**

Location	Date	Rating Background Level (RBL)			L_{Aeq} over the assessment period		
		Day	Evening	Night	Day	Evening	Night
1	25/08/06	27	25	23	43	43	38
2	25/08/06	28	25	22	55	39	37

5.5.2 Assessment Criteria

Project specific noise goals were derived from NSW Government requirements (DEC Industrial Noise Guidelines) and the Environmental Noise Control manual, as well as the existing licence requirements (held by the Australian Rail Track Corporation) for the operation of rail lines.

The project specific noise goals at the potentially most affected residences are shown in **Table 5-11**.



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February 26, 2007

FIGURE 5.9
Location of Noise Monitors and Noise Sensitive Receivers

Delta Electricity Western Rail Coal Unloader

GDA 94 MGA Zone 56

0 250 500
Meters

Table 5-11 Summary of Project Specific Noise Criteria

Description	Day	Evening	Night
DEC INP Operational Criteria All Locations	$L_{Aeq\ 15\ min}$ **35** dB(A)	$L_{Aeq\ 15\ min}$ **35** dB(A)	$L_{Aeq\ 15\ min}$ **35** dB(A)
ARTC Rail Traffic Criteria All Locations	$L_{Aeq\ 15hr}$ **65** dB(A)	N/A	$L_{Aeq\ 9h\ r}$ **60** dB(A)
	80 dB(A) (24hr) L_{Amax} pass-by noise		
DEC Sleep Disturbance Criteria All Location	N/A	N/A	$L_{A1\ 15\ min}$ **37** dB(A)
DEC Construction Criteria All Locations	$L_{A10,\ 15\ min}$ **35** dB(A)		

5.5.3 Operational Noise Impacts Assessment

Results

The potential for noise impacts at nearby residential locations has been assessed by comparing the predicted results from three operational scenarios with the noise goals identified in **Table 5-11**. The assessment scenarios account for stationary as well as moving noise sources associated with the proposed facility for both day and night time periods. An outline of each assessment scenario is given below:

1. Combined operations of the coal unloading dump hopper and coal conveyor. This scenario is assessed against the Industrial Noise Policy criteria.

2. Combined train movements on the existing Mudgee - Wallerawang line and forecast train movements for the Delta Electricity coal unloading loop for 15 hr day and 9 hr night periods. This scenario is assessed against the ARTC Environmental Protection Licence at nominal distances from the existing track.

3. The combined effect of dump hopper, coal conveyor and coal train movements on the balloon loop. This scenario is assessed against the Industrial Noise Policy intrusiveness criteria.

While the noise levels in scenario 1 and 2 are assessed against separate criteria they will, in reality, combine to form a cumulative impact when coal deliveries occur. This case is then assessed in scenario 3 above against a 15 minute criterion to identify intrusive noise impacts. In practice the noise from train movements is likely to mask other operational noise emissions from the coal unloader and the conveyor during a dumping cycle.

Scenario 1 assesses the operational noise levels from the dump hopper and the coal conveyor without the influence of rail noise. While it is not envisaged that the dump hopper and the coal conveyor would be operational without a train present, this assessment predicts the level of contribution of the proposed infrastructure. Conveyor noise emissions have been estimated based on a low noise conveyor having an enclosure constructed of custom orb sides and roof and a concrete base.

For Scenario 2, movements on the existing rail line were considered in combination with train movements on the main line. The existing daily timetable below indicates an average number of train movements on the line over any given 24 hour period. It should be noted that while there is provision for trains in the timetable at given times on the main line, these slots are not always filled and the existing train numbers are approximate.

For the existing day time scenario 4 train movements have been allowed for, 2 up and 2 down. During the night time 2 movements have been allowed for, 1 up and 1 down. Under the proposal these movements would increase by 2 for both day and night as the coal train would return along the same route at the end of the dumping cycle.

In Scenario 3, the combined effect of coal dumping, coal conveyor and train movement on the rail balloon loop for a 15 minute period have been assessed against the Industrial Noise Policy Intrusiveness Criteria.

The SoundPLAN noise model was been used to predict the noise impact from the operations of proposed coal unloading facility. **Table 5-12** presents the results of the noise level predictions at the nearest residences for the operation of the static plant and buildings. The night time operations have also been assessed for adverse meteorological weather conditions. The assessment locations around the proposed rail loop and unloading facility are shown in **Figure 5-9**.

- **Table 5-12 Scenario 1 - predicted noise levels from unloading facility, residential locations**

Location	Predicted Noise Level Operational Levels		Predicted Noise Level Operational Levels + Adverse Weather		Project Specific Criteria $L_{Aeq\ 15\ min}$ dB(A)	
	Day	Night	Day	Night	Day	Night
1	24	24	-	28	35	35
2	24	24	-	29	35	35
3	21	21	-	26	35	35
4	23	21	-	28	35	35
5	23	23	-	28	35	35
6	<20	<20	-	<20	35	35

Predictions for the operational scenario of coal unloader and coal conveyor only, for both day time and night time, indicate that at the nearest residential receivers the noise levels would be below the INP criteria of L_{Aeq} 35 dB(A). Specific mitigation for these items of plant were built into the model. These included acoustic design considerations in the buildings and structures to minimise the transmission of noise from equipment to the local environment.

The noise from train movements has been predicted for nominal distances from the track to indicate the potential for train movements to impact on sensitive receivers. The results of Scenario 2 are shown in **Table 5-13**.

- **Table 5-13 Scenario 2 - predicted noise levels from rail operations**

Nominal Distance From Track	Predicted Noise Level Existing Train movements $L_{Aeq\ 15hr,\ 9hr}$ dB(A)		Predicted Noise Level Increase + Loop Train movements $L_{Aeq\ 15hr,\ 9hr}$ dB(A)		Project Specific Criteria $L_{Aeq\ 15hr,\ 9hr}$ dB(A)	
	Day	Night	Day	Night	Day	Night
75 metres	62	59	+2	+2	65	60
130 metres	55	54	+2	+2	65	60
500 metres	42	41	+2	+2	65	60

Movements for the proposed rail facilities combined with existing rail movements on the Mudgee - Wallerawang rail line were modelled for both day and night time scenarios. Predicted noise emissions from the combined operations indicate that there will be an increase of approximately 2 dB(A) over the existing noise levels. The predicted noise levels indicate that receivers less than 75 metres from the rail corridor may have experience noise levels that are marginally above the ARTC Environmental Protection Licence goals as the result of increased movements on the rail line. An increase of this magnitude is not considered significant and is unlikely to be discernable by most people.

For the combined activities which include dump hopper, conveyor and train noise (Scenario 3), the results of the predicted noise levels when compared to the project criteria are shown in **Table 5-13**.

- **Table 5-13 Scenario 3 Predicted noise levels from combined activities, residential locations**

Location	Predicted Noise Level Operational Levels $L_{Aeq\ 15\ min}$ dB(A)		Predicted Noise Level Operational Levels + Adverse Weather $L_{Aeq\ 15\ min}$ dB(A)		Project Specific Criteria $L_{Aeq\ 15\ min}$ dB(A)	
	Day	Night	Day	Night	Day	Night
1	28	28	-	34	35	35
2	29	29	-	35	35	35
3	29	29	-	35	35	35
4	32	32	-	37	35	35
5	34	34	-	39	35	35
6	<20	<20	-	<20	35	35

Table 5-13 indicates that day time noise emissions would meet the requirements of the INP intrusiveness criterion at all locations. At location 5 the predictions indicate that compliance with these criteria is marginal. The main contribution to the 15 minute L_{Aeq} noise level is the train engine noise from the site.

The night time operational levels under adverse meteorological conditions are likely to exceed the INP guidelines at locations 4 and 5, with compliance being marginal at the other locations.

Discussion

In scenarios 1 and 2 the noise level predictions for individual operations of both the static and moving noise sources are in all cases lower than the INP and ARTC noise requirements for daytime and night time scenarios at the identified receivers. For the rail assessment, noise level increases would occur further up the corridor away from the loading facility. The individual assessment of these impacts is aided by the specific nature of each of the noise sources. That is to say that only train noise is assessed against the train noise criteria and similarly the industrial noise is assessed against the industrial noise criteria.

To a noise sensitive receiver, however, the unloader facility will have a noise output that is the combination of noise emissions even though they may be able to be distinguished as being predominantly from one source. The combined noise experienced from site has therefore been assessed in scenario 3 where the 15 minute INP intrusiveness noise criteria is applied to both daytime and night time noise levels. In this assessment there is no distinction between the types of noise sources and all emissions from the site are treated as industrial noise.

The sensitive receivers near to the proposed coal unloader currently experience noise levels in the low 20 dB (A) range at night. While the assessment shows that noise emissions would comply with environmental requirements of the INP, large noise increases above existing levels may still be the cause of ongoing concern with nearby residents.

The impact of the predicted noise levels is likely to be more significant during the night time period than through the daytime even though the criteria in scenario 3 are the same for both periods. It should however, be noted that the coal unloading facility is only to be operational during the dumping cycle for a period of between 1-$1^{1}/_{2}$ hours.

Control of potential noise emissions from the site would be developed through careful design, thus providing lower intrusive noise emissions than those identified under the INP.

5.5.4 Assessment of Construction Noise

During construction activities, the resulting noise levels at a sensitive receiver will vary according to distance from the works, the type of equipment in operation and any available topographical shielding.

General site works will involve daytime construction activities as well as transport to site of construction materials. Night construction works are not envisaged for the project.

To assess the potential for noise impacts due to normal construction activities during daytime hours, the noise emissions from general works at the site were modelled using the SoundPLAN noise prediction software with the CONCAWE assessment method.

The noise predictions are shown in **Table 5-14**. These were considered representative of anticipated noise levels based on a projected "typical" construction scenario. This typical scenario consisted of 2 haul trucks, 2 compactors, 2 dozers and 2 watercarts, with all equipment operating simultaneously.

Table 5-14 Predicted $L_{A10,\ 15\ minute}$ Noise Levels from Construction Activities at Key Receivers

Location	Predicted Construction Noise Level $L_{A10\ 15\ min}$ dB(A)	Project Specific Criteria $L_{A10\ 15\ min}$ dB(A)
	Day	**Day**
1	52	35
2	52	35
3	51	35
4	52	35
5	50	35
6	30	35

The noise from general works has been assessed and at all receivers except Location 6 the estimated construction noise levels would exceed DEC construction noise goals. Specific noisy activities such as impulsive or explosive noise emissions or night time works would require a more detailed assessment if these works were identified as being required.

5.5.5 Mitigation and Management of Noise Impacts

Operational Noise for Unloader

General operational noise emissions would be required to be controlled by implementing appropriate enclosure design for equipment within the dump hopper building. The dump hopper building itself would also require acoustic design input to ensure noise emissions are minimised.

Take up rollers for the conveyors and coal transfer towers would be designed with acoustic buildings and enclosures for drive motors so as to reduce the transmission of noise from equipment and operations to external environment. Gearbox whine is also a readily identifiable source of noise from some equipment and therefore large reductions of electric motor speeds through gearboxes are not conducive to low noise emission environments. It is proposed that applications and motor speeds would be matched as closely as possible through the correct pole rating of a motor. Any further speed control would then be achieved through the use of gearbox reductions.

On this basis the residual impacts associated with operational noise would be low.

Operational Train Noise

Most of the operational noise is generated by the locomotives during the dumping cycle and therefore reduction of train engine noise is a key issue for the project. Generally barriers or natural topographic cuttings are used to reduce noise from the train exhaust. These barriers would, however, need to be of a significant height, given the height of the source. In addition, noise barriers for this project are not likely to provide sufficient benefit to the nearby sensitive receivers due to the local topography. Many of the potentially affected residences are located on properties that look down onto the site and this would reduce the effectiveness of a noise barrier.

To reduce the likelihood of rail/wheel noise, the inclusion of wooden sleepers, track ballast, rail head profiling and cambering of the track would be included in the design considerations. Rail/wheel noise is also caused by track joints or rail corrugations. The track is to be constructed using welded joints and maintained to avoid rail corrugations which would reduce or eliminate the potential noise emissions from this mechanism. Low speeds for trains leaving the rail loop would minimise the noise impacts from the turn out onto the main line.

Even with these mitigation measures, estimates of the potential for wheel squeal issues indicate that there remains the possibility for this type of impact to occur, despite the optimisation for the design of the rail loop. The provision for trackside lubricators would therefore be made in the project design. While these lubricators units are not initially expected to be needed, rapid implementation would be possible if they prove to be necessary.

Bunching and stretching of wagons during starting and stopping of the train may also result in noise. The preliminary loop design provides a flat grade through the dumping station and loop, with an increase in grade towards the end of the loop to promote a positive traction force in the train during dumping and departure. There remains the possibility of bunching and stretching to occur prior to the dump station as the rail line has a negative grade coming from the existing rail line. Bunching and spreading are usually related to stop/start events. To reduce the risk of this, the train would not normally be permitted to stop during unloading, unless safety concerns prevent it. The provision of a positive grade throughout will be investigated in the detailed design.

The development of mitigation measures will need to be undertaken in detailed design stage and in consultation with the community. The incorporation of these measures is standard design practice in new rail lines where noise is a community issue, and has generally proved to be effective. Similarly, lubricators have been used in various locations to eliminate wheel squeal when it has not been possible to design it out of the system.

The provision of mitigation measures such as those identified above would ensure the residual impacts from train noise would be low. An operational noise monitoring program will be developed to confirm the success of the measures identified.

Construction Noise

Noise attenuation by noise walls and other forms of physical barriers are not likely to be effective in reducing construction noise. Noise mitigation measures will be undertaken through the implementation of appropriate management strategies during construction. A Construction Noise Management Plan (CNMP) addressing potential noise impacts and mitigation measures would be included in the project Construction Environmental Management Plan (CEMP). Typical measures are shown in **Table 5-15**.

Appropriate planning of the construction activities, with provision for noise control, should ensure that the impacts associated with construction noise would be low.

- **Table 5-15 Construction noise and vibration mitigation and management**

Timing	Action Required
Pre construction	Acoustic enclosures should be constructed around fixed plant during the site establishment works;
Pre and during construction	Other General Planning considerations — Maximise the offset distance between noisy plant items and nearby noise sensitive receivers, where possible, using the effects from the following to reduce noise; — Purpose built barriers; — Materials stockpiles; and — Site sheds and material and/or equipment handling areas;
During construction	Orient equipment with directional noise characteristics away from noise sensitive areas;
During construction	Carry out loading and unloading as far away from noise sensitive areas as possible;
During construction	Avoid the coincidence of noisy plant working at the same time close together and adjacent to sensitive receivers;
Pre and during construction	Reduce impact of construction traffic noise by considering: — site road maintenance; — traffic management including limitations on vehicle speeds both on and off site;
Pre construction	Ensure that traffic flow through the site is one direction to prevent delays and to avoid the use of reversing alarms as much as possible.
Pre construction	Use 'smart', reversing alarms (levels vary with changing background noise levels) on plant and equipment such as bulldozers, cranes, graders, excavators, trucks, etc where practicable

Timing	Action Required
Pre and during construction	Consult with the local community as an important part of the noise management of the site.
Pre construction	Mitigate noise through the appropriate selection of plant. The unit with the lowest noise rating which meets the requirement of the job should be used;
Pre and during construction	Appropriate selection of construction processes / methodologies, which minimise the generation of construction noise;
Pre and during construction	Fit particularly noisy equipment with noise suppression measures, where practicable;
During construction	Employ respite periods for particularly noisy activities where possible;
Pre and during construction	Train staff to ensure awareness of noise targets and potential community noise issues with the project;
Pre and during construction	Where possible metal surfaces should be lined with rubber impact protection where there is potential for contact;
Pre and during construction	Use quieter hydraulic hammers or the lowest possible energy level to complete any given task;
Pre and during construction	Conduct regular and effective maintenance of both stationary and mobile plant and equipment;
Pre and during construction	No equipment associated with the work should be left standing with its engine running for extended periods;
Pre and during construction	Ensure that vehicles required within compounds do not “queue” outside the worksite close to residential areas. This particularly applies in the morning where sleep disturbance issues may arise;
Pre and during construction	Entry and departure of heavy vehicles to and from the site are restricted to the standard daytime construction times;
Pre and during construction	All construction activities to be restricted to daytime operational hours;
Pre and during construction	Rock breaking, rock hammering, sheet piling and any other activities which result in impulsive or tonal noise generation are only to be conducted during normal operational hours;

Until a detailed construction plan is developed it is not possible to quantify the effectiveness of the construction noise mitigation measures. Those recommended in **Table 5-15** are generally regarded as appropriate means by which the effects of construction noise can be managed and would result in the residual construction noise impacts being low. Of particular note is on-going consultation with the community so they are made aware of the possibility of noisy activities before they occur and the strict enforcement of construction hours as specified in the approval.

5.6 Visual Amenity

5.6.1 Introduction

This section provides an assessment of the potential visual impacts of the proposed rail coal unloader, railway loop and coal conveyor. It describes the methodology used to consider the existing and the proposed visual environment and the potential visual impacts to provide an assessment of the significance of impacts to sensitive receptors in the area.

5.6.2 Methodology

The visual assessment included an analysis of existing maps, photographs, survey and contour data, followed by a viewshed analysis using a Geographic Information System (GIS). The GIS output included a map of the potential locations, based on the existing topography, from which the proposed facility could be viewed. This did not take into consideration the screening effect of existing vegetation, as such it produced a worst case scenario for visual intrusion. Survey data collected for the site and engineering drawings of the proposed works were also input into the GIS to produce a three dimensional model of the facilities to assist with visualisation of the facilities and impact determination.

The purpose of the visual assessment was to establish the visual impact of the proposed coal unloader, railway loop and coal conveyor by considering the visual modification and visual sensitivity of the surrounding areas.

Visual modification

The degree of visual modification resulting from the proposed development is the level of visual contrast between the new facility and the existing visual setting in which it is to be located. The different levels of visual modification are described in **Table 5-16**. The degree of visual modification generally decreases as the distance between the proposed development and the viewer increases.

- **Table 5-16 Levels of visual modification**

Level of visual modification	Description
High	The proposed development is a major element that contrasts strongly with the existing environment. There is little or no natural screening or integration with the existing environment.
Medium	The proposed development is visible and contrasts with the surrounding environment, but is integrated to some degree. Surrounding vegetation/topography provides some visual screening.
Low	The proposed development may be noticeable but does not markedly contrast with the existing environment. There is a high level of integration in terms of form, shape, colour and 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 considered when developing the different levels of visual sensitivity from land uses surrounding the coal unloader, railway loop and coal conveyor. The levels of visual sensitivity are shown in **Table 5-17**.

Table 5-17 Levels of visual sensitivity

Land use	Foreground		Middleground		Background
	0-0.5km	0.5-1km	1-1.5m	1.5-2km	>2
Rural residential	H	H	M	M	L
Main roads	H	M	L	L	L
Local roads	H	M	L	L	L
Agricultural areas	L	L	L	L	L
Mines	L	L	L	L	L

Typically residential areas are more sensitive to changes in the visual environment than roads or productive land. This is primarily due to the different lifestyle contexts associated with the land uses and the duration of exposure. As a result, rural residential areas have been rated quite highly in terms of their visual sensitivity. The main road, Pipers Flat Road, and the local roads have been given a relatively high visual sensitivity rating due to the number of 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 (as shown in **Table 5-18**).

Table 5-18 Visual impacts matrix

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

5.6.3 Existing Environment

The site of the proposed rail coal unloader is predominantly surrounded by rural and extractive industries (mining). The Mount Piper power station is located approximately 1.5km to the north of the site, with the Ivanhoe Colliery beyond with numerous mines in close proximity. The nearest townships are Wallerawang and Portland located at a distance of approximately 4 km to the south east and north west respectively.

The proposed rail coal unloader and railway loop would be set within a small scale, open rural environment at the baseline of the wooded ridge that forms Mount Piper. The site is bordered to the south by the Wallawerang-Gwebar railway line, with Pipers Flat Road beyond. The fields within which the rail and unloader facilities would be located are currently used for grazing and are relatively flat. Higher ground exists in between the floodplains created by Thompsons Creek, Pipers Flat Creek and Irondale Creek which traverse the site. Vegetation exists in areas along the banks of the creeks, although the most significant stands comprise exotic willow (*Salix)* species.

The coal conveyor passes through the heavily wooded Mount Piper ridge line. This rugged terrain rises to over 30m above the floodplain. This densely vegetated area of land leads on to the Mount Piper power station and is owned by Centennial Coal and Delta Electricity. There are no residences present within the ridge. Open paddocks border the site to the east. The residence associated with this land is located within cleared land at the base of the wooded ridge, with no direct views of the subject site.

The area to the south of the railway line supports open agricultural land with rural residences located along Pipers Flat Road and local roads such as Range Road, Irondale Road and Thompsons Creek Road. A few properties located upon elevated terrain to the south of the site have direct views of the railway line and coal unloader, the significance of the views depends on the amount of vegetation bordering the properties and the terrain present in the line of view. Generally, the undulating terrain to the south of Pipers Flat Road allows for some views in the middle ground. The conveyor, which would be elevated through Pipers Flat ridge, would be visible from a wider area.

Visual management units

The site of the proposed rail coal unloader and railway loop would be located in what can be defined as two distinct visual management units (VMU). The VMUs reflect areas where the landform, vegetation and land use are relatively consistent throughout the unit.

The VMU for the coal unloader and railway loop comprises relatively flat, cleared pasture, between the foot of Mount Piper and the Wallerawang-Mudgee railway line. Pipers Flat Creek traverses the site from north west to south east. Thompsons Creek and Irondale Creek enter the site through culverts beneath Pipers Flat Road and converge with Pipers Flat Creek on the site. These creeks are visible from the road, evidenced by their floodplains and by mature vegetation lining the banks.

The conveyor leading from the coal unloader to Mount Piper Power Station is located within a second VMU, comprising densely vegetation rugged topography. The conveyor would pass in close proximity to an existing pipeline easement through the woodland, where an access road exists and vegetation is less dense.

Visual absorptive capacity

The visual absorptive capacity (VAC) of an environment is the measure of the relative ability of the landscape to absorb visual modification. A landscape with a high VAC is able to incorporate more visual modification without significant impact to the viewer than one with a low VAC.

The degree of absorptive capability is influenced by topography and vegetation. In general, there are more opportunities to minimise the visual impact of a development in varied and undulating landscapes than areas of flat terrain.

In areas where the topography does not conceal the development from the surrounding areas, vegetation can be used to screen the development from sensitive viewpoints. The height, density, colour and seasonal change of the vegetation can all affect the VAC of the environment to conceal the development. 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 VAC of the natural environment to absorb the railway loop and coal unloader would be relatively low, as this land is open pasture. The VAC of the ridge to absorb the conveyor would be slightly higher, providing significant vegetation removal is not undertaken, due to the vegetation present and the structure and form of the conveyor which would incorporate colours which blend with the background.

5.6.4 Visual characteristics of the proposed development

The proposed facilities would comprise the railway loop located on top of an embankment. This would require significant volumes of fill to raise the level of the railway loop above current flood levels. It is possible that some of the fill could be sourced from higher ground within the site and the creek would be diverted. The visible component of the coal unloader would be a solid structure, approximately 8-10 metres in height above the rail embankment. The coal conveyor would be a covered structure, raised above ground level on supports to a height of approximately 2m.

Other proposed facilities include a locomotive provisioning area with diesel storage tanks able to hold up to 40,000 litres, a wagon maintenance siding area and associated shed. There would also be amenities and an office area provided next to the rail unloader.

Culverts would be constructed where the creeks cross under the railway loop. It is intended that the remaining open creek areas would be revegetated and managed for wildlife purposes.

5.6.5 Visual impact assessment

Visual modification

There would be a high level of visual modification as a result of the proposal. Features such as the coal unloader and railway loop, in particular, would provide a strong contrast to the existing rural environment. Due to the scale of the proposal there would be some opportunities for placing screening within the site.

Visual sensitivity

Residences which have direct views of the proposal include the property associated with Premier Farms. This is located next to the chicken shed on the crest of the hill to the south of the project site. There is little screening vegetation associated with this property which would have views in the middle ground. There would be partially obscured views of the site from a number of properties along Irondale Road including Murray Lodge, in the middleground, at a distance of 1-2km. However, the topography and vegetation in this location provides significant screening.

There may be some views in the middleground to background of the coal conveyor as it climbs the ridge. The extent of the views would depend upon vegetation retention along the conveyor route. Users of Pipers Flat Road would have views of the facilities in the foreground as little screening exists along the site boundary or the road verge.

Visual impact

A viewshed analysis was conducted to determine the locations from which the proposed coal unloader may be visible. This is shown in **Figure 5-10.** The analysis was completed using an estimated height of the coal unloader of 17m above the existing ground level.

The model assumes no existing vegetation coverage or screening from other objects and structures. Hence the zone of influence is a 'worst case' and the unloader facility would not actually be visible from all locations shown**.**

The extent of visual modification can be more easily identified from the "birds – eye – view" in **Figures 5-11a,b,c.** **Figure 5-11a** shows a stylised, elevated view from a point to the north east of the site. **Figure 5-11b** shows the same view with revegetation of the site to the extent outlined in **Figure 5-11c**.

The key viewing points for the proposal would be the residence associated with Premier Farms and users of Pipers Flat Road. A number of photomontages were prepared, with views taken from the three locations along Pipers Flat Road shown in **Figure 5-11c**), in which the proposed facilities have been superimposed on views of the existing area. The photomontages are shown in **Figures 5-12a,b,c**. Each view is shown with and without the revegetation outlined in **Figure 5-11c**.

A view from Premier Farms was not possible. For the view from Premier Farms the facilities would not be readily absorbed into the existing landscape and there would be significant views of specific elements of the development within the foreground to middle ground, although the revegetation proposed for the site would soften the impact. Visual impacts for other premises and road users within the area would be low due to screening afforded by the existing topography and vegetation. It should be noted, however, that the proposed landscaping would provide significant protection for viewers on the road and from other viewpoints.

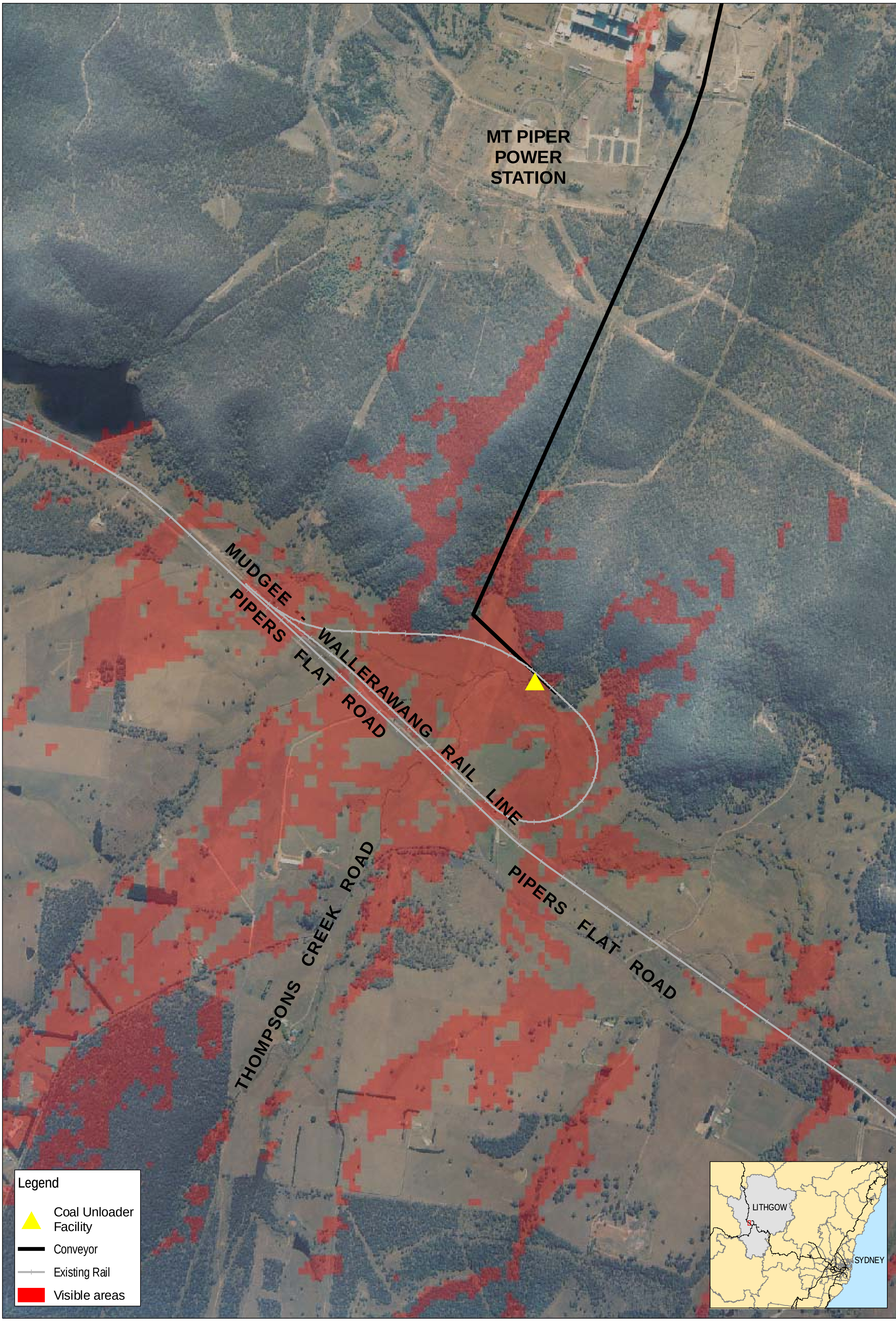

Figure 5 - 10
Viewshed from Coal Unloader

Delta Electricity Western Rail Coal Unloader
GDA 94 MGA Zone 56

0 250 500
Meters

- **Figure 5-11a Elevated Aerial View of the Site**

- **Figure 5-11b Elevated Aerial View of the Site (with Landscaping)**

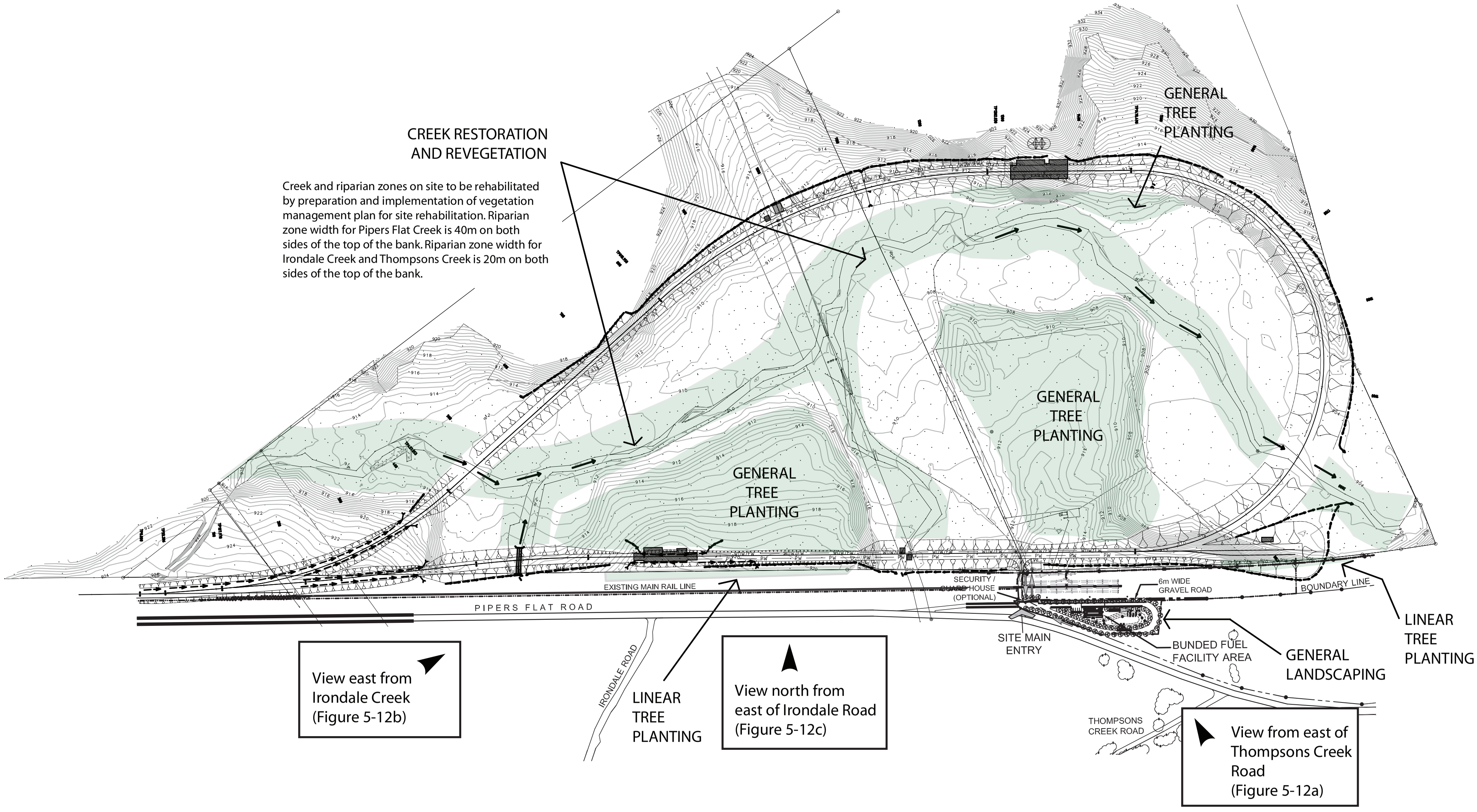

Figure 5-11c View Points and Landscape Plan

PIPERS FLAT - WESTERN RAIL COAL UNLOADER

Figure 5-12a View into site from Thompsons Creek Road

PIPERS FLAT-WESTERN RAIL COAL UNLOADER

Figure 5-12b View east from Irondale Creek

PIPERS FLAT-WESTERN RAIL COAL UNLOADER

Figure 5-12c View north from east of Irondale Road

5.6.6 Mitigation of Visual impacts

Location

The locations of the railway loop and rail coal unloader have been sited within a cleared area to minimise the requirements for vegetation clearance. Potential locations for the railway loop were selected to minimise visual impacts, and the need to satisfy the engineering requirements and grades for safe rail design. The route of the coal conveyor was chosen to follow an existing pipeline easement to minimise vegetation clearance requirements within the Pipers Flat Range.

Design

The facilities would be designed to minimise intrusion impacts to local residences. The design and colour scheme chosen for the built components would be selected to ensure they do not stand out within the natural and rural settings. A significant portion of the coal unloader has been placed below ground, thus minimising visual intrusion.

Landscaping

To minimise the impacts on direct views of the facilities, landscape planting would be provided at key locations around the site. The railway embankments would be grassed and bands of vegetation would be located in front of major structures to improve the view from Pipers Flat Road and from the residences on the southern side of Pipers Flat Road.

Further landscaping along the southern site boundary would also reduce views of the site from Pipers Flat Road. Extensive planting on site would increase the site's Visual Absorption Capacity (VAC). Planting undertaken would include vegetation with a low canopy to screen views down into the floodplain.

Vegetation retention through the ridge would be maximised and replanting undertaken where possible to assist with screening. This linear structure could potentially be visible from some distance, as it is elevated above the surrounding countryside.

5.6.7 Conclusions

The visual impact of the proposed railway loop, coal unloader and coal conveyor would be high for the Premier Farms property and users of the Pipers Flat Road, as these receivers would experience changes to the visual environment in the foreground. Other properties to the south of Pipers Flat Road would generally have limited views of the coal unloader, due to screening by topography or vegetation and the potential impact would be low.

There may be some views of the coal conveyor in the foreground to middle ground. Generally the undulating terrain of the surrounding area and the existing vegetation would prevent significant visual impacts. Further, it would be specified that the colour schemes used for structures associated with the facilities be selected to blend with the natural background.

Landscape planting is proposed for the rail embankments and for site buildings and screening vegetation along the southern site boundary would assist with screening views from Pipers Flat Road. Vegetation would be retained where possible along the route of the coal conveyor, and revegetation undertaken where possible to minimise middle to long range views of this structure as it ascends the ridge.

On the basis of implementing these mitigation measures, residual visual impacts would be regarded as low.