Kerosene Vale
Stage 2 Ash Repository Area
Environmental Assessment

April 2008

Delta Electricity

Parsons Brinckerhoff Australia Pty Limited ABN 80 078 004 798

Ernst & Young Centre,
Level 27, 680 George Street
Sydney NSW 2000
GPO Box 5394
Sydney NSW 2001
Australia
Telephone +61 2 9272 5100
Facsimile +61 2 9272 5101

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Author: ..... Emma Dixon, Melissa Murray, Christine Mueller

Signed: .....

Reviewer: .....Nigel Buchanan

Signed: .....

Approved by: ..... Carlos Olles

Signed: .....

Date: .....April 2008

Distribution: .....

Statement of validity

Submission of Environmental Assessment

Prepared under Part 3A of the Environmental Planning and Assessment Act 1979

Environmental assessment prepared by:

Name:	Nigel Buchanan
Qualifications:	B.E (Environmental)
Address:	Parsons Brinckerhoff Pty Ltd Ernst & Young Centre Level 27, 680 George Street Sydney NSW 2000
In respect of:	Kerosene Vale Stage 2 Dry Ash Repository Area – Environmental Assessment
Applicant name:	Delta Electricity
Applicant address:	Wallerawang Power Station 1 Main Street Wallerawang NSW 2845
Proposed development:	Delta Electricity propose to extend their existing dry ash placement activities in the Stage 1 ash repository area to operate a dry ash repository at Kerosene Vale over the Stage 2 area (refer Figure 1-2) and complete the final stage of their development of the Kerosene Vale repository area.
Land to be developed:	Land generally required for the design refinement, construction and operation of the proposed development, as shown in Figure 1-2.
Environmental assessment:	An environmental assessment is attached that addresses all matters in accordance with Part 3A of the *Environmental Planning and Assessment Act 1979.*
Declaration	I certify that I have prepared the contents of this environmental assessment in accordance with the Director General's requirements dated 27 February 2007 and that to the best of my knowledge, the information contained in the environmental assessment is not false or misleading.
Signature:	
Name:	Nigel Buchanan
Date:	1st April, 2008

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Executive summary

What is proposed?

The Kerosene Vale ash repository area was originally constructed between 1960 and 1990. During this time it was filled with a combination of by-product ash from the Wallerawang Power Station and mining spoil. The ash repository area was capped in around 1990.

In 2001, Delta Electricity determined that there was an operational need to change from wet to dry ash-producing activities at Wallerawang Power Station. As a result of this decision, it was necessary to identify an area for the placement and storage of by-product ash. Owing to its historic use for this purpose, the Kerosene Vale ash repository area was identified as a suitable site. Since this change in operations and the 2002 Stage 1 activities approval, the area over the Kerosene Vale ash repository area has been used for ash placement and site management activities associated with the operation of the Wallerawang Power Station.

The proposed Stage 2 activities would use the extended area of the Kerosene Vale ash repository and would cover the area from the open face of the Stage 1 area to the edge of the original storage area. The proposed staging of ash placement is outlined in Chapter 3.

In order to enable the proposed Stage 2 placement activities to be completed safely, a number of engineering works would be required at various stages of the development. These works, which would be undertaken in parallel with ash placement activities to coincide with operational requirements, include:

- realignment of Sawyers Swamp Creek
- construction of stabilisation structure on the northern embankment
- development of surface water-retention structure
- relocation of existing water transfer system from Sawyers Swamp Creek ash dam and associated retention canal.

Why is it needed?

The need for the development of Kerosene Vale ash repository was identified in 2001 in order to maintain power-generation operations at the Wallerawang Power Station. This was a result of the existing wet ash storage area approaching its design capacity. Dry ash placement at Kerosene Vale ash repository was identified to meet this need. This approach was split into two stages.

Stage 1 dry ash placement at the Kerosene Vale ash repository area was designed to operate for a period of 5 years, and is now reaching its design capacity. Current estimates indicate that Stage 1 capacity will be reached by July 2008.

In the absence of viable reuse options (see Section 2.3) or an alternative area to place the ash produced during the power generating activities of the Wallerawang Power Station, the operation of the power station would either need to be reduced to extend the operation of the Stage 1 ash repository area, or alternative repository areas be identified at the end of operation of the Stage 1 area. An ash storage area for the Wallerawang Power Station is required to maintain the existing level of power supply in the region.

How does the proposal satisfy this need?

Stage 2 dry ash placement at the Kerosene Vale ash repository area would fulfil the second phase of the original proposal. The proposed Stage 2 expansion would provide for continued placement of ash over the Kerosene Vale ash repository area for a further 11 years, at which time it is anticipated that alternative use options would have improved.

Delta Electricity has identified a need for alternative storage for ash by-products from coal-fired power production in order to maintain power production at Wallerawang Power Station. In order to maintain base load power supply from this operation, the Stage 2 placement of ash in the Kerosene Vale ash repository has been identified. This area provides the capacity to enable the continued production of power to the NSW electricity grid, and as such, provide a significant benefit to ongoing electricity demands in NSW.

What would be the consequences of the proposal?

This Environmental Assessment addresses the key environmental issues identified in environmental risk assessments and the Director-General's Environmental Assessment requirements. This assessment has been undertaken under Part 3A of the *Environmental Planning and Assessment Act 1979*.

Against the benefit of ongoing electricity production, the following key potential environmental impacts have been identified in association with the proposal:

- Water quality impacts.
- Aquatic ecology impacts associated with the realignment of Sawyers Swamp Creek.
- Dust and air emission impacts.
- Noise impacts on the local community.

The environmental assessment and design process has identified proposed mitigation and management measures to mitigate and manage these impacts, as outlined in this Environmental Assessment and summarised in the draft Statement of Commitments. Given implementation of the proposed measures, it is considered that the environmental risk of the project (and the identified impacts) can be adequately managed and mitigated.

How can I comment on the proposal and the environmental assessment report?

The Department of Planning will make the Environmental Assessment publicly available for a minimum period of 30 days. During this period, the Environmental Assessment will be available for inspection on the Department of Planning website www.planning.nsw.gov.au, on the project website at http://www.de.com.au/default.aspx?FolderID=295&ArticleID=5424, and at selected Delta Electricity offices and other locations.

A 1800 project information line has been available during the preparation of the Environmental Assessment and will remain available throughout the exhibition period (phone 1800 008 708 toll free).

Any person, including a public authority, may make a written submission to the Director-General regarding the proposal and/or this Environmental Assessment during the exhibition period. Submissions should be made to:

Kerosene Vale - Stage 2 Ash Repository Area
Major Infrastructure Assessments
NSW Department of Planning
GPO Box 39
Sydney NSW 2001

1. Introduction

1.1 Background

Delta Electricity, a state-owned corporation, owns and operates the Wallerawang Power Station, which generates a substantial proportion of NSW's energy base load. Wallerawang Power Station was constructed by the electricity commission of NSW in September 1958. The power station has a total capacity of 1,000 megawatts provided by two generating units. The electricity output is linked into the national grid through 330 kilovolt transmission lines.

Wallerawang Power Station produces electricity via pulverised coal-fired boilers and steam-driven turbo generators. The production of this electricity requires the use of approximately 2.4 million tonnes of coal per annum, the majority of which is supplied by the nearby Angus Place Colliery. As a by-product of the combustion of coal, the power station produces between 450,000 and 500,000 tonnes of ash per annum, 80% of this ash is fly ash and 20% is bottom ash.

Delta Electricity's preferred long-term strategy for the ash by-product is to use the ash in industry, manufacture, and where possible, within site construction activities. Ash is currently re-used as far away as Melbourne with usage constrained only by market drivers. However, there is a need to store this ash material under existing operational conditions and current markets for the use of this material in industry. Options for reuse are further discussed in Chapter 2. An ash management strategy is detailed in Chapter 14.

In order to store the ash produced as part of power production at Wallerawang Power Station, Delta Electricity identified a need for additional ash storage in 2001 due to capacity constraints at Sawyers Swamp Creek Ash Dam (SSCAD). This required a change from wet ash to dry ash operation. The Kerosene Vale ash repository area (KVAR) was identified as a suitable site since the area has historically been used for the purpose of ash placement in conjunction with the operation of the Wallerawang Power Station since 1960.

The Kerosene Vale ash repository area is located approximately 2.5 kilometres north-east of the Wallerawang Power Station and approximately 10 kilometres north-west of the city of Lithgow (see Figure 1-1), which is 150 kilometres west of Sydney.

The Kerosene Vale ash repository site was divided into two stages. Stage 1 activities (initial operations) were identified as not having significant environmental impacts (ERM Hyder, 2002) and were approved in 2002. Stage 2 operations were identified as requiring a more detailed review of environmental impacts.

Delta Electricity propose to extend their existing dry ash placement activities in the Stage 1 ash repository area to operate a dry ash repository at Kerosene Vale over the Stage 2 area (see Figure 1-2) and complete the final stage of their development of the Kerosene Vale emplacement area.

The Stage 1 dry ash placement at the Kerosene Vale ash repository area was designed to operate for a period of 5 years, and is now reaching its design capacity. Current estimates indicate that capacity will be reached by July 2008 and, as originally proposed in 2001, Stage 2 of this development will fulfil the second phase of the original proposal.

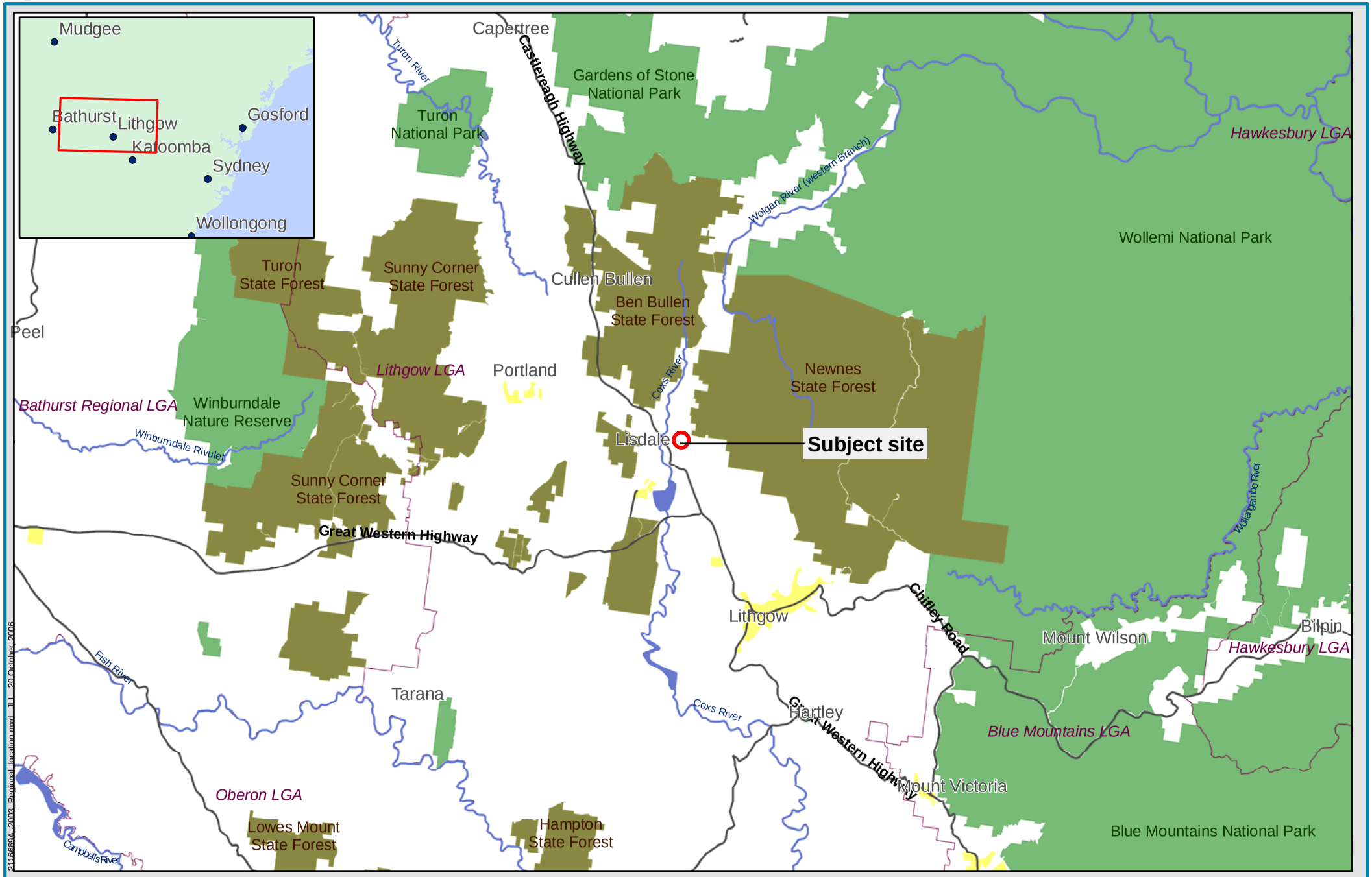

Figure 1-1 Regional context

Figure 1-2 Existing and proposed ash repository areas

The proposed Stage 2 Kerosene Vale ash repository area would operate in a similar manner to the existing Stage 1 operation, fulfilling the second stage of the long-term storage option with minimal change from existing operations. This report assesses the potential environmental impacts of the Stage 2 area to provide for approval of the Stage 2 activities and the fulfilment of the originally proposed scheme.

As part of the proposed Stage 2 operations, the Stage 1 areas that have reached the design height of 940 metres Australian Height Datum (AHD) would be capped, limiting interaction between Stage 1 and Stage 2 areas of storage and providing continuity of operations. The proposed Stage 2 activities would extend the existing Stage 1 repository from the eastern edge directly adjacent to the pine plantation area (as shown in the placement diagrams in Appendix A), then generally north towards Sawyers Swamp Creek.

Development of the proposed Stage 2 ash repository area would provide Delta Electricity with sufficient operational capacity to continue the current level of operations at the Wallerawang Power Station for approximately 11 years.

1.2 Structure and content of this Environmental Assessment

The structure and content of this Environmental Assessment is summarised in Table 1-1.

Table 1-1 Structure and content of this document

Chapter	Description
Chapter 1: Introduction	Outlines the background to the project, the project proponent, location and objectives, and provides a guide to the Environmental Assessment.
Chapter 2: Need for the proposal and options assessment	Outlines the need for the project and the anticipated project benefits and the assessment of options (including ash reuse options) and development of the preliminary and concept design of the proposal in accordance with project objectives, design principles and criteria.
Chapter 3: Description of the proposal	Provides a detailed description of the physical works that make up the project, details the next steps in the delivery of the proposal and how the project is likely to be constructed.
Chapter 4: Planning and approvals	Outlines the legislation, planning strategies and policies that apply to the project.
Chapter 5: Community and stakeholder involvement	Outlines how the community and stakeholders have been and will be involved in the development of the proposal, and summarises the issues raised by the community/stakeholders to date.
Chapter 6: Environmental risk analysis	Details the risk process by which the key environmental issues for assessment were determined.
Chapter 7: Groundwater	Describes the potential impact of the proposal on groundwater quality and hydrology and groundwater management, and outlines measures proposed to avoid, remedy or mitigate those impacts.
Chapter 8: Surface water	Describes the potential impact of the proposal on surface water quality and hydrology and surface water management, and outlines measures proposed to avoid, remedy or mitigate those impacts.
Chapter 9: Aquatic ecology	Describes the potential impact of the proposal on aquatic flora and fauna and outlines measures proposed to avoid, remedy or mitigate those impacts.
Chapter 10: Air quality	Describes the potential impact of the proposal on air quality in comparison to conditions without the proposal, and outlines measures proposed to avoid, remedy or mitigate those impacts.

Chapter	Description
Chapter 11: Noise and vibration	Describes the potential impact of the proposal on noise and vibration and outlines measures proposed to avoid, remedy or mitigate those impacts.
Chapter 12: Land use and mining	Describes the potential impact of the proposal on land use and mining and outlines measures proposed to avoid, remedy or mitigate those impacts.
Chapter 13: Other environmental issues	Describes the potential impact of the proposal on other (non-key) environmental issues and outlines measures proposed to avoid, remedy or mitigate those impacts.
Chapter 14: Environmental management	Provides an overview of the framework of environmental management to be adopted during the detailed design and construction phase of the project.
Chapter 15: Draft Statement of Commitments	Provides a draft overview of all commitments made by Delta Electricity to manage residual impacts associated with the proposal.
Chapter 16: Justification and residual risk	Outlines the justification for proceeding with the proposal, the residual risks associated with the project following application of the proposed mitigation measures and the next steps in the consideration of the proposal.
Appendix A: Design drawings	Design drawings.
Appendix B: Draft Sawyers Swamp Creek Rehabilitation Plan	Draft rehabilitation plan for the section of Sawyers Swamp Creek to be realigned.
Appendix C: Environmental Assessment requirements and cross-reference	Detailed Environmental Assessment requirements issued by the Department of Planning outlining key issues requiring consideration in the Environmental Assessment and where each issue has been addressed in the document.
Appendix D: Agency, stakeholder and community correspondence, consultation and meeting materials	Copies of agency and stakeholder correspondence and consultation and supporting information.
Appendix E: Technical Report 1	Groundwater assessment
Appendix F: Technical Report 2	Surface water assessment
Appendix G: Technical Report 3	Aquatic ecology assessment
Appendix H: Technical Report 4	Air quality assessment
Appendix I: Technical Report 5	Noise and vibration assessment
Appendix J: Technical Report 6	Preliminary biodiversity assessment
Appendix K: Technical Report 7	Preliminary archaeology and heritage assessment

The supporting Technical Reports included in the appendices were used to prepare the main body of this Environmental Assessment.

The mitigation, monitoring and management measures recommended in the technical reports have been taken into account in developing the likely mitigation measures and further investigations for the proposed Stage 2 ash repository. These have been incorporated into the draft Statement of Commitments (Chapter 15). If there is any conflict between the measures recommended in the technical reports and the draft Statement of Commitments, the latter takes precedence.

The Statement of Commitments outlines the commitments that Delta Electricity would make to ensure the ongoing protection of the environment and the community during the construction and operation of the proposal, as well as during any further work required to finalise the concept design and establish an environmental management framework. Should approval be granted by the Minister for Planning, the Statement of Commitments would form part of the conditions of approval.

2. Need for the proposal and options assessment

This chapter outlines the need for the development and various alternatives considered for the management of the ash from operation of the Wallerawang Power Station, including consideration of reuse, reprocessing and recycling options as well as various options and potential locations for ash storage.

It also addresses options considered in relation to the realignment of Sawyers Swamp Creek to enable stabilisation works to be completed prior to the completion of ash placement activities.

2.1 Need for the proposal

The need for the development of Kerosene Vale ash repository was identified in 2001 in order to maintain power-generation operations at the Wallerawang Power Station. This was a result of the existing wet ash storage area approaching its design capacity.

In order to maintain power production at Wallerawang Power Station, a need for alternative storage for ash by-products was identified.

Dry ash placement at Kerosene Vale ash repository was identified to meet this need. This approach was split into two stages.

Stage 1 dry ash placement at the Kerosene Vale ash repository area was designed to operate for a period of 5 years, and is now reaching its design capacity. Current estimates indicate that capacity will be reached by July 2008 and as originally proposed in 2001, Stage 2 of this development will fulfil the second phase of the original proposal.

The proposed Stage 2 expansion would provide for continued placement of ash over the Kerosene Vale ash repository area for a further 11 years, at which time it is anticipated that alternative use options would have improved (see Section 2.3).

In the absence of viable reuse options, as discussed in Section 2.3, or an alternative area to place the ash produced during the power-generating activities of the Wallerawang Power Station, the operation of the power station would either need to be reduced to extend the operation of the Stage 1 ash repository area, or alternative repository areas be identified at the end of operation of the Stage 1 area. An ash storage area for the Wallerawang Power Station is required to maintain the existing level of power supply in the region. Further discussion of alternatives is provided in the remainder of this chapter.

2.2 Ash management

2.2.1 Physical and chemical properties of ash

When coal is burnt in a pulverised fuel furnace for electric power production, coal combustion by-products are produced. On average, for each tonne of coal burnt, approximately 300 kilograms of coal combustion by-products are produced.

Subject to the coal seams in the coal mine and the ash limits set out in the coal contract, Wallerawang Power Station typically produces 18–23% ash and 9% unburnt carbon (Delta Electricity 2007, pers comm., 31 August). At Wallerawang Power Station two types of coal combustion by-products are produced, fly ash and bottom ash. Approximately 2.4 million tonnes of coal are burnt at Wallerawang Power Station each year, producing 450,000 tonnes of combustion by-products per annum, of which approximately 80–90% is fly ash and the remaining 10–20% bottom ash.

Fly ash is comprised of the fine particles that remain in suspension with the combustion gases that are recovered by the fabric filters or electrostatic precipitators. Fly ash is composed primarily of complex aluminosilicate glass, mullite, hematite, magnetite spinel and quartz.

Bottom ash comprises the coarser and heavier ash particles that fall to the bottom of the combustion chamber. Bottom ash consists mostly of sand or gravel-size aggregates.

Table 2-1 summarises the main chemical constituents of the fly ash produced at Wallerawang Power Station.

Table 2-1 Chemical properties of fly ash from Wallerawang Power Station

Chemical composition	Percentage (%) of ash[1]	Typical NSW ash[2]
Silicon as SiO_2	63.40	57.5–67
Aluminium as Al_2O_3	28.60	22.4–27.6
Iron as Fe_2O_3	1.90	1.1–7.6
Calcium as CaO	0.89	0.35–3.3
Magnesium as MgO	0.39	0.3–1.1
Sodium as Na_2O	0.27	0.2–0.9
Potassium as K_2O	2.84	1.6–3.0
Titanium as TiO_2	1.40	0.9–1.3
Manganese as Mn_3O_4	0.05	NA[3]
Sulfur as SO_3	0.07	0.1–0.3
Phosphorus as P_2O_5	0.18	0.11–0.2
Barium as BaO	0.09	0.0–0.1
Strontium as SrO	0.05	NA
Zinc as ZnO	0.02	NA
Other trace elements (Selenium, etc.)[4]	<0.001	NA
Total[5]	**100**	

Source: ACIRL, Lithgow for Delta Electricity based on samples collected 21/05/01 to 29/05/01.

1. Average of Hopper 1B and Hopper 2B composite.
2. Typical NSW ash: Heidrich 2007.
3. NA Means 'Not Assessed'.
4. Selenium concentration in ash is in the order of 5mg/kg or 0.0005%.
5. Note that percentages have been rounded to nearest two decimal places, resulting in a total in exceedance of 100%.

The mineralogical, geotechnical and geochemical characteristics of ash produced at different power stations may vary, depending on the coal feedstock and combustion conditions. Table 2-2 provides an indicative mineralogy of fly ash produced in NSW, which is indicative of the mineralogy of the fly ash produced at Wallerawang.

Table 2-2 Mineralogy of NSW fly ashes

Mineral	Range
Quartz	4.9–11.2
Mullite	8.5–16
Cristobalite	0.1
Spinel	0.2
Magnetite	0.2–0.7
Maghemite	0.1–1.1
Hematite	0.0–1.1
Glass	85.4–86.4

2.2.2 Ash storage volumes

Based on historical data the volume of ash produced each month from the operation of the Wallerawang Power Station, which is the volume of ash required to be stored, has been estimated to July 2008. For every gigawatt hour of electricity generated, 87.28 tonnes of ash is produced. The estimated volume of ash that would be generated each month from August 2007 to July 2008 is given in Table 2-3. These volumes are considered indicative of annual ash production over the life of the proposed Stage 2 ash repository. The volume of ash generated is influenced by various factors, including change in coal purchased or modification of operating procedures; as such, the volumes given are estimates only.

Table 2-3 Estimated ash production to July 2008

Month/year	Electricity generated (gigawatt hours)	Estimated volume of ash (tonnes)
August 2007	497	43,376
September 2007	481	41,979
October 2007	497	43,376
November 2007	481	41,979
December 2007	497	43,376
January 2008	497	43,376
February 2008	465	40,583
March 2008	497	43,376
April 2008	481	41,979
May 2008[1]	329	28,714
June 2008	481	41,979
July 2008	505	44,074
Total	5708	498,167

1. Each year production is estimated to meet market drivers and availability. At certain times of the year units are taken out of service for repairs and maintenance. This, where possible, is undertaken in the months when the impact on the end user is minimised, most commonly around May, resulting in reduced ash production during these planned maintenance activities. The actual month may vary year to year.

2.2.3 Potential environmental and human health impacts

Ash consists principally of silicon, aluminium and iron along with a range of trace elements as shown in Table 2-1. The amounts of these elements, in a general sense, are broadly comparable to amounts in sand and clays. Fly ash is classified as non-hazardous by National Health and Medical Research Council as it is low crystalline quartz. It is understood that the firing process denatures the crystalline structure which is considered hazardous.

The Department of Environment and Climate Change nuisance value for dust deposition is 4g/m^3/month equating to 3.2kg per month on a standard 800 cubic metre block of land. Fly ash may be classified as inert or solid waste, according to the DECC (EPA) Waste Guidelines. Selenium needs to be below a threshold of 2mg/kg to be classified as Inert Waste, less than 20mg/kg to be classified as Solid Waste. According to DECC, ash is generally classified as an inert industrial waste (DECC 2007, pers comm., 10 September).

With regard to the handling of, and exposure to, fly ash, the main property of concern, is respirable dust, as the generation of dust of any type — fly ash, bush fire or alternative source — has the potential to have respiratory impacts, if concentrations and exposure levels are high enough. However, as part of the air assessment in Chapter 10 the level of dust impacts at local residents has been assessed. Modelling indicated that only a small amount of dust would be produced from the proposed Stage 2 ash placement operations and calculated dust levels fall within DECC requirements for dust emissions, and as such, dust-related health risks are consider to be low. These risks will be further mitigated through the use of additional dust suppression on site (e.g. sprinkler system) under certain meteorological conditions (e.g. high winds).

2.2.4 Environmental and regulatory considerations

Under the Protection of the Environment Operations (Waste) Regulation 2005, fly ash and bottom ash are classified as 'residue waste' for which an exemption has been granted under clause 51, part 6 of the Regulation. Subject to the conditions of the exemption, which includes limits on the boron and electrical conductivity levels in the ash, land application of ash for the purposes of growing vegetables is no longer prohibited. Under the exemption, the limits for in-ash contaminant are 60 milligrams per kilogram for boron and 4 dS/m electrical conductivity.

Owing to the furnacing of coal, ash cannot be considered 'virgin excavated natural material' under the DECC's *Assessment, Classification and Management of Liquid and Non-Liquid Waste* (2004), however, fly-ash is generally classified as an inert industrial waste (DECC 2007, pers comm., 10 September).

Reporting of ash reuse is currently required via the purchasing requirements of DECC's Waste Reduction and Purchasing Policy (WRAPP), in relation to the additives in concrete.

Reporting of carbon content in ash from the Wallerawang Power Station is currently required as part of the NSW Greenhouse Abatement Certificates as administered by Independent Pricing and Regulatory Tribunal (IPART).

2.3 Ash reuse, recycling and reprocessing

In 2005, approximately 13 million tonnes of coal combustion products were produced within Australia and New Zealand.

Of the coal combustion products produced, 11% was used in high-value-added applications such as cementitious applications or concrete manufacture, 4% was used in non-cementitious applications, and a further 32% was used in projects offering some beneficial use (i.e. mine site remediation, local haul roads). Comparatively, member countries of the European Coal Combustion Products Association (ECOBA) re-used ash in concrete (37%), followed by Portland cement manufacture (31%) and road construction (21%). In the USA approximately 31.9% was used in cement and concrete, structural fills, waste stabilisations, road base/sub-base and mining applications (Heindrich et al. 2007).

The high-value reuse applications in Australia fall short of international achievements. This is primarily the result of the distances between coal-fired power stations and cement producers, or concrete product manufacturers and major Sydney and Newcastle concrete markets. Consequently transportation costs are high and often outweigh costs of alternatives located nearer to producers, manufacturers and consumers.

2.3.1 Reuse applications

Ash from power-generation activities can be beneficially re-used for cementitious or horticultural purposes, soil stabilisation, engineered fill and road bases, aggregates and geopolymers, and zeolite production, subject to the quality of the ash produced.

Delta Electricity has, and continues to, investigate the reuse of the ash by-product of its power-generating activities in each of the potential reuse areas. Through a process of supporting research and participating in market research and development, Delta Electricity has been working with relevant parties to stimulate the interest in this product.

Fly ash from Wallerawang Power Station has consistency issues, which precludes use in many applications; however, Delta Electricity is encouraging a number of companies to research options for uses such as:

- besser blocks and lightweight bricks
- railway sleepers
- horticultural land fill
- road base.

Delta Electricity is a member on the board of the Ash Development Association of Australia (ADAA) and the Cooperative Research Centre for Coal in Sustainable Development (CCSD). ADAA strive to market ash for a broad range of uses and CCSD are strengthening collaborative links between industry, research organisations and government agencies.

At this time these options are yet to be realised, and in the interim storage is required.

2.3.2 Cementitious uses

Dry conditioned ash can be re-used in cement. Australian Standards for pre-mixed concrete allow up to 40% of Portland cement to be replaced with fly ash (Heeley and Shirtley 2001).

Currently, dry conditioned ash used by cement companies is required to be of a very high standard, with less than 2% unburnt carbon. This is a current industry practice, the Australian Standard allows for an unburnt carbon content of up to 6% for some applications. As a result of the burning process used and the coal supply to the power station, the by-product ash from the Wallerawang Power Station nominally contains approximately 6

to12% unburnt carbon, which compares poorly with Eraring and Mount Piper power plants, which have an unburnt carbon content of less than 1%. Modification of the power-generation operations at the power station would enable separation of finer ashes and reduce the unburnt carbon content of the ash; however, this is unlikely to reduce the unburnt carbon content of the ash to the required level to make cementitious reuse options economically viable for Wallarawang Power Station.

In comparison, new power generation facilities of Eraring, Mount Piper and Bayswater, which have relatively new 'front fired' boilers (meaning the coal is fed into the front of the furnace) that result in lower carbon content in output ash.

The Australian cement industry is rigorous in its standards and will not allow for any appreciable vagaries.

Eraring uses coal from the Hunter Valley, which is from different seams and, hence has different properties and burning impacts. As a result of this difference in quality Eraring reuses 32% of its ash for this purpose, however, the current market and limited number of major cement producers (due to vertical integration) means that market forces limit the ability of Wallerawang operations to reuse by-product ash. Eraring has long-term contracts for this reuse, but these are based on the quality of the end product. Delta Electricity has similar arrangements for Mount Piper ash, but Wallerawang ash is not of sufficiently low carbon content for this type of end use to be viable.

There are many trials carried out for the purpose of ash reuse, but market forces constrain most options. Wallerawang power station is situated well off the main industrial hubs, as such moving ash from this area to substantial worksites becomes cost prohibitive. Additionally, the market is constrained, Eraring ash by-products, by virtue of position, are utilised for the bulk of cementitious uses. Delta Electricity's Wallerawang Power Station is, by necessity, a market follower for ash recycling. Even when ash is offered free or with subsidised arrangements market forces preclude the use of the ash in most industry.

Until there is a larger market or smaller independent companies increase demand, this situation is likely to continue and in the short-term will limit the ability to reuse ash from the Wallerawang power station resulting in a need for storage as discussed in this Environmental Assessment.

2.3.3 Horticultural uses

Owing to the dominance of silt-sized particles and the porous nature of the components in fly ash, addition of the ash to soils may help to increase the water-holding capacity and modify the permeability of otherwise unfavourable soils, thereby increasing the level of water infiltration and retention and decreasing the rate of water loss in agricultural and horticultural applications (Heindrich et al. 2007). Addition of ash to sandy soils, for example, can reduce episodes of moisture deficit, and also aid the retention of nutrients such as nitrate, ammonium and phosphorus in the rooting zone, leading to increased plant yield and a range of associated economic and environmental benefits. Ash may also be used to increase the porosity and permeability of clay-rich soils, lowering bulk density, providing better water infiltration and increasing aeration (Heindrich et al. 2007).

Addition of ash may change the soil pH, and also provide chemical nutrients otherwise lacking, making up deficiencies that might arise due to prolonged weathering or extended cropping. Some elements, such as boron, molybdenum and selenium are beneficial, but may become toxic at higher concentration levels, and the mobility of these components under soil

conditions may need to be taken into account when considering horticultural use (Heindrich et al. 2007). Testing of NSW ashes has shown the concentration of these and other chemicals are well below the level of toxicity.

The use of fly ash in horticultural process has been exempt from the prohibition placed on waste substances in the Protection of the Environment Operations (Waste) Regulation 2005 since 1 December 2006. Prior to this exemption, a previous exemption had expired in December 2006. Delta Electricity has a representative on the Board of the Ash Development Association of Australia (ADAA) who has instigated discussions for reclassifying ash as a fertiliser and also pursued the determination of analyte levels in fertilisers. Delta Electricity is keenly pursuing the use of ash for horticultural purposes, as this would provide an additional asset to their operations. Given that the percentage of unburnt carbon content in ash from Wallerawang Power Station is higher than other ash reserves and producers, Wallerawang Power Station has a small, but not insignificant, competitive advantage in the application of ash for horticultural purposes.

2.3.4 Soil stabilisation, engineered fills and road bases

Fly ash may be added to otherwise well-sorted (poorly graded) sandy soils to fill the void spaces, increasing the overall density and aiding in compaction. In some cases the self-cementing properties of the ash may help to bind the soil. Such stabilisation increases the capacity of the soil to support roads (road base), bridges, buildings and other man-made structures, and maintain the soil's stability for the lifetime of the structure. The fly ash and soil may be compacted into layers (structured fills), or a mixture of fly ash, soil, water and Portland cement may be placed as a liquid (flowable fills) to solidify as a low-strength but effective engineered fill material.

2.3.5 Aggregates and geopolymers

Coarse (gravel-size) and fine (sand-size) aggregates for concrete and other applications can be produced from fly ash by partially or completely melting the ash, typically with the aid of a flux to lower the melting temperature, and either forming the melt into appropriately-sized particles or crushing it on cooling. Alternatively, aggregates can be produced by binding ash particles into larger masses with a cementing agent (Heindrich et al. 2007).

Another approach is to transform the ash into geopolymers, which are artificial rock-like silicate materials produced by synthetic reactions between the ash and other agents at temperatures below 100°C (Swanepoel and Strydom 2002). Geopolymerisation involves the dissolution of aluminium and silicon from the surfaces of waste materials as well as the surface hydration of undissolved waste particles, followed by the polymerisation of active surface groups and soluble species to form a gel and subsequently, a hardened geopolymer structure.

Delta Electricity has communicated with a number of companies that have expressed their interest in processes that blend ash with polymers to produce a product with similar properties and strengths as quarry gravels. The approval and/or support of the relevant authorities (such as the DECC, the Department of Planning and the Roads and Traffic Authority (RTA)) would need to be sought before such products could be used in major road projects. An assessment of the commercial viability of this form of reuse would also be required. In addition, the product would need the support and backing of the wider construction industry. At this time, approval for the use of the product has not been sought,

as the approval would need to be granted by the relevant council within whose area the reuse application would be undertaken, and the RTA.

Options for the reuse of ash in road projects continue to be pursued by a number of private companies. However, the market drivers are not in place at this point in time to make this reuse application viable. In addition ADAA members also continue to pursue the reuse of ash in road projects, including trial projects in the region.

2.3.6 Zeolite production

The abundant aluminosilicate glass component in fly ash provides a potential raw material for zeolite synthesis. A range of zeolite minerals may be produced by reacting silica, alumina and cations under hydrothermal conditions (pH 10–14, >100°C). Zeolites are used as controlled-release fertilisers, soil conditioners and ion exchange media, detergent builders, pesticide carriers, and animal dietary supplements. Although natural zeolites are available, synthetic zeolites, including materials made from fly ash, may be tailored more specifically to meet particular market requirements.

There is currently little work/research being undertaken in this area through local generators. This is due in part to the cost of the process in comparison to 'normal' fertiliser production as well as the fact that this reuse comes under the existing exemption (see Section 2.3.3).

2.3.7 Backfilling of mine sites and soil amelioration

Currently the backfilling of mine sites, including haulage roads, accounts for 27% of the reuse of ash in Australia and New Zealand (ADAA, based on 2006/2007 figures). The Cooperative Research Centre for Coal in Sustainable Development (including Delta Electricity) has undertaken extensive environmental assessment with industry on the use of ash in mine backfill (Ward et al 2006). Backfilling of mine sites allows for the rehabilitation of the sites, provides ground support, subsidence control and the potential to improve soil structure and land use potential of the site. Ash also functions similarly to lime and gypsum as an inorganic soil additive, improving the pH and increasing the nutrient levels making it suitable for compacted clay soil and nutrient-poor sandy soils.

Given the unfavourable water quality (e.g. acid pH) associated with mining, the main beneficial use of ash for mine backfill, especially overseas, has been derived from the interaction of alkaline ash with mine solids, (Heindrich et al 2007).

Fly ash has also been used as a contaminant barrier to reduce the escape of waterborne contaminants from potentially toxic mine products such as preparation tailings, and as an additive to enhance the fertility of mine soils in reclamation programs (Heindrich et al 2007).

While the open-cut mines in the Hunter and Newcastle region lend themselves to ash backfilling, most mines in the Lithgow area are underground. Some of the issues to consider in such operations are the occupational health and safety risk resulting from subsidence during the backfilling operations, operational hazards associated with pumping wet ash into underground mines, and that many of the sites are flooded due to groundwater ingress, (Department of Primary Industries 2007, pers comm., September). While the Department of Primary Industries is responsible for mine site rehabilitation, many of the closed and derelict mine sites in NSW are not known and mapping is difficult to interpret (Johnson 1998). The existing Kerosene Vale site and proposed storage area is an old mine site.

Further to this is the consideration of the costs associated with transporting ash from the power station site to another mine site, which subject to proximity, is often cost prohibitive for power station operators.

2.3.8 Reuse of bottom ash

Bottom ash can be used as part of stability berms and other site stability structures to minimise the need to use naturally extracted materials and reduce the requirement to place ash in the repository area, which would increase the operational life of the proposal. In this respect, options for the design of the stabilisation structure have assessed the properties of the bottom ash and provide for its use within this structure. On the basis of this assessment, a structure using bottom ash and clinker is currently proposed for stabilisation of the Stage 2 area and will be subject to final design.

Delta Electricity will continue to look at opportunities to use bottom ash within site works and with third parties to minimise demand on natural resources and extend the life of the proposed Stage 2 ash repository. This will be undertaken on a project-specific basis and will incorporate an assessment of any environmental impacts associated with the use of bottom ash. If impacts are considered likely, mitigation measures to allow for the reuse of bottom ash will be investigated. This is an ongoing part of the ash management strategy for Delta Electricity.

2.4 Consideration of ash storage options

2.4.1 Options for ash storage

The following storage options for ash from Wallerawang Power Station have been considered:

- Kerosene Vale ash repository area
- Mount Piper ash placement site
- Sawyers Swamp Creek Ash Dam (SSCAD)
- A new green field site.

2.4.2 Ash storage at Kerosene Vale ash repository area

The Kerosene Vale ash repository is located approximately 1.5 kilometres from the Wallerawang Power Station. As documented in Delta Electricity's Kerosene Vale Dry Ash Placement Environmental Management Plan (2005), the combined Stage 1 and Stage 2 areas of the Kerosene Vale ash repository have capacity to store approximately 7.8 million cubic metres of ash (approximately 16 years of storage based on 2001 rates of production). Recent investigations, optimisation of fly ash storage, and current and projected rates of ash production estimate that, given approval for use of the Stage 2 area, ongoing storage of ash at the Kerosene Vale ash repository could continue for approximately 11 further years. However, the approved Stage 1 operations area will reach capacity in 9 months, the Stage 1 area having been in operation for 5 years.

The considerations with respect to development of the proposed Stage 2 ash repository area at Kerosene Vale are:

- By-product ash would be placed in an area that has previously been used for ash placement, resulting in reduced environmental impacts compared to use of a new location.
- The proposed ash placement strategy is based on a proven method used during the existing Stage 1 operations at the site.
- The proximity of the Kerosene Vale ash repository area to the Wallerawang Power Station would mean reduced ash haulage related impacts and associated costs.
- The location of the ash repository within the Delta Electricity site removes the need for ash haulage trucks to travel on the public road system.
- Existing infrastructure and equipment at both the power station and the Stage 1 area could be used during the proposed Stage 2 ash placement activities.
- The design of the proposed Stage 2 works would allow for ash stored at Kerosene Vale to be extracted and re-used in industry should feasible reuse options and industry demand develop at a later stage.

2.4.3 Ash storage at Mount Piper

The existing ash storage site at Mount Piper is located 7 kilometres from the Wallerawang Power Station.

This option would involve transporting ash produced at the Wallerawang Power Station to the existing dry ash storage facility at Mount Piper. The considerations with respect to this option are as follows:

- By-product ash would be placed in an area that has previously been used for ash placement, resulting in reduced environmental impacts compared to use of a new location.
- The proposed ash placement strategy is based on a proven method currently in use at the site.
- Existing infrastructure and equipment at both the Wallerawang Power Station and the Mount Piper ash emplacement facility could be used.
- Increased traffic associated with ash transport would increase noise and other amenity impacts on communities surrounding the Mount Piper and Wallerawang power stations as ash would be transported via the public road system. Transport of ash via public roads would also increase the potential for other off-site impacts. It is estimated that transport of ash from Wallerawang to Mount Piper would require 60 truck loads of ash along the Castlereagh Highway 7 days a week. It is considered that the associated impacts of such truck numbers on a public road in comparison to haulage on a private road (as would be undertaken under the proposed Stage 2 expansion) would be significant.
- The volume of fill deposited at Mount Piper would be substantially increased, which would decrease the life span of the existing Mount Piper ash storage facility. Based on a yearly storage requirement of 450,000 tonnes of ash, each year that ash from the Wallerawang Power station was stored at Mount Piper would shorten the life of Mount Piper storage area by 58%. If the facility at Mount Piper fills more quickly than expected, new land at Mount Piper, or a new process would be required to store the ash generated

at both Mount Piper and Wallerawang power stations, not just that from the Wallerawang facility.

- The operation of the storage facility at Mount Piper would be intensified beyond that intended in the original design, which could result in unforeseen off-site impacts.
- Operating costs for this option would be high.

2.4.4 Ash storage at a new greenfield site

There is a possibility to establish an alternate site for the placement of ash at a 'greenfield' site in proximity to Wallerawang Power Station to ensure efficiencies of operation and economic viability.

This option would involve transporting ash produced at the Wallerawang Power Station to a proposed new location via public roads. The considerations with respect to this option are as follows:

- A significant purchase of land is likely to be required, which will require a significant capital cost for the power station operators when compared to alternate options.
- Increased traffic associated with ash transport would increase noise and other amenity impacts on communities surrounding the Mount Piper and Wallerawang power stations as ash would be transported via the public road system. It is estimated that transport of ash from Wallerawang would require 60 truck loads of ash 7 days a week, including public holidays. It is considered that the associated impacts of such truck numbers on a public road in comparison to haulage on a private road (as would be undertaken under the proposed Stage 2 expansion) would be significant.
- Use of a greenfield site would result in an increased footprint for Delta Electricity's operations and potential for associated sterilisation of additional land. Sterilisation impacts may include impacts on mine resources and loss of productive agricultural land.
- A greenfield site would enable the development of a new facility specifically designed for the storage and management of ash that could potentially be designed to receive larger volumes of ash, but this may require a significant lead time and capital investment prior to realisation. This schedule constraint may mean that the current Stage 1 placement area would reach capacity prior to the establishment of a greenfield site and result in impacts on Wallerawang power generation operations.
- Use of a greenfield site may result in additional visual impacts from Delta Electricity's operation through the creation of a new site and may further impact on the regional visual context of the area.

2.4.5 Ash storage at Sawyers Swamp Creek Ash Dam (wet ash)

Should the power station operations be changed back to wet ash disposal, ash storage at the SSCAD could be considered. However, given that capacity constraints associated with SSCAD were the impetus to move to a dry ash production process and the use of the Kerosene Vale site for storage of the dry ash by-product, the use of the SSCAD to store wet ash is not a viable long-term option. In addition, the limited remaining capacity at the SSCAD needs to be retained for water management and for emergency ash storage purposes.

2.4.6 The preferred option

The preferred option is to extend the current Stage 1 ash placement activities and operate a dry ash repository area at Kerosene Vale over the Stage 2 area (see Figure 1-2).

The Stage 2 Kerosene Vale ash repository area provides a long-term storage option with minimal change in operational requirements from Stage 1, as the proposed Stage 2 activities would operate in a similar manner. This option would be implemented in accordance with placement techniques and activities identified for the current Stage 1 operations, which minimise off-site dust, noise and visual impacts to residents of the adjoining Lidsdale area. For example, earthen benches or lifts along the western side of the repository against which ash is placed in layers and which can be promptly vegetated will be utilised to minimise these impacts.

The preferred option would provide Delta Electricity with sufficient operational capacity to address the current level of operations at the Wallerawang Power Station for approximately 11 years. The preferred option also provides for the reuse of ash if viable options are identified in the future. A detailed description of this option is provided in Chapter 3.

2.5 Consideration of creek realignment options

2.5.1 Options for creek realignment

In order to undertake the preferred ash storage option at Kerosene Vale ash repository, it will be necessary to realign a section of Sawyers Swamp Creek to facilitate the installation of structural stabilisation works of Kerosene Vale ash repository. The existing course of Sawyers Swamp Creek through the site has been subject to realignment and channelisation in the past, as a result of past land use in the area. As such, the section to be realigned does not constitute a natural waterway. The following options have been considered for this creek realignment:

- undertake placement activities without the relocation of Sawyers Swamp Creek
- relocate to the southern side of the ash repository
- relocate to the original Sawyers Swamp Creek alignment
- realign a minimal section to enable the stabilisation works.

2.5.2 Undertake placement activities without relocation of Sawyers Swamp Creek

It is possible to undertake placement of ash in the identified Stage 2 area of Kerosene Vale ash repository without the requirement to realign Sawyers Swamp Creek. The initial stages of the proposed development do not require this realignment. However, there are several considerations in relation to the use of a reduced area of Kerosene Vale ash repository:

- The inability to install stability structures would reduce the capacity and thus the design life of the proposed Stage 2 operations resulting in a need to identify additional alternative storage arrangements through the design life of the project. It has been estimated that placement would be limited to areas over the pine plantation, to be sufficiently offset from areas that would require a stabilisation berm. This design would reduce capacity to approximately 37% of the total proposed placement area, and reduce design life to less than 5 years. (Placement areas are shown in Appendix A.)

- The existing creek along the northern edge of the ash repository is currently not geomorphically stable and in the longer term may erode the existing stability structures in this area and result in the need for creek realignment at some future time to address this ongoing issue for safety reasons and to stabilise existing structures.
- There would be a project cost saving due to reduced earth works and enabling works, but this would be offset by requirements to construct alternative storage facilities to meet the proposed design life of the project.
- There would be no opportunity to improve the stability and quality of the creek (which has been affected by previous realignment and land use practices) through the realignment process.
- There would be no impact on the aquatic ecology and the river environment if realignment was not required.
- There would be no change to the current flood and flow regimes.

2.5.3 Return to natural creek alignment

The original alignment of Sawyers Swamp Creek runs along the base of hills located to the north of the proposed ash repository area. An option for creek realignment would be to return the creek to this realignment. The considerations with respect to this option are:

- The creek would be returned to its natural realignment below Sawyers Swamp Creek, providing an opportunity to rehabilitate the creek and improve its quality within the original creek location.
- The original creek realignment is no longer in its original form and no longer supports creek ecology. Whilst it could be rehabilitated, significant earthworks would be required, resulting in a longer disruption to the creeks flow regime.
- The realignment would cross third-party properties and result in additional costs in relation to land ownership.
- Capital cost associated with this realignment have been estimated to be approximately 1.4 times the cost of the option described in Section 2.5.5 due to the increased length of realignment and associated rehabilitation and earth works as well as a requirement for a new culvert under the private haul roads.
- The realigned creek would cross significant mine reserve areas and potentially sterilise these areas unless relocated to undertake mining activities.
- Impact on culverts and roads in the area with associated redesign and disruption.

2.5.4 Relocate to southern side of ash repository

The creek could be moved to a new location away from the existing activities to reconnect with the creek further downstream. There are several route options that could be considered to the south of the Kerosene Vale ash repository. All of these options would have the following considerations:

- Highest capital costs of the proposed options as this option would require construction of the longest section of creek realignment. It has been estimated that this would cost in the order of 5 times the cost of the option described in Section 2.5.5, excluding costs of third party property, due to increased length of alignment requiring additional excavation and riparian zones, additional erosion and control measures due to the steep terrain in this area, and the requirement for a new culvert under the private haul road.

- The realignment would cross third-party property, requiring agreements to undertake the activities, which may not be possible within the proposed timeframes.
- The realignment would cross significant areas of mining holdings. It is unclear what the proposed plans are in relation to exploration leases over these, as a result this option has the potential to impact on these reserves.

2.5.5 Minimal realignment of creek to facilitate stabilisation

The realignment of the smallest section of the creek feasible to enable the stabilisation works would involve the movement of approximately 380 metres of creek to the north (Figure 2-1). The considerations for this option are:

- This option has the lowest capital cost compared to other realignment options and has been estimated at approximately $0.7M.
- Stabilisation works to be completed to enable the Kerosene Vale ash repository to meet its intended design life.
- Minimal disturbance to the creek and possibility of rehabilitating this section of the creek.
- Limited impacts to Delta Electricity property and does not impact on third-party property areas.
- Has the potential to impact on mining leases as described in Chapter 12.
- Existing stability issues can be addressed.

2.5.6 The preferred option

The preferred option is to undertake the minimal creek realignment to enable the Stage 2 activities (see Figure 2-1). This option requires works only on Delta Electricity land, requires the minimum amount of realignment of Sawyers Swamp Creek, and enables the Kerosene Vale ash repository to meet its initially proposed design life of 11 years.

The preferred option would provide Delta Electricity with sufficient operational capacity to address the current level of operations at the Wallerawang Power Station for approximately 11 years once stabilisation structures are completed. A detailed description of this option is provided in Chapter 3.

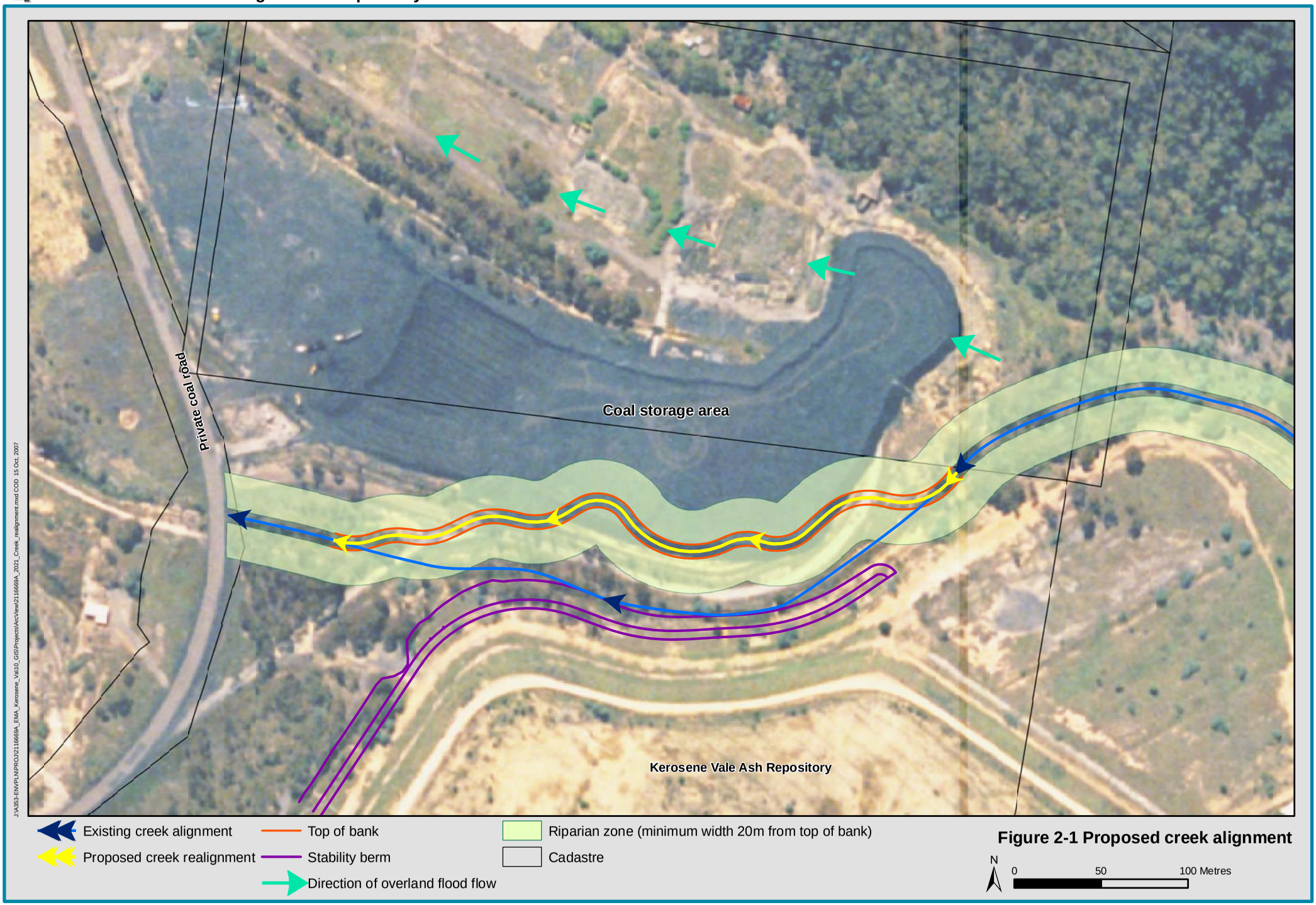

Figure 2-1 Proposed creek alignment

3. Description of the proposal

3.1 Location and site history

The Kerosene Vale ash repository area is located approximately 2.5 kilometres north-east of the Wallerawang Power Station and approximately 10 kilometres north-west of the city of Lithgow (see Figure 1-1), which is 150 kilometres west of Sydney.

The nearest residences to the site are at Lidsdale, approximately 1.5 kilometres to the west, while the community of Wallerawang is located approximately 4.5 kilometres to the south-west. The site falls within the Lithgow Local Government Area.

Kerosene Vale is within the Sawyers Swamp Creek Catchment, which flows into the Coxs River and forms part of the Sydney Drinking Water Catchment.

The Kerosene Vale ash repository area was originally constructed between 1960 and 1990; during which time it was filled with a combination of by-product ash from the Wallerawang Power Station and mining spoil. The ash repository area was capped in around 1990.

In 2001, Delta Electricity determined that there was an operational need to change from wet to dry ash producing activities at Wallerawang Power Station. As a result of this decision, it was necessary to identify an area for the placement and storage of by-product ash. Owing to its historic use for this purpose, the Kerosene Vale ash repository area was identified as a suitable site. Since this change in operations and the 2002 Stage 1 activities approval, the area over the Kerosene Vale ash repository area has been used for ash placement and site management activities associated with the operation of the Wallerawang Power Station (see Figure 1-2).

The proposed Stage 2 activities would use the extended area of the Kerosene Vale ash repository and would cover the area from the open face of the Stage 1 area to the edge of the original storage area (Figure 1-2).

All Stage 1 and Stage 2 areas that have reached the design height of 940 metres Australian Height Datum (AHD) would be capped.

3.2 Construction activities

In order to enable the proposed Stage 2 placement activities to be completed safely a number of engineering works would be required at various stages of the development. These works, which would be undertaken in parallel with ash placement activities to coincide with operational requirements, include:

- Realignment of Sawyers Swamp Creek (in approximately March 2009).
- Construction of stabilisation structure on the northern embankment (March/April 2009 — following realignment).
- Development of surface water-retention structure in line with surface water management measures (from commencement — July 2009).
- Relocation of existing water transfer system from SSCAD and associated retention canal (approximately December 2009 in line with ash placement progress — see staging drawings in Appendix A).

Construction activities would be undertaken in two periods: Phase 1 would comprise construction of the stabilisation berm, realignment of Sawyers Swamp Creek and installation of surface water-retention areas. The Phase 2 of construction would comprise the relocating of existing surface water drainage systems once the alternative retention system is complete.

The construction workforce for these activities would be limited and is anticipated to peak at approximately 20 personnel. This work will form part of the ongoing management contract for the ash placement area. As staff would be sourced from the existing operations staff, construction traffic movements associated with construction would be limited.

Construction truck movements will be limited to site other than for the initial mobilisation and demobilisation. Earth works for the site have been estimated to include 17,500 m^3 of excavation works, which is offset by fill requirements of 19,000m^3. It is intended that wherever possible ash material will be used within structures such as the stabilisation berm to enable initial cut material to be used as part of capping and other site activities. This approach will restrict offsite truck movements to mobilisation and demobilisation, and as such minimise traffic impacts on the local community.

The precise scheduling of these activities would be finalised following final design activities. All construction activities would be undertaken in accordance with a Construction Environmental Management Plan and staged in accordance with ash placement activities. Construction will occur in parallel to operational activities as placement of ash in areas over the former pine plantation can be undertaken prior to completion of proposed construction activities. In this respect the monitoring activities proposed within later sections of this environmental assessment for operations will be in place prior to the commencement of construction activities and as such will be utilised for both construction and operational monitoring.

The proposed progress of placement areas is further outlined in Section 3.3. Each of these activities is further described in the following sections and the impacts of these activities are assessed in chapters 7 to 13. All construction activities will be undertaken between 7 am and 6 pm Monday to Friday and 7 am and 1 pm Saturdays, with no work on Sundays or public holidays. Operational activities are discussed in Section 3.3.

3.2.1 Creek realignment

To establish the required stabilisation structures as described in Section 3.2.2 a small section of Sawyers Swamp Creek would require realignment. This section is located on the northern side of the ash repository area and is approximately 400 metres long (see Figure 2-1).

The design of the proposed realignment has been undertaken in consultation with the Department of Water and Energy and other relevant stakeholders. The initial design requires the creek to be moved 380 metres north and would have a cross-sectional width of approximately 52 metres inclusive of a 20-metre riparian zone (buffer) as required by the Department of Water and Energy. The final detailed design will be required to provide a geomorphically stable structure and would include allowance for key structures. Key structures, including riffle and pool structures to allow the creek to be as close as practical to natural channel morphology, are further outlined in the draft rehabilitation plan provided as Appendix B.

The construction of the creek realignment would require the excavation and establishment of the revised channel using excavators and earth-moving equipment prior to the installation of features to mimic the natural creek flow and development of a construction road access. The construction would be sequenced to complete the revised alignment prior to the transfer of creek flow from the current alignment. The design flow is 4.3 metres per second, based on a capacity to hold the 2-year flood event in line with the Department of Water and Energy design guidance for creek realignment.

Following the completion of construction activities the creek would be rehabilitated in line with the finalised rehabilitation plan, which would be provided to the Department of Planning and the Department of Water and Energy for final approval. A draft of this document is provided in Appendix B.

On completion of the rehabilitation activities the realigned section of creek is anticipated to be of an improved quality in comparison to the existing quality. Details of ongoing monitoring requirements to assess the success of the rehabilitation and to enable the modification of management practices are outlined within the rehabilitation plan (Appendix B) and further discussed under operational requirements (Section 3.3).

It is anticipated that the construction phase of the proposed Stage 2 ash repository would be approximately 6 months. The impacts of the construction activities are discussed within the environmental assessment provided in chapters 7 to 13. All construction activities would be required to comply with the project CEMP. This document would be prepared and provided to the Department of Planning prior to the commencement of construction.

Final mitigation and control measures would be incorporated into the CEMP, which as a minimum, would include:

- Soil erosion and control measures.
- Measures to prevent site runoff to Sawyers Swamp Creek during construction.
- Dust management measures.
- Construction hours will be 7 am - 6 pm Monday to Friday and 7 am - 1 pm Saturdays, with no work on Sundays or public holidays.

3.2.2 Bund wall strengthening

In order to stabilise the existing dam structures and ensure the long-term stability of the ash repository area the existing bund wall at the Kerosene Vale ash repository would be buttressed and strengthened. This will require the installation of a stabilisation berm along the length of the existing bund (see Figure 2-1).

The berm would be 7.5 metres wide at the base and 5 metres wide at the top with a factor of safety of 1.4 along the length of the northern berm wall. This structure will ensure the overall stability of the repository area in the longer term. Cross-sections of this structure are provided in Appendix A.

Several materials have been assessed to determine their appropriateness for the construction of the stabilisation berm. Alternative material sources are preferred to minimise the use of virgin natural excavated material and to maximise on-site re-use of the ash by-product. The following three material options were considered for construction of the berm:

- General earth fill material such as sandstone.
- Mix of clinker and bottom ash.

- Bottom ash.

All materials demonstrated sufficient factors of safety to enable their use for the construction of the stabilisation berm. On this basis the preference is to construct the stabilisation structure using clinker and bottom ash to maximise the reuse of ash material and improve the life and available space of the repository areas within the Kerosene Vale ash repository area that form the basis of this proposal.

The final detailed design of the stability structures would be completed in an integrated manner with the completion of the design of the creek realignment. Final mitigation and control measures would be incorporated into the CEMP and as a minimum would include:

- Soil erosion and control measures.
- Measures to prevent site runoff to Sawyers Swamp Creek during construction.
- Dust management measures.
- Construction hours will be 7 am - 6 pm Monday to Friday and 7 am - 1 pm Saturdays, with no work on Sundays or public holidays.
- Site surface water runoff control measures.

Construction activities would occur over a 6-month period and would involve the use of excavators, heavy earth-moving equipment and truck movements on private haul roads. These activities and associated impacts are discussed within the environmental assessment provided in chapters 7 to 13.

3.2.3 Water management

In order to manage surface water runoff and prevent discharge to the creek, and ultimately the Coxs River, it will be necessary to manage operational water use and surface water runoff on the site throughout the life of the project.

During existing Stage 1 activities, water is captured within the settlement canal located on the eastern edge of the Stage 1 area. This canal would be maintained through the initial Stage 2 placement activities; however, this structure may be relocated within the north-east corner of the proposed Stage 2 area as ash placement moves towards this area during the later stages of operation. Additionally, the 3 megalitre (ML) dirty water collection system will be modified and relocated to allow the existing canal and transfer piping from SSCAD to be relocated from within the ash location area to the southern side of the ash storage area. A brief description of construction activities for the water infrastructure is provided below; details of operational water usage are outlined in Section 3.3. There is an existing retention basin on the north-east side of the repository. (See Chapter 8).

Water-retention basin

The water-retention basin would be relocated to replace the existing structure to ensure that all site run off is captured as ash placement progresses to the north during ash placement activities. This system would be designed to minimise impacts on Sawyers Swamp Creek and ensure water from the disturbed area is captured (less than 0.5% of total Sawyers Swamp Creek catchment). The construction of the water-retention basin would involve the excavation and/or building of an earth bund using material excavated from the pine plantation area located in the north-eastern area of the site (see Chapter 8). The final sizing of this structure has been estimated at 25 ML based on the existing structure and overall surface water assessment provided in Chapter 8 to allow for flood events. This sizing will ensure the capture and management of all surface water runoff from open faces on the site

and prevent runoff of material with contaminants or high sediment load. Under normal operations (non-storm events) the smaller 3 ML system will be used to capture runoff.

The construction of this structure will form part of the creek realignment and bund wall development and would be completed during the same 6-month construction period and managed in accordance with the CEMP for these activities. Following completion of this structure the existing settlement canal used for the transport of water from SSCAD to Delta Electricity's facility would be relocated. This is further discussed below.

Settlement canal realignment

The existing settlement canal on the eastern edge of the Stage 1 repository area would be rerouted or modified to allow the continued reuse of water from the SSCAD — adjacent to the Kerosene Vale ash repository area — in the operation of the Wallerawang Power Station.

The realignment of this structure is anticipated to be along the southern edge of the Kerosene Vale ash repository area and would involve the construction of a new canal or pipeline (see Chapter 8).

The construction of this structure would be completed following completion of the creek realignment and development of alternative retention structures and managed in accordance with the CEMP for these activities. It is anticipated that the development and realignment will take approximately 8 weeks, use similar machinery to other construction activities and primarily involve the use or earthwork machinery.

3.3 Operational activities

Ash placement activities during the operation of the proposed Stage 2 area would be similar to those associated with the existing Stage 1 area, as detailed in the following sections. Prior to the commencement of the proposed Stage 2 operations, Delta Electricity would prepare an Operational Environmental Management Plan to incorporate commitments as outlined in Section 14.2. The section below outlines the operational processes for the placement of ash that form the basis of this environmental assessment. It should be noted that operational activities will commence prior to or in parallel to construction activities as placement of ash in areas over the former pine plantation area can occur prior to the completion of construction activities. In this respect operational monitoring activities discussed in this environmental assessment would be in place prior to construction and as such would be utilised for both construction and operational monitoring

3.3.1 Ash delivery

Ash generated as a by-product of the operation of the Wallerawang Power Station would be pneumatically conveyed from the power station to two storage silos. The ash would then be conditioned to approximately 15% moisture content to minimise the potential for dust generation and enhance compaction on placement over the Kerosene Vale ash repository area.

The dry conditioned ash would be transported from the storage silo via an existing haul road in semi-trailers or trucks with attached dog-trailers. It is estimated that approximately 60 vehicle trips per day would be required. All truck loads would be covered during transport.

3.3.2 Ash placement activities

On delivery to the Kerosene Vale ash repository area, the dry conditioned ash would be deposited at the operating ash placement area. Lifts, compactors and bulldozers would be used to place the ash in stable landforms and to establish adequate and appropriate drainage. Ash placement would occur in stages, with placement commencing in the easterly corner working back to the boundary with the Stage 1 area and then north towards Sawyers Swamp Creek. Proposed placement staging is provided in Appendix A. Ash placement can be broadly described as including the following processes:

- Identifying the current operational location for placement of ash, which is normally an approximately 18 metre face.
- Placing ash at the existing face using truck and shaping of ash with a bulldozer.
- Compacting the ash material using bulldozer and driving over area of placement.
- Repeat process in 2-metre-high benches with batter slopes of 2.5:1 to lower benches.
- Once the design height of 940 metres AHD is reached, cap with material to be sourced from the pine plantation area and other locally available material and commence replanting and restoration activities.

The Stage 2 ash placement activities at the Kerosene Vale ash repository area were initially proposed to occur 24 hours a day to align with Wallerawang Power Station power production operations. However, the environmental assessment identified the need for a noise barrier to allow 24 hour operation to occur. As an alternative to a noise barrier, Delta Electricity are now proposing operation would be limited to between 7 am and 10 pm, with truck movements and ash placement to be undertaken outside of these hours only in emergency or abnormal operational situations. Under abnormal situations, truck movements will be limited to five trucks per 15-minute period, based on the noise assessment described in Chapter 11.

Capping of exposed ash areas would be undertaken progressively as the Stage 2 area reaches the design height of 940 metres AHD. Material for capping would be obtained from the pine plantation area used for Stage 1 area capping material. The pine plantation area would be excavated to provide space for ash placement and capping material for both Stage 1 and Stage 2 areas. Material recovered from this area may be temporarily stored on site to manage placement activities.

On completion of ash placement in this area the site would be decommissioned and revegetated. At this stage the design life of the facility has been estimated at 11 years based on current power production and associated ash quantities. This life may be extended if viable reuse and recycling options are identified or power production levels are altered significantly (see Section 2.2).

3.3.3 Water management

The proposed operational activities at the Stage 2 ash repository area would require a limited amount of water as water would only be used for dust suppression, and where required for compaction purposes. This is due to water content of the ash being 15–22% prior to transport to the ash repository area. All water required for the operational placement of ash would be sourced from either the site retention basins or the existing storage of SSCAD. It should be noted that the proposed development would not require any additional water during operation beyond water used for current Stage 1 area operations.

The management, collection and monitoring of surface water to ensure site runoff is contained would also be undertaken as part of the current development activities. Site specific management practices would be put in place to prevent site runoff from exposed ash surfaces from entering Sawyers Swamp Creek. Site management measures would be incorporated into the site OEMP and as a minimum would include:

- Development of a retention basin (or use of the existing basin) to capture site surface water runoff (see Section 8.4).
- Placement of ash with designated slopes to direct water to retention areas.
- Diversion of clean water away form disturbed areas to existing surface water drains and Sawyers Swamp Creek to provide environmental flows.
- Capping and revegetating completed areas to enable the diversion of clean water to site drainage systems.
- Sediment and erosion controls.

As part of the existing Stage 1 works, surface water monitoring is undertaken to assess any change in receiving water quality. Monitoring would be continued throughout the proposed Stage 2 activities. Details of the proposed monitoring regime are outlined in the relevant chapters, and a full list of proposed monitoring is provided in Chapter 14.

The generation of leachate from the ash storage activities during Stage 1 operations has been reduced through the implementation of a range of mitigation measures. These measures would be continued throughout the proposed Stage 2 activities and operations will be undertaken in line with an OEMP to be developed for the Stage 2 activities. These measures are discussed in greater detail in Section 8.4 and would include:

- Recycling and reuse of runoff from the ash repository area.
- Recycling of water from the water-retention basin and perimeter drains and for reuse at the Kerosene Vale ash repository area or the Wallerawang Power Station.

Surface drainage from the ash repository areas area would be captured to minimise impacts on Sawyers Swamp Creek and for reuse in site operations, thereby minimising potable water use. Recapture water would be stored in a retention basin as described above. Surface water runoff from capped areas would be directed to Sawyers Swamp Creek to maintain environmental flows within the creek. Monitoring of surface water flows to the creek would be undertaken on an ongoing basis to ensure water runoff to the creek is of an acceptable water quality. Details of the proposed monitoring are provided in Section 3.3.4 and Chapter 8.

Further details on the environmental impacts of the project on water management issues are described in Chapter 7 and Chapter 8.

3.3.4 Maintenance and monitoring of the realigned Sawyers Swamp Creek

During detailed design, performance and completion criteria will be established for the proposed creek realignment and riparian zone. A program to monitor and maintain the realigned creek and associated riparian zone will also be developed. The program will include assessment of erosion and scour, management of exotic weeds, and provision of

contingency plans to respond to any issues arising in association with the new creek channel and/or riparian zone.

Once completed the realigned section of the creek would be monitored against reference sites identified during the environmental assessment process to ensure the rehabilitation plan is operating effectively and that the desired outcomes are being achieved. The reference sites are discussed in Chapter 9 and details of the proposed monitoring are further outlined in the draft rehabilitation plan provided as Appendix B.

As a minimum, reference monitoring would be undertaken over the first 5 years of the development in order to adjust rehabilitation programs to meet outcomes. It is anticipated that in the first year monitoring will be undertaken quarterly. This monitoring will include additional monitoring following wet weather events, with a minimum of two events recorded within the first 12 months of operation, to ensure that the implemented water quality controls are operating effectively and preventing impacts during wet weather events.

Water quality monitoring for the creek would be undertaken as part of overall site monitoring activities, which are outlined in Chapter 14.

4. Planning and approvals

4.1 Part 3A and the project approval process

4.1.1 Background

In order to store the ash produced as part of power production at Wallerawang Power Station, Delta Electricity identified a need for additional ash storage in 2001 due to capacity constraints at SSCAD. This required a change from wet ash to dry ash operation.

The Kerosene Vale ash repository area was identified as a suitable site since the area has historically been used for the purpose of ash placement in conjunction with the operation of the Wallerawang Power Station since 1960. The Kerosene Vale ash repository site was divided into two stages. The existing Stage 1 and proposed Stage 2 ash repository areas are shown on Figure 1-2.

The Stage 1 ash placement activities at Kerosene Vale were approved under Part 5 of the Environmental Protection & Assessment Act, 1974. As the Stage 2 activities comprise an extension to the approved Stage 1 activities, they also fall under Part 5 requirements. The Stage 1 works were deemed to not have a potentially significant environmental effect, due to the small area of impact and short-term nature of the activities. However, the review of environmental factors (REF) undertaken for Stage 1 (ERM Hyder 2002) indicated that an EIS under Part 5 would be required for the Stage 2 activities (the proposal) as these activities would have an extended life, would affect a larger area, and would require the realignment of Swayers Swamp Creek, which was considered to potentially have a significant environmental impact. On this basis, an EIS was anticipated for the Stage 2 activities.

4.1.2 Why Part 3A?

Delta Electricity has requested project approval for the proposal under Part 3A of the EP&A Act.

Part 3A applies to development that is declared to be a Part 3A project by either a state environmental planning policy (SEPP) or a Ministerial Order published in the Government Gazette (under Section 75B of the EP&A Act). In July 2005, the Minister issued an Order declaring that development that is an activity for which the proponent (that is not a local council or county council) is also the determining authority and that, in the opinion of the proponent would (but for this Order) require an EIS to be obtained under Part 5, is development to which Part 3A applies (refer NSW Government Gazette No. 96).

The proposal falls under this Order as the proponent (Delta Electricity) is also the determining authority and has determined in consultation with the Department of Planning that this project would require an EIS under Part 5, and as such Part 3A approval applies. The Part 3A planning approvals process is outlined in Figure 4-1 and discussed below.

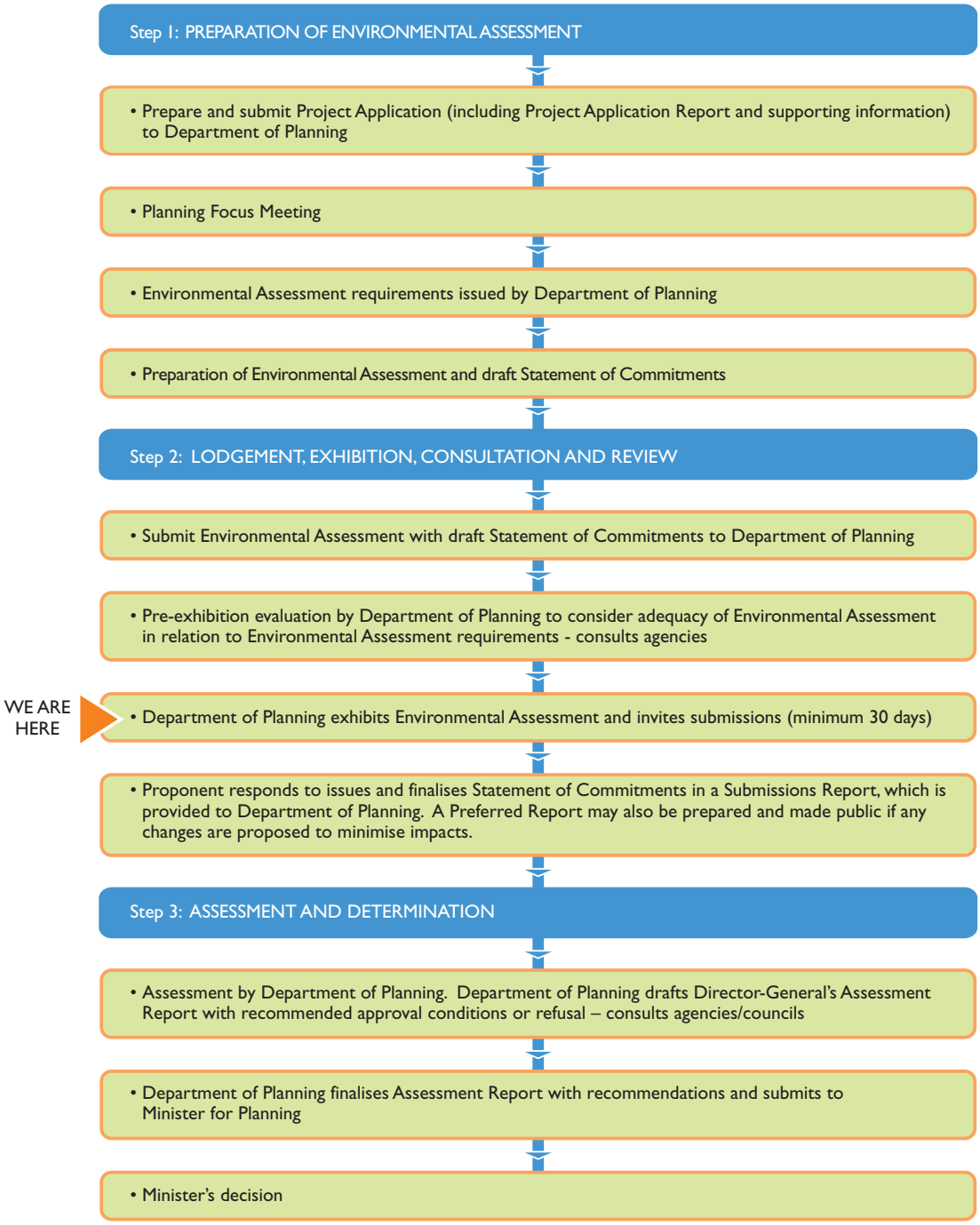

Figure 4-1 Approval process under Part 3A of the Environmental Planning and Assessment Act 1979

4.1.3 What is project approval?

Delta Electricity has requested project approval for the proposal under Part 3A of the EP&A Act. The process of project approval commenced in December 2006 when a Project Application was lodged with the Department of Planning nominating key environmental issues and seeking requirements for the preparation of the Environmental Assessment.

Project approval recognises that the project is at an advanced stage of planning in comparison to a project seeking 'concept' approval. This means that detailed information about the proposed project is available to be included and the key environmental impacts can be addressed in detail in the Environmental Assessment.

Project approval from the Minister for Planning would allow Delta Electricity to progress the proposal to the construction and operation phase, subject to the Conditions of Approval. The Conditions of Approval for the project may include requirements for additional approvals to be sought from the Department of Planning or other regulatory authorities.

4.1.4 The Project Application and Preliminary Environmental Assessment

Prior to the preparation of this Environmental Assessment, Delta Electricity was required to submit a 'Project Application' for the proposal to the Department of Planning. The Project Application also provided the opportunity for Delta Electricity to assess the issues that it believed would require further consideration in the Environmental Assessment.

The Project Application was supported by a Preliminary Environmental Assessment (PB 2006). The Preliminary Environmental Assessment comprised an assessment of the potential environmental impacts of the proposal, including hydrology and water management (flooding, surface water and groundwater); air quality; noise; biodiversity; Indigenous and historic heritage; visual impacts and landscaping issues; traffic and transportation; and land use. The document also included details of the project history, development and need and statutory planning context. As part of the Project Application and Preliminary Environmental Assessment Report a proposed scope for the Environmental Assessment was determined by the Department of Planning in the form of Environmental Assessment requirements. These are provided in Appendix C.

Details of the project were advertised and the Project Application and supporting information was placed on the NSW Department of Planning website in December 2006. These documents remain available to the public on the Department of Planning website (major projects register) and the Delta Electricity website (http://www.de.com.au/default.aspx?FolderID=295&ArticleID=5424).

4.1.5 Planning focus meeting

A planning focus meeting was held, following advertisement of the Project Application, on 6 February 2007 at Delta Electricity's offices at Mount Piper Power Station. The planning focus meeting was attended by key government agency and council stakeholders, including representatives of the Department of Primary Industries (Fisheries), the Department of Planning, the Department of Environment and Conservation (now DECC), Sydney Catchment Authority and Lithgow City Council. The planning focus meeting provided an opportunity for discussion of the project as detailed in the Project Application Report,

consideration of the scope of the Environmental Assessment provided in the Project Application Report and discussion of any further work that may be required to assess the environmental impacts of the proposal.

A full list of participant organisations at the planning focus meeting is provided in Section 5.2.

4.1.6 Environmental Assessment requirements

Using information provided in the Project Application documentation and discussions during the planning focus meeting, the Department of Planning, in consultation with local and state government agencies, issued requirements for the preparation of the Environmental Assessment. A copy of the Environmental Assessment requirements is provided in Appendix C.

4.1.7 The Environmental Assessment

Under Part 3A, an Environmental Assessment is required to address requirements, called 'Environmental Assessment requirements' (see Appendix C), which are issued by the Director-General of the NSW Department of Planning after consultation with other key government stakeholders. The Environmental Assessment demonstrates that the project proponent (Delta Electricity) has addressed the potential environmental impacts of the project through design development, robust assessment, and the development of appropriate mitigation and management measures.

The Environmental Assessment (this document) has drawn upon information already provided in the Project Application and Preliminary Environmental Assessment Report for the proposal (PB 2006), and also addresses the key issues identified in the Director-General's Environmental Assessment requirements (see Appendix C).

The Environmental Assessment provides a description of the proposal, the changes to the existing environment likely to result from the construction and operation of the proposal, and how Delta Electricity proposes to mitigate or manage any residual impacts associated with these changes.

The Environmental Assessment includes environmental risk assessments (see Chapter 6 and Chapter 16) prepared in accordance with the Environmental Assessment requirements and incorporates input from various government agencies and other stakeholders during the consultation process.

The Environmental Assessment will be submitted to the Director-General of the NSW Department of Planning. Once the Director-General is satisfied that the Environmental Assessment adequately addresses the Environmental Assessment requirements, the Environmental Assessment will be made publicly available for at least 30 days (the exhibition period).

The Environmental Assessment focuses on the key issues identified during the Project Application phase and Environmental Assessment requirements and briefly describes 'other issues' that can be mitigated through the use of standard environmental mitigation measures.

The Environmental Assessment also contains a draft Statement of Commitments (see Chapter 15).

4.1.8 Assessment and Determination of Project

The Environmental Assessment will be made publicly available for a minimum period of 30 days. During this period, the Environmental Assessment will be available for inspection on the Department of Planning website (www.planning.nsw.gov.au), on the project website (http://www.de.com.au/default.aspx?FolderID=295&ArticleID=5424) and at selected Delta Electricity offices and other locations.

A 1800 project information line has been available during the preparation of the Environmental Assessment and will remain available throughout the exhibition period (phone 1800 008 708 toll free).

Any person, including a public authority, may make a written submission to the Director-General of the Department of Planning regarding the proposal and/or this Environmental Assessment during the exhibition period. Submissions should be made to:

Kerosene Vale - Stage 2 Ash Repository Area
Major Infrastructure Assessments
NSW Department of Planning
GPO Box 39
Sydney NSW 2001

A submissions report will then be prepared, collating and responding to the key issues identified in the submissions. If Delta Electricity or the Department of Planning considers that the issues raised require a significant change to the project, Delta Electricity will be required to prepare a Preferred Project Report. The Director-General of Planning may also require Delta Electricity to submit a revised statement of Commitments. Following this, The Director-General will prepare an Environmental Assessment Report pursuant to Section 751 of the Environmental Planning and Assessment Act 1979.

The Minister for Planning will then consider whether to approve the proposal based on:

- the Project Application and supporting information
- the Environmental Assessment Report
- the Submissions Report (and Preferred Project Report, if required)
- the report from the Director-General of the Department of Planning
- any advice that may be presented by the Minister for Energy.

4.1.9 Post-approval activities

Should the proposed activities be approved and Delta Electricity makes a determination to proceed, Delta Electricity would:

- Notify the local community of the decision to proceed with the proposal by correspondence, newspaper notices and/or newsletters (such notification would include an indication of the anticipated timing of construction works and contact details for further information).
- Prepare a construction environmental management plan (CEMP) for any construction activities falling outside the scope of the approved Stage 1 activities. The Stage 1 approval includes clearing of the pine plantation and removal of overburden.

- Prepare a detailed operational environmental management plan (OEMP) for application at the commencement of operations and throughout the operating life of the project. This plan would be based on the existing OEMP in use for the Stage 1 ash repository, updated as required.
- Meet all conditions stipulated in the approval either directly or through contractual arrangements with its contractors.

If there is a change to the preferred activity and the Director-General of the Department of Planning requires it, Delta Electricity would make the following documents available for public inspection at selected locations:

- The approval of the NSW Minister for Planning (including any conditions).
- The Submissions Report and Preferred Project Report (if required).
- The assessment report of the Director-General of the Department of Planning.

4.2 Other approvals and relevant planning documents

Section 75U of the EP&A Act states that a number of authorisations are not required for an 'approved project' for which part 3A applies; however, certain approvals may be required. In addition, consideration has been given to the intent of legislation where approvals are no longer required.

4.2.1 NSW Government approvals

A review of other NSW legislation that may be applicable to the construction, development and ongoing maintenance of the project, which may trigger the requirement for further licences, permits and approvals, has been undertaken. This review, in association with the investigations for this Environmental Assessment, did not identify any other requirements, as the project is classified as an 'existing use' for the site (ash placement) and would merely require a minor modification to the existing licence conditions. It has been determined as part of the Preliminary Environmental Assessment (PB 2006) that the proposal is unlikely to affect any threatened species or heritage sites. If any previously unidentified sites are identified during the project implementation, the relevant legislation would be applied and managed through identified practices within the industry.

4.2.2 Commonwealth approvals

The Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is the key piece of Commonwealth legislation of potential relevance to the proposal. Under this Act, proposals that have the potential to significantly impact on matters of national environmental significance, or the environment of Commonwealth land, must be referred to the Commonwealth Minister for the Environment and Water Resources. Matters of national environmental significance include:

- World heritage properties.
- National heritage places.
- Wetlands of international significance.
- Listed threatened species and ecological communities.
- Listed migratory species.

- Commonwealth marine areas.
- Nuclear actions (including uranium mining).

An ecological assessment undertaken as part of the Project Application Report (PB 2006) did not identify any threatened species or communities or any sites identified under Schedule 1 of the EPBC Act. Accordingly, no referral to the Commonwealth Minister for the Environment and Water Resources is required.

No other Commonwealth legislation has been identified as applicable to the proposal.

4.2.3 Other relevant planning instruments

Drinking Water Catchments Regional Environmental Plan No. 1

The Drinking Water Catchments Regional Environmental Plan No. 1 was prepared in accordance with Part 3 of the EP&A Act and the *Sydney Water Catchment Management Act 1998*. The plan was made to secure the environmental, social and economic future of the catchments that supply drinking water to Sydney, the Blue Mountains and the Illawarra. These catchments extend over 16,000 square kilometres, from the headwaters of the Coxs River, north of Lithgow, to the Shoalhaven River, south of Braidwood. The plan aims to sustain these catchments so as to create healthy water catchments, improve water quality in degraded areas, and maintain or improve water quality where it is currently suitable. The plan came into effect on 1 January 2007.

The proposed Stage 2 ash repository requires the realignment of a section of Sawyers Swamp Creek, which feeds into the Coxs River, and is part of the Drinking Water Catchment. Accordingly, the Drinking Water Catchments Regional Environmental Plan No. 1 is relevant to the proposal. As part of the requirements of the Regional Environmental Plan, the detailed assessment would need to consider whether the proposed activity would have a neutral or beneficial effect on water quality. An assessment of the likely impact of the proposed activity on water quality in Sawyers Swamp Creek is included in Chapter 8.

State environmental planning policies

No state environmental planning policies are specifically relevant to the proposal.

4.2.4 Other relevant local planning documents

Lithgow Local Environmental Plan 1994

Delta Electricity is a state-owned corporation under the *State Owned Corporations Act 1989*. Pursuant to Section 4 of the EP&A Act, Delta Electricity is a 'public authority'. Accordingly, the proposal is considered a public utility undertaking.

The proposal site falls within the local government area of Lithgow and is zoned 1(a) Rural (General) under the Lithgow Local Environmental Plan 1994 (the LEP). Under the LEP, the proposed activity within this zone is permissible only with the consent of Lithgow City Council.

However, the LEP adopts the Environmental Planning and Assessment Model Provisions (the Model Provisions). Clause 35 (Schedule 1, paragraph 8) states that, generally, nothing in an LEP may be construed as restricting or prohibiting or enabling the consent authority to restrict, prohibit or enable the carrying out of any development specified in Schedule 1.

The proposal falls within the relevant definition of Schedule 1 of the Model Provisions that specifies development not requiring consent under local environmental plans with respect to public utility undertakings for the supply of electricity. The Stage 2 ash placement activities at Kerosene Vale (the proposal) are an undertaking by Delta Electricity for the purposes of supporting electricity generation. The scope of the proposed activity is to deposit ash in an area historically used as an ash storage facility. Accordingly, the proposal falls under the meaning of Section 2(f) of Schedule 1 of the Model Provisions and is permissible without consent under the Lithgow LEP.

5. Community and stakeholder involvement

5.1 Overview

A communications strategy for the environmental assessment phase of the project was developed as part of the Project Application and Preliminary Environmental Assessment. Based on this strategy, a community and stakeholder consultation plan for the project was developed by Delta Electricity and PB for implementation during the Part 3A environmental assessment process in accordance with the Director-General of the Department of Planning's Environmental Assessment Requirements. The purpose of the consultation plan was to create awareness of the project, gather stakeholder input and ensure that the concerns of those directly affected by the project and the community are identified and addressed during the environmental assessment phase.

The key community and stakeholder consultation activities undertaken during the environmental assessment phase and detailed in this chapter include:

- Key stakeholder meetings with Lithgow City Council and the Department of Planning.
- A planning focus meeting with government stakeholders and service providers.
- Community information letter, advertisements and display.
- Webpage, community information line and project email address.
- Internal communications with Delta Electricity personnel.

Details of all submissions, issues raised and where they are addressed in the Environmental Assessment are included in this chapter.

Submissions made during the exhibition of the Environmental Assessment would be addressed within the Submissions Report to be prepared as part of the next stage of the approvals process.

The remainder of this section outlines consultation to date.

5.2 Community and stakeholder consultation activities

5.2.1 Department of Planning

A briefing letter was sent to the Department of Planning on 12 September 2006 to request a meeting to discuss the proposal and to determine the proposal under Part 3A of the EP&A Act. The letter described the proposal background information and need for the proposal.

A meeting was held with the Department of Planning on 14 September 2006 to discuss the project in further detail. Potential key issues were identified at this meeting and are described in Table 5-1.

Two representatives from the Department of Planning also attended the Planning Focus Meeting. In addition, there has been ongoing dialogue between the Project Team/Delta Electricity and the Department of Planning throughout the preparation of the Environmental Assessment. This will continue throughout the planning approvals process.

5.2.2 Lithgow City Council

Lithgow City Council has been consulted throughout the Project Application and Environmental Assessment phases.

A meeting was held with Council on 23 November 2006 in the initial planning phases to discuss the proposal, comments from the Department of Planning, the need for the project and potential impacts. A letter was also sent to Council following the meeting requesting further input into the proposal.

Council responded to PB's letter on 15 December 2006 and provided a detailed summary of the issues they required to be addressed in the Environmental Assessment.

A representative from Council also attended the planning focus meeting for this project.

The issues raised by Council and an indication of where these are addressed in the Environmental Assessment are provided below in Table 5-1.

Council was informed of the commencement of community consultation activities in the environmental assessment phase on 4 September 2007 via email. At this time they were invited to make further comment on the consultation process and the environmental assessment phase.

5.2.3 Bathurst Local Aboriginal Land Council

A site walkover and consultation was undertaken with the Bathurst Local Aboriginal Land Council to ensure any heritage issues or concerns were identified and addressed in the Environmental Assessment. The site walkover was undertaken on 5 October 2006 and was attended by representatives of Delta Electricity, Bathurst Local Aboriginal Land Council and heritage and ecological subconsultants.

Following the site visit, the Bathurst Local Aboriginal Land Council provided input to the preliminary archaeological and heritage assessment by sending a letter (dated 7 October 2006) to Delta Electricity advising that there are no Aboriginal artefacts., land titles or issues concerning the area within which the proposed Stage 2 ash repository area falls. Further details of the assessment can be found in Section 13.3.

5.2.4 Planning focus meeting

A planning focus meeting was held on 6 February 2007 with key government stakeholders to discuss issues for inclusion in the Environmental Assessment. The following stakeholders attended this meeting:

- Department of Planning
- Department of Primary Industries (Fisheries)
- Department of Environment and Conservation (now DECC)
- Sydney Catchment Authority
- Lithgow City Council
- Delta Electricity.

Submissions were received from Lithgow City Council, Department of Natural Resources (now the Department of Water and Energy) prior to the planning focus meeting outlining their requirements for the Environmental Assessment.

Submissions were sent from the Department of Natural Resources, Department of Primary Industries, Sydney Catchment Authority and Department of Environment and Conservation (now DECC) to the Department of Planning and incorporated into the Environmental Assessment requirements, which were sent on 6 March 2007.

A summary of the issues raised during the Planning Focus Meeting and an indication of where these are addressed in the Environmental Assessment is provided in Table 5-1.

A representative of the Department of Natural Resources (now Department of Water and Energy) undertook a site visit on 2 November 2006.

Additional agency meetings were held during the preparation of the Environmental Assessment as follows. A meeting was held with representatives of the Department of Water and Energy (formerly the Department of Natural Resources) on 27 August 2007 to discuss the requirements for the realignment of Sawyers Swamp Creek. A meeting was held with the Department of Primary Industries (Mineral Resources Division) on 4 July 2007 to discuss issues relating to coal reserves.

5.2.5 Community consultation

This section describes the consultation activities undertaken with the community and local residents:

Resident information letters

A resident letter was prepared and distributed during the preparation of the Environmental Assessment.

This letter advised the community of the commencement of the Environmental Assessment and was sent in September 2007. The letter included a description of the proposal, information about the Environmental Assessment, a map of the site and the nearby village of Lidsdale, Stage 1 and proposed Stage 2 operations, and the proposed realignment of Sawyers Swamp Creek.

Residents were invited to raise any issues or concerns about the project with the project team for inclusion in the Environmental Assessment.

A second information letter will be sent to advise residents of the key outcomes of the environmental assessment process and the public exhibition process, including dates, exhibition locations of and an invitation to make formal submissions on the Environmental Assessment.

An overview of the issues raised by the community to date is provided below in Table 5-1.

Community advertisements

An advertisement was placed in the Lithgow Mercury on 6 October 2007 advising the greater Lithgow community of the commencement of the Environmental Assessment. The advertisement provided information on the proposed expansion, the proposal community information line (1800 008 708), and invited the community to raise any issues or concerns about the project with the project team for inclusion in the Environmental Assessment.

A second advertisement will be placed in the *Lithgow Mercury* to advise the greater Lithgow community of the finalisation and exhibition of the Environmental Assessment, including exhibition dates, locations, and dates and times of staffed exhibitions.

The advertisement invited the community to raise any issues or concerns about the project with the project team for inclusion in the final Environmental Assessment.

A summary of the final issues raised by the community will be incorporated into a submission report.

Internal communications with Delta Electricity personnel

A newsletter was prepared and distributed to Delta Electricity employees during the preparation of the Environmental Assessment.

This newsletter advised Delta Electricity employees of the commencement of the Environmental Assessment and was distributed to Delta Electricity staff on 6 September 2007. The letter included a description of the proposal, information about the Environmental Assessment, a map of the site and the nearby village of Lidsdale, Stage 1 and proposed Stage 2 operations, and the proposed realignment of Sawyers Swamp Creek. A copy of the newsletter and map is included in Appendix D.

A second newsletter will be distributed to advise Delta Electricity employees of the public exhibition of the Environmental Assessment. Exhibition dates, locations and times of exhibitions would also be included.

Public exhibition

The Environmental Assessment will be exhibited for a period of at least 30 days in line with statutory requirements. Displays of the Environmental Assessment exhibition will be located at:

- Nature Conservation Council of New South Wales
- Lithgow City Council
- Lithgow Library Learning Centre
- Wallarawamg Branch Library
- Mount Piper Power Station information centre.

Webpage

A project webpage has been established on Delta Electricity's existing website and includes information about the project. This information includes the Project Application and Preliminary Environmental Assessment. The website was updated as required with new information and updates for the community. The website was referenced on all advertisements community information letters. Contact details for the project team were also provided.

Project email address

A project email address was established to give the community the opportunity to provide feedback, raise issues with the project team during the environmental assessment phase. The email account was checked daily and all enquiries were responded to within 3 business days.

At the time of writing this report (April, 2008), one response had been received on the project email address. The responses were recorded and the residents' names were placed on a mailing list for future use by the project team for project information.

Community information line

A community information line (1800 008 708) was established at the commencement of the Environmental Assessment process to give the community the opportunity to raise any questions or issues they may have. The line is a free-call 1800 number and operated during business hours (9 am to 5 pm Monday to Friday). All calls are responded to by PB's community liaison representative.

At the time of writing this report, four responses had been received through the proposal community information line. The responses were recorded and the residents' names were placed on a mailing list for future use by the project team for project information.

Additional comments received during the exhibition of the Environmental Assessment will be incorporated into a Submissions Report.

5.3 Stakeholder and community issues

A summary of community and stakeholder issues raised during the Environmental Assessment development prior to exhibition (beyond those identified within the Environmental Assessment requirements) and where these are addressed in the Environmental Assessment is provided in Table 5-1. A summary of where Environmental Assessment requirements have been addressed is provided in Appendix C.

Table 5-1 Summary of community issues

Issues raised	Where addressed in Environmental Assessment
EA process	
▪ will community members have the opportunity to comment on the EA?	Executive Summary, Section 4.1.8 and Section 5.2.5
Air quality and dust	
▪ ash from the repository area covers local residences; the wind blows the ash all through the area.	Section 10.3 and Section 10.4
▪ previous operations saw the ash dampened before being stored in the repository area; not sure why this practice was stopped.	Chapter 2, Chapter 3, Section 10.3 and Section 10.4
▪ trucks carrying ash drive along the haul road without covering loads, increasing the amount of ash covering the road and houses.	Existing operational issue, however, considered in Section 10.3 and Section 10.4
▪ are current levels of 'fall out ash' from the site being measured and is an assessment of anticipated future levels being conducted as part of the environmental assessment?	Yes, see Section 10.3 and Section 10.4
▪ concerned that will have to install airconditioning in summer because of dust emissions.	Section 10.3 and Section 10.4
▪ health implications of dust emissions.	Section 2.2.3, Chapter 10
▪ effectiveness of sprinklers used to dampen the ash.	Section 10.3 and Section 10.4
▪ dust emissions during construction.	Section 10.3 and Section 10.4
Noise impacts	
▪ noise impacts on Lidsdale residents from activities and in particular truck haulage.	Section 11.4
▪ noise during construction.	Section 11.4

Issues raised	Where addressed in Environmental Assessment
Visual impacts	
▪ height and size of the proposed expansion area. ▪ visual impact of the site.	Chapter 3, Appendix A Project Application Report, Chapter 13
Water quality	
▪ water quality in Sawyers Swamp Creek.	Chapter 8
Ecology	
▪ impact of the expansion area on nearby wildlife and vegetation.	Project Application Report
Alternative options	
▪ expressed a preference for ash to be placed wet.	Chapter 2
Geotechnical	
▪ stability of the original site.	Chapter 3
Other	
▪ explanation of the area of disturbance.	Refer below

Area of disturbance

One of the maps included in the Preliminary Environmental Assessment, which is available on the Department of Planning website, outlines an area labelled ‘area of disturbance’. This refers to an area that was subject to disturbance between the years of 1960 and 1990, as a result of previous activity including agriculture, such as land clearing and grazing, or industrial activity, such as mining. Figure 1-2, which was also attached to the first letter sent to Lidsdale residents is also included in the Preliminary Environmental Assessment, outlines the new area where it is proposed that ash would be deposited as part of the Stage 2 operations.

The area of disturbance in Figure 6-2 of the Project Application and Preliminary Environmental Assessment are historic disturbance, not proposed.

6. Environmental risk analysis

6.1 Approach

One of the objectives of the new Part 3A process of the EP&A Act is to develop a streamlined and targeted approach to the environmental assessment of proposed infrastructure developments. Part 3A impact assessment is tailored to areas of greater environmental risk identified on a proposal specific basis (i.e. based on the type of development proposed or the environment within which the development would occur). This provides for a more focused assessment directed more closely to potentially critical environmental issues (key issues) for the proposal.

This change in emphasis also provides for better recognition of the considerable effort of early phase environmental impact assessment typically undertaken during option development, planning and concept design refinement, and also during the project application and preliminary environmental assessment.

The Department of Planning has issued Environmental Assessment requirements for the project based on their understanding of the key issues from the Project Application and Preliminary Environmental Assessment Report and supporting information. The key issues identified in the Environmental Assessment requirements are those identified by the Department of Planning as presenting a medium to high perceived or actual impact.

In accordance with the process outlined in Part 3A of the EP&A Act, environmental issues for consideration in this Environmental Assessment were also identified during the preparation of the Project Application and Preliminary Environmental Assessment Report. This included identification of environmental issues considered by Delta Electricity to be key issues/risks for this project. The Project Application and Preliminary Environmental Assessment Report also identified other environmental issues likely to be of lower environmental risk (based on the constraints and existing use of the proposed site and experience of the Stage 1 operations at the site). Such ‘other issues’ are those considered able to be dealt with adequately using standard controls and management measures.

Government agencies have been involved in the identification of issues for consideration in this Environmental Assessment. Relevant agencies were invited by the Department of Planning to review the Project Application and Preliminary Environmental Assessment Report and attend a planning focus meeting in February 2007 to discuss project issues and help refine the key issues for further consideration and documentation in the Environmental Assessment.

The Director-General of the Department of Planning subsequently released requirements for the Environmental Assessment (see Appendix C). These requirements outline the scope for the Environmental Assessment, considering the issues investigated as part of the Project Application and Preliminary Environmental Assessment Report, and other input/advice from agencies.

The preliminary environmental analysis in the Project Application and Preliminary Environmental Assessment Report has been used as the basis for an environmental risk analysis for the project. This process drives the environmental assessment to areas of key concern as required under Part 3A. The preliminary risk assessment is then used as the basis for assessing the residual risk following the implementation of measures identified during the environmental assessment. The residual risks are discussed further in Chapter 16.

6.2 Environmental risk analysis

The detailed environmental assessment of the proposal commenced at the development of the Project Application and associated Preliminary Environmental Assessment. This process identified key issues and requirements for the detailed environmental assessment phase and issues that could be addressed adequately in the preliminary assessment.

The criteria used for the environmental risk analysis are described in Table 6-1. All items assessed as Category A or identified in the Environmental Assessment requirements have been further assessed within this Environmental Assessment report.

The outcomes of the preliminary risk assessment are provided in Table 6-2 and form the basis of this Environmental Assessment report along with the Environmental Assessment requirements that were received from the Director-General for Planning on 27 February 2007 (see Appendix C). All of the issues identified as 'key issues' within the Project Application and Preliminary Environmental Assessment were confirmed as key issues in the Environmental Assessment requirements. This confirms that the preliminary environmental assessment process serves as a notable phase of environmental risk analysis, in this case focusing on the key environmental risks associated with the proposal.

The assessment of key issues in this Environmental Assessment report focuses on the key environmental risks identified during the preliminary environmental assessment process, as well as the additional key issues identified within the Environmental Assessment requirements.

Following receipt of the Environmental Assessment requirements and the completion of further environmental investigations, the environmental risk analysis for the proposal was updated. This additional risk analysis identified land use, particularly with regard to mining reserves, as a potential additional key environmental risk issue and as a result this has been incorporated into the detailed environmental assessment process.

The process of risk assessment from preliminary environmental assessment through to commencement of the Environmental Assessment is summarised in Table 6-2. The initial risk in Table 6-2 is the risk as assessed prior to initial regulator consultation and prior to the commencement of the Part 3A process. The assessment of residual risk following the environmental assessment process, preliminary environmental assessment and implementation of mitigation measures as identified in chapters 7 to 13 is provided in Chapter 16.

Table 6-1 Risk category descriptions

Risk category	Description
A	Proposal may have a medium to high level impact. Investigations are required to determine the level of potential impact and to identify appropriate measures to manage the effects.
B	Proposal may have a low to medium level of impact. However, the environmental impacts can be reduced to an acceptable level through the use of standard or identified management measures.
C	The proposal would have a low level impact manageable through the use of standard measures.

Table 6-2 Environmental risk analysis

Issue	Risk	Risk assessment	Document reference
Air quality	▪ Impacts from dust and emissions from vehicles, plant and equipment during Stage 2 operations. ▪ Impacts from dust during ash placement and stockpile management operations.	A	Environmental Assessment: Chapter 10
Aquatic ecology	▪ Loss of or disturbance to threatened aquatic flora and/or fauna species. ▪ Potential impacts on/loss of endangered ecological communities. ▪ Loss of aquatic habitat. ▪ Impacts on aquatic ecology associated with the realignment of Sawyers Swamp Creek.	A	Environmental Assessment: Chapter 9
Erosion and sediment control	▪ Soil erosion and sedimentation associated with surface flows, increased runoff and the realignment of Sawyers Swamp Creek.	B	Environmental Assessment: Chapter 13
Groundwater	▪ Impacts on groundwater quality and volumes associated with the realignment of Sawyers Swamp Creek. ▪ Potential for infiltration of surface/rain water to groundwater, affecting groundwater levels and/or quality.	A	Environmental Assessment: Chapter 7
Hazards and risk	▪ Potential for spillage of hazardous material. ▪ Potential impacts associated with storage of hazardous materials during construction. ▪ Operational hazards.	C	Project Application and Preliminary Environmental Assessment
Archaeology and heritage	▪ Direct or indirect impacts on items of Indigenous or non-Indigenous heritage value. ▪ Potential for impacts to heritage context/viewsheds associated with identified heritage items.	C	Project Application and Preliminary Environmental Assessment, Chapter 13
Landscape and visual impacts	▪ Visual impacts on nearby residents (within up to 20 kilometres of the site). ▪ Change in view from residences located west and south west of the site.	C	Project Application and Preliminary Environmental Assessment, Chapter 13
Land use and mining	▪ Potential land use conflicts. ▪ Ownership of mining reserves beneath/adjacent to the site.	C (B)[1]	Environmental Assessment: Chapter 12
Noise	▪ Noise and vibration impacts on sensitive receivers associated with construction equipment and vehicles. ▪ Noise and vibration impacts on sensitive receivers associated with operations including ash haulage.	A	Environmental Assessment: Chapter 11
Surface water	▪ Impacts on surface water quality and flows associated with the realignment of Sawyers Swamp Creek. ▪ Impacts of ash repository on site drainage and surface runoff. ▪ Impacts on the Sydney Drinking Water Catchment.	A	Environmental Assessment: Chapter 8

Issue	Risk	Risk assessment	Document reference
Terrestrial ecology	▪ Loss of/disturbance to threatened flora and/or fauna species. ▪ Potential impacts on/loss of endangered ecological communities. ▪ Vegetation clearance and loss of habitat.	B	Project Application and Preliminary Environmental Report, Environmental Assessment: Chapter 13
Traffic	▪ Increase in traffic on haul road during construction and operation. ▪ Increased hours of operation of haul road during operation (traffic only, refer noise). ▪ Short-term increase in traffic movements on local road network during construction of stability berm and creek realignment.	C	Project Application and Preliminary Environmental Report
Waste, energy and demand on resources	▪ Demand on resources during construction and operation. ▪ Energy consumption during construction and operation. ▪ Generation of waste materials during construction and operation.	C	Environmental Assessment: Chapter 13

1. Note the risk associated with impacts on mining was reassessed following additional input from DPI and as a result has been further addressed in this Environmental Assessment, and residual risk increased to Category B.