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NSW Treasury

Mt. Piper Power Station

Preliminary Environmental Site Assessment

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July 2013

The world's leading sustainability consultancy

Mt. Piper Power Station

Preliminary Environmental Site Assessment

NSW Treasury - Project Symphony

July 2013

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Environmental Resources Management Australia Pty Ltd Quality System

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EXECUTIVE SUMMARY

ERM was engaged by NSW Treasury to provide advice in relation to potential soil and groundwater contamination issues which may be relevant to the sale of certain electricity generation assets owned and operated by Delta Electricity and Erraring Energy. The subject of this report was the Mount Piper Power Station.

The specific objectives for ERM's scope of works were to:

- *assess the nature and extent of potential soil and groundwater contamination issues which may be present at the sites;*
- *assess the potential financial liabilities associated with those issues (assuming ongoing commercial / industrial use as power generating facilities);*
- *identify what additional works may be required to establish a baseline of soil and groundwater conditions present at the sites to support the potential sale of the sites.*

ERM reported these in this Preliminary Environmental Site Assessment (ESA) which included background research from a variety of sources as well as management and staff interviews and site visits.

The Preliminary ESA identified that limited previous intrusive ESAs have been completed on the sites and a number of potential contamination sources were identified as follows:

- *Former Mine and Backfilling of Operational Area;*
- *Former Landfills;*
- *Coal Storage Area;*
- *Electrical Transformers;*
- *Water Holding Ponds;*
- *Workshops;*
- *Mobile Plant Refuelling Area;*
- *Operational and Decommissioned USTs;*
- *Operational ASTs;*
- *Current Ash Repository; and*
- *Lamberts North Ash Repository.*

Based on the results of the Preliminary ESA undertaken by ERM and consideration of Government's intended approach to establishing a baseline of soil and groundwater contamination, a programme of intrusive (Phase 2) assessment of potential soil and groundwater contamination issues is provided. The most appropriate sampling design is considered to be a combination of systematic (grid based) and judgemental (targeted) sampling of soil and groundwater at locations across the Site.

Based on the information available at the time of preparation of this report, ERM has not identified any actual contamination issues which are currently undergoing or likely to require material remediation, assuming ongoing industrial land use as a coal fired power plant. Preliminary remediation costs have not therefore been prepared at this point in time. It is proposed that the subject of remedial costs be revisited following completion of the proposed Stage 2 investigations.

1 INTRODUCTION

1.1 BACKGROUND

On 24 November 2011, the New South Wales (NSW) State Government (Government) announced that it would divest specific State-owned electricity generation assets and the Cobbora Coal Mine development. More specifically, the Government intends to:

- sell the electricity generation assets of Macquarie Generation, Erraring Energy and Delta Electricity, including the assets related to the generation trading ('GenTrader') agreements of Erraring Energy and Delta Electricity;
- sell the electricity generation development sites at Bayswater B, Munmorah and Tomago; and
- sell or lease the Cobbora Coal Mine development.

In order to support the sale of certain electricity generation assets owned and operated by Delta Electricity (a State Owned Corporations – SOC), NSW Treasury (Treasury) on behalf of the State of New South Wales, engaged ERM as the Site Contamination Environmental Adviser (the 'Adviser') to provide advice in relation to potential soil and groundwater contamination issues which may be relevant to the transaction.

The subject of this report is Mount Piper Power Station.

1.2 OBJECTIVE

The specific objectives of ERM's scope of works were to:

- assess the nature and extent of potential soil and groundwater contamination issues which may be present at the sites;
- assess the potential financial liabilities associated with those issues (assuming ongoing commercial / industrial use as power generating facilities);
- identify what additional works may be required to establish a baseline of soil and groundwater conditions present at the sites to support the potential sale of the sites.

1.3 SCOPE OF WORK

The scope of this Preliminary ESA was outlined in the Request for Proposal (RFP) issued by Treasury on 14 February 2013 and included the following key elements:

- development of a site history via interviews with employees and review of information such as:
  - relevant documents identified by employees;
  - the database managed by the NSW Office of Environment and Heritage for information on notices issued by the NSW EPA under the Protection of the Environment Operations Act 1997 and the Contaminated Land Management Act 1997;
  - aerial photographs;
  - historical Titles;
  - S. 149 certificates from Local Council; and
  - civil engineering works records.
- review of existing soil and groundwater reports.
- desktop assessment of the environment in which the site is set such as site drainage, geology, hydrogeology and soil conditions at the site and surrounding areas.
- inspection of the site.
- identification of actual and/or potential soil and groundwater areas of concern via:
  - identification of past and present potentially contaminating activities at, and adjacent to, the Sites;
  - identification of potentially impacted areas;
  - identification and assessment of the chemicals of potential concern (COPC) that may have been associated with historical and current use of the site;
  - evaluation of the possible migration pathways of the COPC; and
  - assessment of the sensitivity of surrounding areas and/or property.

- preliminary identification of potential cost implications of actual and/or potential soil and groundwater areas of concern, to assist in assessing whether those issues may be material.

- where Stage 2 intrusive investigations are necessary on each site and, more specifically:

  - where it may be necessary to undertake a preliminary sampling and analysis program at each site to assess the need for detailed investigation; and

  - a detailed scope-of-works for Stage 2 investigations at each site.

- comment on possible remediation options (Stage 3) for any clearly identified issues and their associated remediation cost estimates.

It is noted that Treasury also specifically requested that the Stage 1 ESA reports be prepared in general accordance with the NSW OEH (2011) *Guidelines for Consultants Reporting on Contaminated Sites*, (refer to *Section 1.7* for further discussion of report structure).

Spatially, the scope of ERM's assessment was limited to those areas shown within the site boundary presented in *Figures 1* and *2* of *Annex A*.

1.4 MATERIAL THRESHOLD

ERM adopts a technically rigorous approach to assessing potential risks and liabilities during Environmental Due Diligence (EDD), and typically focuses on what is *material* to the transaction. In this situation, a material threshold was applied to items contained within the EDD reports.

Based on ERM's experience of similar projects and discussions with the Client, ERM adopted a materiality threshold of AUD 0.5 M (+ GST if applicable) per contamination source. In addition, any issue that ERM considered could have the potential to lead to prosecution by the regulatory authorities that could lead to significant business disruption or reputational impact was considered material.

1.5 APPROACH AND METHODOLOGY

ERM's approach to the assessment was to break the work down into individual tasks as follows.

1.5.1 Project Initiation Meeting

In order to ensure that ERM and Treasury were fully aligned in terms of the scope and anticipated deliverables, the ERM Partner in Charge and Project Manager attended a project initiation meeting with Treasury.

1.5.2 Introductory meetings with the individual SOCs

In order to facilitate cooperation with the SOCs and to seek assistance from the asset maintenance and environmental team throughout the project, ERM completed introductory meetings with key contacts within both Erraring Energy and Delta Electricity.

1.5.3 Review of Existing Data

Relevant environmental information on the specific SOC assets was made available to ERM via an electronic dataroom. ERM reviewed relevant information on all sites and a list of all documents reviewed is included in *Section 11*.

In addition, ERM conducted background research using publicly available information on each of the sites. Following discussions with Treasury, and given the timescale of this assessment, the large number of lots comprising the Site, the good level of information available on the history of the site available from both Delta Electricity and a review of historic aerial photography (refer to *Section 3.2*), a search of historic land titles and S.149 certificates has not been undertaken.

A site setting review was also undertaken to understand both the sensitivity of the surrounding area to environmental impact and the potential impact on the site resulting from neighbouring activities, past and present. Key areas addressed included site description and activities, site history, geology, hydrogeology and hydrology (refer to *Section 2*).

1.5.4 Site Visits and Management Interviews

ERM mobilised to site and completed site management interviews and a site visit to the assets on 19, 20 and 21 March 2013.

The assessment focussed on potentially material contamination issues that were considered likely to require further assessment relevant to Bidders and to identify where a baseline assessment may be required. Topics that were evaluated as non-material were not assessed in detail.

1.5.5 Preparation of Stage 1 ESA Reports

The Stage 1 ESA Reports were prepared in general accordance with NSW OEH (2011) on the basis of information collected during the previous tasks. In preparing these reports, (and in particular the proposed scope of work for Stage 2 assessments and remedial cost estimation) ERM utilised a combination of experience gained in the planning and delivery of similar vendor due diligence projects for government, professional judgement of suitably qualified contaminated land professionals and reference to relevant guidelines made or approved under the *Contaminated Land Management Act* (1997).

Following a process of review by Treasury and other key advisors, draft reports were finalised for issue.

1.6 REPORT STRUCTURE

This report has been structured in order to align generally with the requirements for a Preliminary Environmental Site Assessment outlined with NSW OEH (2011) *Guidelines for consultants reporting on contaminated sites.* Where necessary, minor additions and modifications to the structure have been made to accommodate the fact that this assessment is being undertaken for a specific purpose (that being Vendor Environmental Due Diligence VEDD).

2 SITE DESCRIPTION AND SURROUNDING ENVIRONMENT

2.1 SITE IDENTIFICATION

Mount Piper Power Station is owned and operated by Delta Electricity, a State Owned Corporation (SOC) that manages a number of electricity generating assets located throughout NSW, Australia.

Mount Piper Power Station is situated approximately 18 km north-north-west of Lithgow in the Central West region of New South Wales. The approximate coordinates of the Power Station are 223759 m E and 6304970 m S and the street address is 350 Boulder Road, Portland, NSW 2847.

The boundary of the Site is identified in *Figure 1, Annex A*. A listing of the registered titles for the Site at the time of reporting is provided in *Annex F*. The Site includes the main power station operational area, ash repositories and the associated water assets, Lake Lyell and Thompsons Creek Reservoir.

2.2 SITE DESCRIPTION

2.2.1 *Overview*

Mount Piper Power Station is a large coal-fired Power Station providing base load for the region via two 700 MW units. The Mount Piper and Wallerawang Power Stations form Delta Electricity's western region operation, known collectively as Delta West.

The station commenced operations in approximately 1993 and is expected to continue operations until the GenTrader Agreement contract closure date of 2042/43. The station was originally designed to allow installation of an additional two units however this has not yet been required.

The total area of the Mount Piper site is approximately 820 hectares and includes:

- the main operational area of the Power Station, which comprises electricity generating activities and the associated coal stockpile;
- the ash emplacement area within a former mine void adjacent to the operational area;
- a buffer zone comprising native forested areas and open woodland and rehabilitated and revegetated land, and including a number of ancillary activities such as transmission line easements and former waste dumps; and
- the associated water assets, Lake Lyell located directly south, and Thompsons Creek Reservoir to the south-east.

The entire area is described as "the Site" or "Mount Piper" in this report and is shown in the Site Layout Plan provided as *Figure 2*.

Water is supplied from off-site storage facilities detailed in *Section 4.1.1*. These water storage facilities are outside the scope of this report.

There are several parcels of land within the Mount Piper "fenceline" most of which are owned and operated by other electricity SOCs and Energy Australia, and these are outside the scope of this report. The affected parcels consist of:

- a large area of land on the western side of the operational area that has been transferred for potential future expansion of the Power Station (additional units). ERM's review of NSW government property mapping indicates that the parcel of land appears to consist of Lots 1, 2, 3 and 4 of DP1092737;

- a large triangular parcel of land to the south earmarked for the proposed rail coal unloader. ERM's review of NSW government property mapping indicates that the parcel of land appears to consist of Lots 1 and 2 of DP800003. This is agricultural land and is leased for agricultural pursuits;

- the Power Station's switchyard which is owned and operated by the transmission SOC Transgrid. ERM's review of NSW government property mapping indicates that the parcel of land appears to consist of Lots 1, 2, 3 and 4 of DP1092737;

- a high voltage substation which is owned and operated by the transmission SOC Transgrid. ERM's review of NSW government property mapping indicates that the parcel of land appears to consist of Lot 22 of DP832446; and

- a section of forested land along Boulder Road that has been sold to the Lithgow District Car Club. ERM's review of NSW government property mapping indicates that the parcel of land appears to consist of Lot 1 of DP1127747.

2.2.2 Operational Area

Processes conducted within the main operational area are detailed in *Section 4*. The operational area incorporates the coal stockpile and conveyors, electricity generation (coal mills, boilers, turbines, generators), air emission controls (fabric filters and chimney stack), cooling water processes (intakes, pre-treatment facilities, cooling towers and returns), wastewater holding ponds and treatment facilities; maintenance facilities; and administration offices.

The switchyard is adjacent to the main operational area (on the southern side) but as noted above is owned and operated by Transgrid.

2.2.3 *Ash Repository*

Ash generated as a by-product of the combustion process is transported either pneumatically (flyash) or via truck (bottom ash) to the on-site Ash Repository. Fly ash is conditioned with site process water to increase moisture content for better handling, compaction and reduction of dust emissions during transport and placement.

The current Ash Repository is located in the former Western Main open cut mine void adjacent to the Power Station on the north-eastern side (refer to *Figure 2*). Brine is co-disposed in the Ash Repository within an area specified by the relevant development approvals. The current Ash Repository area covers approximately 43 ha and is nearing capacity: with two to 12 years of storage remaining (Worley Parsons 2013). Capacity increases to the upper end of the range if normal water conditioned ash is placed in the recently approved Lamberts North Ash Repository area. Otherwise the remaining brine conditioned ash storage area will be exhausted with Normal Water Conditioned Ash. The Ash Repository is operated by Delta's contractor Lend Lease.

In February 2012, Delta Electricity obtained Project Approval from the Minister for Planning and Infrastructure for a new Ash Repository at Lamberts North to cater for the ash generated from the existing Mount Piper Power Station and proposed Power Station extension. The Lamberts North site is located adjacent to the existing ash repository, and is a former open cut coal mine operated by Centennial Coal (who continue to mine coal to the immediate south). Lamberts North includes an area known as the Huon Void (refer to *Figure 2*), which is a former groundwater collection pit and is currently being filled with a base to elevate ash placement above the groundwater level. Lamberts South is proposed as a washery rejects disposal area by Centennial Coal. Part of the former mine void adjacent to Delta's Lamberts North Ash Repository to the east is also being considered by Lithgow City Council for a large municipal waste landfill.

2.2.4 *Buffer Lands*

Extensive buffer lands are located to the north and west of the operational area.

The buffer land to the west is the larger area and consists of hilly forested country on a ridge above the operational area. The ridge separates the operational area from the township of Portland to the west. The western buffer land has been subject to both open cut and underground coal mining. The western buffer land includes:

- former landfills used by the Power Station and former coal mines (discussed in more detail in later sections);

- two large water storage tanks of 25 ML each holding Fish River water supply for the Power Station;
- transmission line easements; and
- a high voltage substation and switchyard (as noted earlier) which are owned and operated by Transgrid.

The buffer land to the north runs mainly in a strip on the opposite side of the Boulder Road and Castlereagh Highway, and consists of hilly forested country to the west, and valleys used for agriculture to the east. Much of the land has been subject to underground coal mining.

In addition, an area of forested land between the operational area and Lamberts North has been purchased relatively recently from Centennial Coal. The land consists of a ridge between the operational area and Lamberts North and has been subject to extensive underground coal mining.

2.2.5 Lake Lyell

The Coxs River was dammed downstream of Lake Wallace to form the Lake Lyell reservoir in 1982. Prior to the construction of Lake Lyell the area was predominantly bush and agricultural land. Lake Lyell has an active capacity of approximately 31 GL, sourced from local runoff, and the water is also pumped to off-stream storage at Thompsons Creek, which supplies Mt Piper, or to Lake Wallace, which supplies Wallerawang.

A pumping station is located on the western side of the dam wall adjacent to the spillway and comprises a brick building and a small fenced compound. Aboveground infrastructure in the fenced compound includes two surge tanks which are supplied with compressed air from a compressor in a small brick building. Two transformers are located in a concrete bund adjacent to the pump house. Small volumes of hydraulic oils are stored within the compound for use in the pump house.

During construction of the dam soil and rock materials were quarried from the adjacent hillside, and the area was revegetated. A small brick building is located on the access road from the Rydal Sodwalls Tarana Road which is currently used as a weather station. This building formerly housed an air compressor which was used to inflate a rubber dam bladder which was temporarily used to raise the height of the dam wall prior to the current dam wall configuration. Adjacent to the weather station building is a switchyard owned and operated by Transgrid.

The pumping station supplies water through a pipeline travelling approximately 250 m in elevation from Lake Lyell to Thompsons Creek Reservoir (full supply level (fsl) at Lake Lyell 785.5 m AHD, Thompsons Creek Reservoir 1033.5 m AHD). The pipeline runs underground within an

easement from the pumping station to Thompsons Creek Reservoir, with a surge tank and a valve house located at intervals along the pipeline.

There are currently three local farmers with agreements with Delta to agist stock within the buffer lands around Lake Lyell. Lithgow City Council owns a portion of lands adjacent to Lake Lyell, as well as leasing additional lands which are publicly accessible for camping and recreation areas.

2.2.6 Thompsons Creek Reservoir

Thompsons Creek Reservoir was constructed in 1992 on a small creek to provide off-stream storage for supply of the water to Mt Piper and Wallerawang. The dam wall was constructed of earth and rock fill. Prior to the construction of the dam, the area was predominantly bush and agricultural land. Although the surface runoff catchment of Thompson Creek is relatively small, Thompsons Creek Reservoir has a storage capacity of up to 27.5 GL with water routinely pumped from Lake Lyell.

The dam wall can be accessed by vehicles through a locked gate with an access road running along the northern side of the reservoir. An emergency spillway is located on the northern side of the reservoir at the end of the access road, however this is not frequently required, as the water level in the reservoir is controlled with releases through the pipeline. A small brick building in a fenced compound is located adjacent to the spillway and contains an air compressor. Black staining was observed on the gravel surface of the compound (<5 m^2) during the inspection which appeared to be oil residue leaking from an air outlet hose from the air compressor however this is not likely to be a material issue.

Pedestrian access to the reservoir is also available to the public for recreational fishing. The buffer lands are generally vacant vegetated lands, with some areas used for stock grazing by local farmers under agreements with Delta.

2.3 SENSITIVE RECEPTORS

The closest major population centre in the region is Lithgow, located approximately 18 km to the south-east of the site. Other population centres within reasonable proximity to the Power Station site are Portland, approximately 4 km to the west, and Wallerawang approximately 10 km to the south-east. Smaller centres are located at Cullen Bullen, approximately 6 km to the north, Lidsdale approximately 6 km to the south-east, with small settlements at Blackmans Flat approximately 3 km to the east and Angus Place approximately 7 km to the north-east. There are two schools, one child care facility and a hospital within 5 km of the Power Station, all situated within the town of Portland.

The site is located within the Upper Cox's River Catchment. Key waterways near the site include:

- Western Drain located within the site on the western boundary of the operational area. This diverts runoff from the hills above the site along the western boundary and into Neubecks Creek;

- Neubecks Creek (also known as Wangcol Creek) located immediately to the north of the site. Neubecks Creek drains from the area west and north of Mt Piper Power Station to join the Cox's River north of Lidsdale;

- Huons Gully located along the western edge of the area mined by Centennial Coal. This natural drain line has been significantly disrupted by coal mining and is being partially reinstated at a slightly higher elevation by Delta in the recently purchased Lamberts North area. Due to the land purchase this drain line runs between the current ash emplacement area and the new Lamberts North ash repository. The drain line includes the large void known as Huons Void. This void was used as a Groundwater Collection Pit by the coal mine but as noted above is now being filled with a base to allow ash emplacement;

- the Cox's River located approximately 2.5 km east from the site boundary. The Cox's River runs from north to south, and is dammed at Lake Wallace and Lake Lyell to provide water supply for the Delta Electricity Power Stations. The lakes are also used for other purposes including public recreation such as boating and fishing. The river ultimately flows to Lake Burragorang;

- Pipers Flat Creek located approximately 1.5 km south of the site boundary, running from west to east beyond the forested ridge behind the site; and

- Thompsons Creek Dam located approximately 8 km south-west from the site boundary of Mt Piper. This dam impounds Thompsons Creek to supply water to the Delta Electricity Power Stations. As the dam has a small catchment it is supplemented with water from Lake Lyell. It is used recreationally for trout-fishing. Thompsons Creek appears to run south to north joining Pipers Flat Creek mentioned above.

2.4 SURROUNDING ENVIRONMENT

Coal mining and power generation are the important industries in the region, and cement production was also a major industry until the closure of the Portland works in 1986. The residential areas of Lithgow, Portland, Lidsdale and Blackmans Flat are surrounded by areas used mainly for mining purposes with some grazing and commercial forestry activities.

Key industrial uses in the area are:

- Delta Electricity's Wallerawang Power Station located approximately 7 km to the south east.
- Existing and former coal mines surrounding the site and within the site footprint;
- The former Portland cement works are located 4 km to the west.

Immediate neighbours around the site are:

- North - Ben Bullen State Forest, located on ranges above the site. A small area of land in a valley created by a reach of Neubecks Creek is occupied by agricultural land rather than State Forest;
- East – coal mining (Centennial Coal), beyond which is the hamlet of Blackmans Flat;
- South-east - Ben Bullen State Forest;
- South–west – forested hills; and
- West – valley housing agricultural land and the town of Portland.

Almost all land around and within the site boundaries has been subject to underground or open cut coal mining over time and hence has been subject to considerable disturbance.

2.5 TOPOGRAPHY

According to the Mt Piper Environmental Impact Assessment (Electricity Commission 1980), the elevation of the site ranges from 925 to 960 m above sea level while the hills surrounding the site rise to elevations of about 1000 m at distances approximately 3 km to the north, and 1 km to the south, east and west of the centre of the Mount Piper Power Station.

The operational area lies within a valley created by ridges forming a U-shape to the east, south and west. The floor of the valley has been levelled to construct the Power Station. Hilly forested country lies across the Castlereagh Highway to the north.

2.6 GEOLOGY

2.6.1 Regional Geology

The site is located on the western edge of the Sydney Basin which is characterised by easterly dipping sedimentary deposits. The 1:100 000 Western Coalfield geological map indicates that the site is underlain by the

Permian Illawarra Coal Measures comprising interbedded shale, sandstone, conglomerate and coal (Department of Mineral Resources, 1992). The Illawarra Coal Measures are in turn underlain by Permian age sandstone, shale and conglomerate of the Shoalhaven Group.

2.6.2 *Local Geology*

A description of the local geology based on environmental investigations conducted in the vicinity of the site cited by CDM Smith (2012) is provided in *Table 2.1*.

Table 2.1 Description of Local Geology[1]

Stratigraphic Unit	Geological Formation	Description	Approximate Thickness (m)
Illawarra Coal Measures	Bunnyong Sandstone	Silty sandstone	1 - 1.5
		Sandstone, siltstone and shale	12 - 14
	Lidsdale Seam	Coal, carbonaceous shale and sandstone	1.1 - 1.8
	Blackmans Flat Conglomerate	Sandstone (medium to coarse grained) with interbedded siltstone	3 – 6
	Lithgow Seam	Coal, carbonaceous shale	1.9 - 2.3
		Siltstone, mudstone and shale	0.3 - 0.6
	Marrangaroo Conglomerate	Sandstone with siltstone bands and some boulders	3.5 - 4.6
Shoalhaven Group	Berry Formation	Siltstone or silty sandstone, some pebbles.	>30

1 Table modified from CDM Smith (2012)

Coal seams within the Illawarra Coal Measures have been widely mined in the region, and sections of the site are underlain by abandoned coal workings (both underground and backfilled open cut) from mining of the Lidsdale and Lithgow seams. The Irondale seam has also been mined on higher elevations to the west in the Pipers Flat area.

The existing ash repository is located within a former open cut mine and the Lamberts North Ash Repository will be as well. Both open cut mine workings extended to the base of the Lithgow Seam. Whilst approximately 1 m of fill material was placed at the base of the existing ash repository prior to ash deposition, 5 m of fill material will be placed at the base of the Lamberts North ash repository prior to ash deposition (Nino Di Falco, personal communication, 20 March, 2013 and SKM, 2010).

2.7 *HYDROGEOLOGY*

2.7.1 *Regional Hydrogeology*

Information on regional aquifer properties is limited (CDM Smith, 2012). No regional scale productive aquifer has however been identified in the vicinity

of the site. Large scale regional groundwater flow is expected to be towards the north/east, following the dip of the sedimentary deposits.

2.7.2 *Local Hydrogeology*

Historic mining activities have had a significant impact on the groundwater regime underlying the site, impacting aquifer properties and groundwater flows.

Where underground workings have been left in place, hydraulic conductivities as high as 5 to 50 m/d have been reported for the disturbed coal seams (Merrick 2007, as cited in CDM Smith 2012). A hydrogeological investigation (HLA-Envirosciences 2004) for the proposed Blackmans Flat Waste Management Facility (located directly down-gradient of the Site) reported an approximate hydraulic conductivity of 10^{-1} m/d for the material used for backfilling of the open cut mine voids and approximately 10^{-3} m/d for the Marrangaroo Conglomerate underlying the Lithgow seam. Groundwater seepage has been observed in remaining mine voids (such as the Huon Void/Pond, formerly known as the Groundwater Collection Basin).

Considering the above, the base of the open cut fill materials are considered to present the shallowest laterally extensive groundwater bearing unit at the site in locations of former open cut mining. Localised perched shallow groundwater has been noted in various groundwater monitoring wells installed for the purpose of assessing potential contamination from Underground Petroleum Storage Systems (UPSS). In areas where former underground mines remain in place, the disturbed coal seams are considered to present the shallowest laterally extensive groundwater bearing unit.

The groundwater flow direction at the site reportedly has a north-easterly to south-easterly component (CDM Smith 2012). Locally there may however be different directions in groundwater flow due to local variations in topography and surface water interactions.

It is further noted that groundwater quality has reportedly been affected by coal mining activities, with groundwater impacted by low pH, elevated salinity and trace metal concentrations in a number of locations (Connell Wagner 2008).

2.7.3 *Groundwater Use and Potential Surface Water Receptors*

The *NSW Natural Resource Atlas* online bore register identifies that a number of groundwater bores are located within a 10 km radius of the site which are registered for irrigation, private domestic and stock use. The standing water level in the bores reportedly varies between 1 and 15 m bgl.

Neubecks Creek presents the closest surface water body, located adjacent to the site in a north to north easterly direction.

Information from Lithgow City Council indicates that municipal water is sourced from surface water dams (Farmers Creek Dam #2 and Oberon Dam) which are not linked to or used for water supply by the Delta Western Power Stations and hence are not considered to be a sensitive receptor for the purposes of this assessment. The Lithgow City Council Local Government Area covers a large area and incorporates all the townships within the vicinity of the Delta Western Power Stations.

3 SITE HISTORY AND REGULATORY SETTING

3.1 SUMMARY OF SITE HISTORY

3.1.1 Coal Mining (1880s – current)

The area was home to a number of collieries from the 1880s onwards including the Irondale Colliery from 1883, the Cullen Bullen Colliery from 1885, the Ivanhoe Colliery from 1893, and the Commonwealth Colliery in 1895, which in 1940 became the first open cut mine in NSW. Numerous other mines opened in the Lithgow Valley particularly around Cullen Bullen such as the Great Western Mine in 1899 and the Invincible Colliery in 1900, along with a number of smaller mines.

The site and immediately surrounding areas have been mined for coal since at least the 1940s, firstly by shallow underground 'bord and pillar' methods, secondly by 'roof lifting' activities to extract coal pillar remnants, and thirdly by open-cut mining (CDM 2012). Collieries that mined within the Mount Piper site boundary include (PPK 2000):

- Ivanhoe No1. Colliery
- Huon Extended No 3. Colliery
- Huon Extended No 4. Colliery
- Western Main Colliery

Mining activities in the 1990s moved away from underground mining to open-cut mining, often utilising the existing underground mined areas. Some areas of underground workings still remain across the valley.

Open-cut mining generally focused on removing the remnants of the Lidsdale Coal Seam as well as extracting coal from the Lithgow Coal Seam which runs beneath it (CDM 2012). At the end of mining operations, nearby old open-cut mine voids have been used as ash repositories for Mt Piper Power Station. The current Ash Repository and part of Lamberts North, including the Huon Gully, lie within the former Western Main Colliery holding (SKM 2010 in CDM 2012).

Centennial Coal undertook coal mining and washing operations on the Lamberts North site until early 2012, when it was acquired by Delta Electricity and used for construction of the Lamberts North Ash Repository. Centennial Coal continues to operate open-cut mining and coal washery activities in Lamberts South, immediately adjacent to Lamberts North Ash Repository.

Based on historical mining maps (CDM 2012 and PPK 2000), former open-cut mines were present beneath the current operational areas of the power-

station. These voids were backfilled with overburden at the end of mining operations.

3.1.2 Construction of Mt Piper Power Station

Construction of Mt Piper Power Station began in 1984, was halted in 1986 and began again in the early 1990s, with the station commissioned in 1993. Substantial earthworks were required to level the land and backfill the former open-cut mine on the site.

Site management advised that there have been no substantial changes to the building footprint and the current operational areas are representative of operations over the period from 1993 to 2013.

There are three landfills which date from the early years of construction and operation of Mt Piper Power Station:

- Construction Landfill –the use of this landfill was uncontrolled and was used by contractors for disposal of building waste and materials from the construction of Mt Piper Power Station;

- Uncontrolled Domestic Waste Landfill – a series of trenches were constructed and used for disposal of unknown wastes from 1993-1997. Historical maps indicate that part of the landfill was constructed over an old open cut mine (which may have been first backfilled with overburden); and

- Chitter Dam Landfill – was constructed originally as a surface water dam but was never used for storage of water supplies, although there is some indication from aerial photos that water may have ponded within the dam. The dam was converted for use as a landfill for chitter, which is a coarse reject material from coal washing (PPK 2000). 'Hard' construction waste such as concrete was also disposed in this landfill (PPK 2000).

3.2 SUMMARY OF HISTORICAL AERIAL PHOTOGRAPHS

A review of historic aerial photographs was conducted by ERM and is summarised in *Table 3.1* (below).

Table 3.1 Aerial Photograph Review

Year	Site	Surrounding Area
1950	Large areas of the Site have been cleared of vegetation, including the square which now forms the coal storage area. An open-cut mine is visible in the south-west corner of the Site, extending to the north-east. Mine workings are also visible north of Boulder Road at the Ivanhoe Colliery. A small open-cut mine void is visible along the highway north of the current ash repository. Mine workings are visible near the location of the current Lamberts North.	Roads and cleared areas south-east of the Site may be related to underground mine workings. The area to the north, around Blackmans Flat has been cleared with some buildings present. A dam is visible on Pipers Flat Creek immediately south of the Site.
1961	The open-cut mine has been extended, with a second working also running south-west to north-east. Clearings in the forested area in the western part of the site indicate small mining operations. The Huon Colliery is visible (current location of Huons Gully).	An open-cut mine is located to the south-east of Huons Gully. Mine workings are visible on the ridges to the north of the Site along the highway.
1969	Open-cut mine workings can be seen across the Site as well as the mine heads of small underground workings in the forested area in the western part of the Site. Water is present in some open mine voids, and Neubecks Creek can be seen connecting a series of ponded open mine voids. Huon Colliery remains active. The remainder of the Site is crossed with tracks, with no other activities visible.	There are two large open-cut mine workings to the south of Huon Colliery, both north and south of the highway. Several flooded mine voids are visible on Blackmans Flat along Neubecks Creek.
1975	The footprints of the two open-cut mine workings on the Site remain unchanged. The mine workings in the forested area have been expanded, with more cleared areas. Trees have been cleared for transmission lines along the ridgetops to the south of the Site.	Further development on Blackmans Flat, with larger mine workings and buildings constructed.
1984	The Site has been cleared and earthworks are partially completed for construction of the Mt Piper Power Station. The mine voids have been backfilled. The Chitter Dam and the Construction Landfill are visible. Ponds are being constructed to the east of the coal storage area which has been levelled. Construction has begun on the main operations area. Temporary buildings are present on the buffer land to the east of the main operations area. The water ponds to the north of the highway (within the buffer lands) are present. Transmission lines have been cleared along ridgetops. Most of the current road network is visible. The Huon Colliery is still visible, with water present in Huon's Gully flowing to the south-west. A small mine working is present in the south of the Site near the current Transgrid switchyard. This is connected by a track to the Pipers Flat Creek.	A track has been cleared to the dam on Pipers Flat Creek to the south of the Site. Further development on Blackmans Flat, and to the south-east of the Site along the highway.
1998	The power station is active in its present-day layout. The mine working in the south of the Site is still active. The three landfills are filled and have started to regenerate vegetation, but the outlines are clearly visible. Water tanks are visible in the western part of the Site. Brine-ash has been deposited in the current ash repository on the western side, with former mine workings still visible on the eastern side. Huons void is flooded and a second flooded mine void can be seen north of the highway. Coal mining operations are active in Lamberts North (and South)	The Ivanhoe Colliery is still active to the north of Boulder Road.

Table 3.2 Summary of Historical Aerial Photographs - Lake Lyell

Year	Site of Present Day Lake Lyell	Surrounding Area
1958	The Coxs River runs north to south through the Site, before heading east. The Site is largely forested, with limited development. The Site is bisected by several streams which join the Coxs River. The Rydal Sodwalls-Tarana Road crosses the Site east-west.	The surrounding area is largely forested gullies, with agriculture on flatter land to the west.
1966	The Site is similar to 1958, with some homesteads and agriculture along small streams to the east of the Coxs River.	The surrounding area is similar to 1958, with further agricultural development.
1975	The Site is similar to 1966.	The surrounding area is similar to 1966.
1984	Lake Lyell has been constructed by damming of the Coxs River. The Rydal Sodwalls-Tarana Road has been diverted around the new lake, and the old road is still visible on the east bank of the lake. The dam wall and infrastructure are visible on the southern end of the lake. A small cluster of buildings is present next to the dam wall.	The surrounding area is similar to 1975, with further development for agriculture and forestry.
1994	The Site is similar to 1984, with further development of the small homesteads on the eastern side of the lake.	The surrounding area is similar to 1984, with further development for agriculture and forestry.
2012	The Site is similar to 1994.	The surrounding area is similar to 1994.

Table 3.3 Summary of Historical Aerial Photographs – Thompsons Creek Reservoir

Year	Site of Present Day Thompsons Creek Reservoir	Surrounding Area
1952	The Site is forested with some areas of land cleared for agriculture. Several small streams run through the Site.	The Great Western Highway runs along the southern side of the Site.
1954	The Site is similar to 1952.	The surrounding area is similar to 1952.
1964	The Site is similar to 1954, with further land clearing for agriculture.	The surrounding area is similar to 1954, with further development of agriculture.
1989	The Site is similar to 1964, with further land clearing for agriculture. There are several (>10) small farm dams present along small creeks.	The surrounding area is similar to 1964 with further land clearing to the north and south for agriculture.
1993	The streams previously present on the Site have been dammed to form the Thompsons Creek Reservoir.	The surrounding area is similar to 1989.
2012	Thompsons Creek Reservoir is a large reservoir located in an agricultural area, with a roadway along the north edge. There is no visible infrastructure aside from the dam wall and the air compressor building along the northern shore of the lake.	The surrounding area is similar to 1993 with further development for agriculture and forestry.

3.3 ZONING & LANDUSE

The land is zoned Rural 1a under the City of Greater Lithgow LEP dated 1994, current version for 1 March 2011 (PPK 2000). Delta management reported that all uses are permissible with consent under this zoning. Delta management has advised that a revision to the LEP is proposed which will preserve the right to generate electricity is preserved.

3.4 ENVIRONMENTAL APPROVALS, LICENSES AND MANAGEMENT

Delta Electricity operates under a range of State and Commonwealth Government environmental legislation. It is noted that whilst a comprehensive review of planning approvals and general environmental management was beyond ERM's scope of work for this assessment, in some instances these approvals and management system provide context for potential contamination sources (eg ash disposal) and hence a summary of salient points in relation to these issues has been set out in this report.

3.4.1 *Planning Approvals*

Original approval for the construction and operation of the Mount Piper Power Station was granted to the then Electricity Commission of New South Wales by the then Minister for Planning and Environment on 1 April 1982 subject to certain conditions. Mount Piper commenced operations in 1992 with a Board approved life to 2046.

Since the original approval, a number of modification applications were granted Ministerial approval. There have also been new applications approved by Lithgow City Council or internally by Delta Electricity under Part 5 of the Environment Planning and Assessment Act 1979. A summary of planning approvals and consents that have been granted to Mount Piper follows (Worley Parsons 2013):

- 1982 Development Consent for the construction and operation of the Mount Piper Power Station (approved by Minister for Planning and Environment, 1 April 1982);
- 1990 Development Consent for Dry Ash Placement at Mount Piper (approved by Lithgow Council, March 1990);
- 1991 Modification to allow temporary storage of brine waste until 30 June 1996 (approved 18 March 1991);
- 1996 Modification to extend temporary storage by four years to 30 June 2000 (approved 21 June 1996);
- 1999 Modification adding a condition requiring that all necessary approvals be obtained prior to construction or modification (approved by Lithgow City Council, 18 January 1999);

- 2000 Modification to allow brine co-placement in ash (approved by Minister for Urban Affairs and Planning, 3 April 2000);
- 2006 Modification to increase the capacity of the Power Station in two phases (approved by Minister for Planning, 3 June 2006);
- 2006 Development Consent for construction of a substation (approved by Lithgow Council, 7 November 2006);
- 2008 Modification to extend the brine and ash co-placement area (approved by Minister for Planning, 23 March 2008);
- 2009 Construction and operation of the Western Rail Coal Unloader (approved by Minister for Planning, 27 June 2009) – this development site was subsequently sold to TRUenergy;
- 2011 Subdivision – 6 into 3 Lots (approved by Lithgow Council, 3 May 2011); and
- 2012 Mount Piper Stage 2 Ash Placement Project (approved by Minister for Planning and Infrastructure, 16 February 2012).

The Mount Piper Extension development site (MP 09_0119) and Western Rail Coal Unloader development site was sold to TRUenergy (now Energy Australia) as part of the NSW Government's Energy Reform Strategy.

3.4.2 Environmental Protection Licences

Delta Electricity holds Environmental Protection Licence EPL No. 13007 for Mount Piper, issued under Section 55 of the Protection of the Environment Operations Act 1997, for the premises described as Mount Piper Power Station 350 Boulder Road, Portland, NSW 2847. The EPL also references the relevant property descriptors however these have been superseded by recent land acquisitions and Delta advised that these will be updated in the upcoming EPL review.

The EPL authorises the following activities:

- Generation of electrical power from coal (> 4,000 GWh generated);
- Chemical storage;
- Coal works;
- Crushing, grinding or separating;
- Sewage treatment; and
- Waste storage.

According to Worley Parsons (2013), Mount Piper and Wallerawang were both previously included in EPL No. 766, until the current separate licence (EPL 13007) was issued for Mount Piper in early 2009.

The licence includes a range of general conditions, from the general requirement to operate in a "proper and efficient" manner to specific conditions such as methods for monitoring and analysis. The EPL is a Load Based Licensing licence. Site -specific conditions in the EPL include:

- water monitoring requirements and one licensed monitoring point (with no specified limits) for surface water runoff, which is the final holding point at Neubecks Creek;
- air monitoring requirements and two licensed discharge points for air emissions;
- a condition permitting certain wastes generated at the Power Station to be disposed at the Ash Repository (fabric filter bags, ion exchange resins etc.);
- a condition permitting Wallerawang wastewater to be disposed at the Ash Repository (referred to as the "Ash Storage Area" in the Licence);
- monitoring of weather conditions; and
- monitoring of impurities in any alternative fuels used, and restrictions on alternative fuels.

The EPL does not set emission limits for noise.

3.4.3 Environmental Management

Delta has an Environmental Management System (EMS) for the management of environmental issues. The EMS is certified *to ISO 14001:2004 Environmental Management Systems – Specifications and Guidance for Use*. According to Worley Parsons (2013), the original certification was achieved in June 2005 and includes Delta Electricity Western and Central Coast Power Stations on the one certificate. The most recent external EMS surveillance audit was undertaken by DNV in August 2012, with the certificate being valid until 4 August 2014.

In addition to AS/NZS ISO 14001:2004 audits, Mount Piper undertakes external audits every three years to assess ongoing compliance and environmental performance at the station (Worley Parsons 2013).

Delta Electricity operates an environmental incident recording and reporting procedure that incorporates Mount Piper. Environmental, health and safety, and other incidents are recorded on an incident notification form, located on the Delta intranet (Worley Parsons 2013).

Mount Piper maintains a complaints register as part of its EMS, which includes the date and details of the communication, inquiry type, the required action (if any) and details of the response (Worley Parsons 2013).

4 OPERATIONS

4.1 GENERAL DESCRIPTION OF PROCESSES

4.1.1 Water Supply

Water supply for Delta Electricity's Western Region Power Stations is sourced from four main supplies:

- the Cox's River scheme;
- the Fish River water supply scheme;
- Angus Place and Springvale Mines; and
- Reverse Osmosis plant.

The majority of the water used at Mount Piper and Wallerawang is supplied form the Cox's River System, which includes three storages:

- Lake Wallace which supplies Wallerawang and has an active capacity of 3230 ML;
- Lake Lyell which is further downstream and has an active capacity of about 31 000 ML;
- Thompsons Creek Reservoir which provides additional storage capacity of up to 27 500 ML.

Mount Piper uses approximately 1.65 ML of water per GWh of electricity generated (Worley Parsons 2013). It is used for the production of high purity steam, condensate cooling, supply of domestic water and miscellaneous operations including dust suppression.

A Water Management Licence was first issued on 1 July 2000 and sets out conditions for Power Station access to the Cox's River water supplies. Delta Electricity is authorised to take and use up to 23 000 ML/year from the Cox's River water source for the operation of Mount Piper and Wallerawang (Worley Parsons 2013). In the event that Delta Electricity's Minimum Annual Quantity from the Fish River water supply is reduced by 30% or greater, Delta Electricity is entitled to obtain an additional 2000 ML/year from the Cox's River water source. The Water Management Licence requires Delta Electricity to operate Mount Piper to achieve certain average annual water use efficiency targets; to monitor water quality, river health and geomorphics; and to report on key matters such as dam releases, incidents and water extraction. This information is provided in the Delta Electricity Western Water Management Licence Annual Compliance Report (Worley Parsons 2013).

Delta Electricity is the major customer of the Fish River Water Supply Scheme and has an annual allocation of 8184 ML (Worley Parsons 2013). Fish River water is currently sourced from the Duckmaloi Weir and the Oberon Dam. Due to the quality of water from the Fish River system, this water is more suitable for use at Wallerawang Power Station. Delta Electricity's allocation is restricted according to the level at Oberon Dam.

In 2011, Delta Electricity constructed a reverse osmosis water treatment plant at Wallerawang which was commissioned to treat up to 6 ML/day of cooling water blowdown (Worley Parsons 2013). The RO plant reduces the quantity of the cooling water makeup and thereby eliminates reliance on the Fish River scheme during drought. The wastewater from the Wallerawang RO Plant is transferred by a 5 km pipeline to the Mount Piper brine concentrator system.

4.1.2 Fuel Supply

Coal for Mount Piper is sourced from several local open cut and underground mines, including: Angus Place; Springvale; Ivanhoe North; Pinedale; Invincible and Cullen Valley (Worley Parsons 2013). Coal is primarily supplied by truck, although Springvale coal is supplied via conveyor. Mount Piper currently consumes around 4 Mt per annum (Worley Parsons 2013).

The coal handling plant is located on the north-west corner of the operational area and consists of a truck dump hopper and truckwash (with associated settling ponds); the Springvale conveyor; a receival bin and weighers; a 1 Mt longterm stockpile; stackers; a dry storage silo; conveyors and crushers; a mobile plant workshop and refuelling area; and runoff settling ponds.

To reduce dependence on local coal mines, Delta Electricity investigated coal supply from regional mines via the proposed Western Rail Coal Unloader and Western Rail Upgrade, located on land to the south of Mount Piper. The Western Rail Coal Unloader project received Project Approval in June 2009 but has not proceeded at this stage (Worley Parsons 2013).

Mount Piper Power Station uses refined recycled oil (RRO) for its auxiliary fuel requirements at start-up, mill change-over and low load running. The auxiliary fuel is delivered to the station by road tanker (Worley Parsons 2013).

Mount Piper also uses diesel fuel for operation of the emergency diesel generator and for trucks and mobile plant (Worley Parsons 2013).

4.1.3 Electricity Generation

Mt Piper Power Station comprises two 700MW units, which commenced operation as 660MW units in 1992/1993 and were upgraded to current capacity in 2009/10 (WorleyParsons 2013).

The main features of Mt Piper generating assets include (WorleyParsons 2013 and Delta Electricity pers comms Nino DiFalco 2013):

- coal bunkers and feeders;
- seven ball mills generating pulverised coal feed;
- air fans and associated rotary air heaters for conveying coal and for combustion;
- feedwater/steam/condensate system including pre-treatment of boiler feedwater (ion exchange resin demineralisation of makeup water and chemical treatment of feedwater); economisers, steam drums, furnace water wall tubes, superheaters, re-heaters, condensers, de-aerators and condensate polishing plant (ion exchange resins);
- light fuel ignition system;
- two semi-clad balanced draught, natural circulation, sub-critical boilers incorporating reheat and divided convection back pass;
- boiler blowdown systems;
- tandem compound steam turbines driving hydrogen and water cooled generators, in a fully enclosed turbine building;
- emergency diesel generator and associated transformer and switchboard;
- generator, auxiliary, station and external plant transformers;
- hydrogen plant (no longer used as hydrogen is supplied by cylinder);
- compressed air system;
- cooling water system including two natural draft hyperbolic cooling towers;
- flue gas cooling/heat recovery systems;
- 40 cell fabric filter fly ash collector;
- one flue gas chimney serving both boilers; and
- a central control room servicing both units and accommodating a distributed control system.

Ancillary activities include offices, maintenance workshops, contractors compounds, process water storage and treatment and fuel stores. These are detailed in following sections where relevant.

4.1.4 *Transmission*

The two Mount Piper units are directly connected to the 330 kV network at the nearby Transgrid 330 kV switchyard which is directly connected by tie transformers to the Transgrid 500 kV switchyard immediately adjacent to the Site. A secondary connection to the national grid also exists via the 132/66 kV switchyard.

4.1.5 *Ash Disposal*

The bulk of Mount Piper's ash is placed in a dry on-site ash repository described in earlier sections. A percentage of fly ash is sold to the cement industry.

Fly ash collected in the fabric filters is discharged from the filter hoppers to a pneumatic conveying vessel. The pneumatic conveying system transfers the fly ash to one of two storage silos – one is for fly ash that is to be sold as a cement-replacement for the production of concrete; the other is for the balance of fly ash that has to be disposed of. Fly ash that has been sold is removed from the site by use of privately owned road tankers (Worley Parsons 2013).

Fly ash is conditioned with either water or brine and then transported by covered conveyor from the Power Station silo to a silo at the Mount Piper ash repository.

Submerged chain conveyors remove bottom ash from the furnace and, after de-watering, bottom ash is trucked to the Mount Piper ash repository.

Placement of the ash at the repository is carried out using mechanical plant. The operation and maintenance of the ash handling system (inclusive of the fabric filter) is contracted to Lend Lease.

Delta gained approval in February 2012 to place ash at Lamberts North which is immediately east of the existing ash repository as discussed in earlier sections.

4.2 *INVENTORY OF CHEMICALS AND WASTES*

An inventory of significant storage facilities is provided below, based on the site's Dangerous Goods Licence and observation. Minor stores are also kept in the maintenance workshop and other operational areas.

In addition, a number of large transformers contain significant quantities of insulating oil. The PCB content of oil in all Mount Piper transformers is reportedly less than 2 mg/kg (the concentration below which the oil is no longer subject to the relevant Chemical Control Order under the *Environmentally Hazardous Chemicals Act 1997*). Delta site management advised that transformers were installed without PCB-contaminated oil.

Transformers are housed on concrete bases that drain to the contained oily water system described in this report.

Chemical storage tanks reportedly undergo testing quarterly, and site management were not aware of any integrity issues in tanks or associated pipework. ERM has requested documentation relating to testing and suggest confirmation during Phase II in order to further assess the need for intrusive investigation. An apparent release from the diesel UST at the coal stockpile refuelling plant is described further in *Section 4.3*. A total of 47 individual storage vessel are listed on the Site's register as detailed in *Annex E.*

4.3 PRODUCT SPILL AND LOSS HISTORY & OTHER DISCHARGES

Several minor spills have occurred but were captured onsite:

- overfilling of a diesel Aboveground Storage Tank (AST) resulted in loss of material to the eastern site drain, but this spill was captured in the Final Pond;
- a minor leakage in a diesel fuel oil pipe (less than 100 L) was contained locally. This issue was not discussed in detail as it is not considered material; and
- a breach in the bund wall on the dry ash stockpile following heavy rain occurred in approximately 2002 resulting in spillage of ash to Delta land. This issue was not discussed in detail as it is not material from a contamination perspective (note dam wall integrity is an engineering issue outside the scope of this report).

Groundwater impact has been identified in the vicinity of the wash bay in the mobile plant refuelling area which indicates a historical unreported spill / release has occurred here at some point in the past (as discussed further in *Section 5.1.2)*. The identified Light Non-aqueous Phase Liquid (LNAPL) was weathered with an age estimate of 25 years and was unrelated to the diesel currently in the UST. Documentation for the diesel UST was not available, however it is understood that the UST dates to the commissioning of Mt Piper in 1993, approximately 20 years ago, and there are no other known USTs in the mobile plant refuelling area.

4.4 FUEL MANAGEMENT

The site's main fuel is coal, and large stockpiles are located to the north of the main plant. While some contamination may be associated with stormwater percolating through these stockpiles, the use of the land for coal stockpiling has been approved through various planning processes. A settling pond for the removal of sediment from stormwater is located along the northern edge of the coal stockpile.

The site also uses diesel for backup generators as well as mobile plant used in the coal stockpile, ash stockpile, and operational area. Fuel is stored in several locations as detailed in *Annex E:*

- two 1.2ML diesel ASTs;
- 34 200L E10 and 20 900L diesel UST;
- 11 800L diesel UST; and
- 10 000L diesel UST and 5000l AT day tank for back-up generator.

4.5 WASTE AND ASH DISPOSAL

4.5.1 Ash Management

Ash generated as a by-product of the combustion process is transported either pneumatically (flyash) or via truck (bottom ash) to the on-site Ash Repository. Fly ash is conditioned with site process water to increase moisture content for better handling, compaction and prevention of dust emissions during transport and placement.

The current Ash Repository is located in the former Western Main open cut mine void adjacent to the Power Station. Brine is co-disposed in the ash placement area within an area specified by the relevant development approvals. The current Ash Repository covers approximately 43 ha and is nearing capacity – two to twelve years of storage remain (Worley Parsons 2013). Capacity increases to the upper end of the range if normal water conditioned ash is placed in the recently approved Lamberts North Ash Repository area. Otherwise the remaining brine conditioned ash storage area will be exhausted with Normal Water Conditioned Ash. The Ash Repository is operated by Delta's contractor Lend Lease.

In February 2012, Delta Electricity obtained Project Approval from the Minister for Planning and Infrastructure for a new Ash Repository at Lamberts North to cater for the ash generated from the existing Mount Piper Power Station and proposed Power Station extension. The Lamberts North Ash Repository site is located adjacent to the existing Ash Repository, and includes an area known as the Huon Void, which is currently being filled with a base to prepare the site for ash placement. According to Worley Parsons 2013, the Mount Piper Ash Placement Project originally proposed the development of four sites (Lamberts North, Lamberts South, Ivanhoe 4 and Neubecks Creek), however the other three sites are being redeveloped for alternate purposes.

4.5.2 *Other Waste Management*

The Mt Piper EPL permits the site to dispose the following types of waste at the ash disposal area (WorleyParsons 2013):

- ash;
- mill pyrates;
- demineralisation and polisher paint effluents;
- chemical clean solutions;
- cooling tower sediments;
- ion exchange resins;
- fabric filter bags;
- brine conditioned fly ash;
- biomass co-firing ash;
- settling pond sediments; and
- oil and grit trap sediments.

4.6 *WATER AND WASTEWATER MANAGEMENT*

Stormwater from "clean" operational areas (such as carparks and grassed areas) is collected through a network of grates and pipes (colour coded red) and carried via the West and East Drains to the Final Holding Pond. A reclamation pump is used to allow stormwater to be used as makeup water for the cooling towers. An underflow weir allows excess water (eg associated with a large storm event) to discharge to Neubecks Creek at an EPA licenced monitoring point (with no discharge limits).

Sewage from plant amenities is collected and treated in a Pasveer channel treatment plant, originally built in the early 1980s to service both the construction period and subsequent operation period. Treated effluent is used as makeup water for the cooling towers, and the sludge from this process is stockpiled and disposed of off-site by licensed contractors, although this has never yet been required.

Process wastewater is reused on site as cooling tower make-up water, after treatment to ensure appropriate quality. Process wastewaters fall into the following main categories:

- wastewater from cooling tower blowdown;

- stormwater and wastewater from areas that are likely to generate oil contamination, such as fuel store bunds (colour coded green);

- floor washings and stormwater that is likely to be contaminated with ash (colour coded blue); and

- floor washings and stormwater that is likely to be contaminated with chemicals, such as bund areas (colour coded purple).

Treatment processes for these streams vary depending on the nature of the contaminant and include settlement, chemical neutralisation, oil water separation, brine concentration and reverse osmosis.

Potential contamination sources from wastewater process include pipework and in-ground pits and open ponds used to store and treat wastewaters.

The integrity of the pipework and pits has not been assessed and may present a contamination source if leaks have occurred.

Site management reported that the open ponds used to store and treat wastewaters are lined with rubber to prevent wastewater loss, and that monitoring bores are located near the ponds to allow detection of leakage. Site management reported that monitoring results indicate that leakage has not occurred. Site management also reported that the lining is reaching the end of its technical lifespan, however an independent engineers review has confirmed that the liners remain in good condition and as such may not require replacement for some time.

The main open and lined ponds include:

- contaminated water - one 8 ML contaminated water pond collecting wastewater from areas where oil spills may occur;

- ash washdown and chemical waste settling ponds - three 8 ML settling ponds that allow suspended solids to settle while chemical wastes are neutralised;

- cooling water blowdown pond B – the 103 ML blowdown pond B collects feeds to the brine concentrators, consisting mainly of cooling tower blowdown, but also high TDS wastewater from the demineralisation and polisher regeneration plant, waste from the cooling water reverse osmosis plant and clean water from the setting ponds;

- cooling water blowdown pond A – the 77 ML blowdown pond A receives the high TDS water from Pond B and provides feed to the brine concentrators.

- Brine Concentrator brine waste ponds - High salinity waste from the brine concentrators is stored in two 20 ML waste brine ponds, and is used to condition ash prior to placement in the ash repository.

- clean water pond – one 30 ML clean water pond receiving good quality water from the contaminated water oil water separators, the brine concentrator, boiler blowdown and sewage plant.

5 SITE CONTAMINATION HISTORY

5.1 OVERVIEW

The current processes being undertaken upon the Site have not changed greatly since operation of the Site commenced in 1993. Potential and actual areas of contamination can be assessed based upon historical mining and landfilling activities (*Section 3.1)*, current operations (*Section 3.1.2*), chemical storage and waste inventory (*Section 3.7*), and a review of the limited soil and groundwater investigations completed to date (*Section 3.6*). Potential and actual soil and groundwater areas of concern are presented in *Section 4*.

5.2 REGULATED CONTAMINATED SITES IN VICINITY

The *NSW EPA Contaminated Lands Register* lists sites that are known to be contaminated and are regulated by the NSW EPA under the *Contaminated Land Management Act 1997*. At the time of this assessment (March 2013) the site was not listed on the register.

Sites listed on the *NSW EPA Contaminated Lands Register* in the Lithgow City Council Local Government Area are as follows:

Table 5.1 Sites in the Vicinity of Mount Piper which appear on the Contaminated Lands Register

Suburb	Location	Site	Notices
Hartley Vale	Hartley Vale Road	Hartley Vale Former Shale Oil Refinery	1 current
Lithgow	Methven Street	ADI Lithgow Small Armaments	1 former
Portland	Williwa Street	Blue Circle Southern Cement	2 former

NSW landowners and occupiers who are aware or ought reasonably be aware that their sites may be contaminated above certain levels specified in the *Contaminated Land Management Act 1997* must notify the NSW EPA of the suspected contamination. The contamination may or may not be significant enough to warrant regulation by the EPA. Following notification, the EPA conducts an assessment process to determine whether regulation is required. The *NSW EPA List of Contaminated Lands Notified to the EPA* describes these sites. Information provided by site management indicated that the site has recently self-reported potential or actual contamination to NSW EPA under Section 60 of the *Contaminated Land Management Act 1997* in relation to the Mobile Plant Re-fuelling Area within the CMP.

An adjacent site, the Ivanhoe Colliery on Pipers Flat Road, has reported potential or actual contamination to NSW EPA under Section 60 of the *Contaminated Land Management Act 1997*. The Ivanhoe Colliery extends to the

north of the Site, and it appears that part of the Ivanhoe Colliery is within the lands owned by Delta. However, the nature and exact location of the reported contamination is not known.

Table 5.2 Sites in Vicinity of Mount Piper Notified to NSW EPA under the CLM Act

Name	Location	Use	EPA Review Status
Blackmans Flat	Lamberts Gully Castlereagh Highway	Other Industry	In progress
Blackmans Flat	Mount Piper Extension Development Site 2847 Boulder Road	Other Industry	In progress
Cullen Bullen	Baal Bone Colliery Castlereagh Highway	Other Industry	In progress
Lidsdale	Angus Place Colliery Wolgan Road	Other Industry	In progress
Lithgow	BP Service Station 1106 Great Western Highway	Service Station	In progress
Lithgow	Caltex Lithgow (Quota Park) Adjacent to 1131 Great Western Highway	Unclassified	Completed
Lithgow	Former Gasworks Mort Street	Gasworks	Completed
Lithgow	Former Shell Depot 6 Gasworks Lane	Other Petroleum	In Progress
Lithgow	Lithgow Thales 4 Martini Parade	Metal Industry	Completed
Lithgow	Mobil Depot 353 Main Street	Other Petroleum	In Progress
Portland	Ivanhoe Colliery Pipers Flat Road	Other Industry	In progress
Wallerawang	Delta Electricity 1 Main Street	Other Petroleum	In Progress
Wallerawang	Lidsdale Coal Loading Facility Main Street	Other Industry	In progress

5.3 PREVIOUS ENVIRONMENTAL INVESTIGATIONS

In accordance with industry practices Mt Piper Power Station has undergone a limited amount of intrusive soil and groundwater assessments to date. As summarised below, these have been targeted to specific identified issues rather than presenting a comprehensive assessment of site conditions, which is not an unreasonable approach for an operational industry of this type.

Regular groundwater monitoring has been undertaken since construction to monitor conditions around the settlement ponds and the Brine-Ash Repository, and more recently a program has been initiated to achieve compliance with underground petroleum storage system (UPSS) legislation.

The following section summarises the relevant reports reviewed by ERM.

PPK (2000), Phase 1 Environmental Site Assessment, Uncontrolled Landfill Sites, Mt Piper Power Station, Portland, NSW

A Phase 1 Environmental Site Assessment (ESA) was undertaken of a number of uncontrolled landfills previously operated at Mt Piper Power Station. As discussed in *Section 3.1*, these included a construction landfill, uncontrolled/domestic waste landfill and the Chitter Dam landfill. PPK 2000 identified the following potential contaminants:

- Acid drainage from the weathering of sulphide-rich waste from mining activities may result in the mobilisation of heavy metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel and zinc);
- Hydrocarbon based contaminants from the disposal of waste products. This may include total petroleum hydrocarbons (TPH), benzene, toluene, ethylbenzene and xylenes (BTEX), polycyclic aromatic hydrocarbons (PAHS);
- Organochlorine and organophosphorus pesticides from the disposal of drums or residues; and
- Nitrates, nitrites, ammonia phenols from the breakdown of putrescible waste within the uncontrolled landfill.

SMEC (2012) Draft Report: Design and Installation of Underground Tank Testing Boreholes at Mount Piper Power Station (January 2012)

Eight groundwater monitoring wells were installed around three USTs within the shallow aquifer at depths between 4 and 7 m below ground level (bgl). No soil samples were collected or analysed during the well installation. A round of groundwater monitoring was also conducted. Groundwater monitoring results identified concentrations of TPH, BTEX and PAH exceeding the adopted site assessment criteria in both wells installed in the Mobile Plant Refuelling Area (MWMP7 and MWMP8), and in one well located near the Store UPSS (MWMP1). SMEC considers the likely source of hydrocarbon contamination in MWMP1 (up-gradient of the Store UPSS) to be from a potential spill in the area, although it is noted that no delineation was undertaken to confirm the extent or the source.

SMEC (2012) - Underground Petroleum Storage System (UPSS) Groundwater Monitoring – Mt Piper and Wallerawang Power Stations (September 2012)

Quarterly monitoring of groundwater wells at Mt Piper for compliance with UPSS Regulations was undertaken in 2012. Light non-aqueous phase liquid (LNAPL) was identified in a groundwater monitoring well (MWMP8) screened to intersect perched groundwater on the northern side of the wash bay, adjacent to the oil-water separator in October 2012 (SMEC 2012). There were no other groundwater issues identified during the UPSS monitoring.

GHD (2012a) Preliminary Baseline Contamination Assessment & Duty to Report Contamination Western Region - Wallerawang Power Station, Mt Piper Power Station

Delta engaged GHD to review the findings of the PB (2010) Duty to Report Contamination Background Report and conduct a risk screening of contaminated and potentially contaminated areas at Mt Piper and Wallerawang. GHD (2012) identified 33 Areas of Environmental Concern (AECs) and assessed each AEC against a standard risk screening tool. GHD noted that the risk ranking could be lowered if monitoring wells were installed downgradient of landfills and if the analytical suite of the existing groundwater monitoring program was modified. GHD (2012) recommended that notification be made to NSW EPA in regards to the Mobile Plant Area.

GHD (2012b) Western Region Summary Report - Contaminated Sites and Landfills

This report summarises the key findings of GHD (2012a), documenting the nature, location and estimated risk of potential contamination issues for preoprties in the Delta Western region.

Merrick, N.P. (NCGM) (2007) Groundwater Modelling of Brine Conditioned Fly Ash Co-Placement at Mount Piper Power Station

This report provides an assessment of the effects of the proposed extension of the brine-conditioned ash placement area on groundwater quality and trace elements at Neubecks Creek, Huon Creek (formerly referred to as the Eastern Drain) and Huon Pond. Huon Pond is the Huon Mine No. 6 Void and has also been formerly referred to as the Groundwater Collection Basin. This report also explores the contribution of water in mine goaf areas to the water quality observed in Huon Pond.

This study found that there was no risk at Neubecks Creek, with extremely low concentrations predicted. There is also a low risk that some trace elements generated from ash disposal will increase background levels by more than guidelines at Huon Creek or Huon Pond. The modelling indicates that the worst case is silver, with a maximum concentration at about 56% of the guideline value. The water-conditioned ash and the brine-conditioned ash appear to contribute fairly evenly to concentrations of groundwaters discharging into the pond and Huon Creek.

It appears that the mine goaf zones are bleeding continuously into the spoil material, which otherwise would flush readily, under the attraction of the groundwater sink at the Huon Pond. The goaf was found to be contributing

some trace elements to the Pond at concentrations above ANZECC guideline levels but this is unrelated to the brine-conditioned ash placement.

CDM Smith (2012) Lamberts North Ash Placement Project Groundwater Modelling Report.

CDM Smith Australia Pty Ltd (CDM Smith) undertook groundwater modelling in order to assess the potential impacts of the proposed ash placement works on groundwater at Lamberts North in accordance with the requirements in Section B2 of the Conditions of Approval (CoA).

CDM Smith concluded that construction of Lamberts North would not affect groundwater flow or levels. Groundwater monitoring and modelling indicated that recent high chloride concentrations detected in a borehole (Bore D10) were likely to be due to upstream coal reject ponds (now abandoned) in the south-west corner of Lamberts North.

The model also confirmed that there was no evidence of chloride contamination in the groundwater from either Mount Piper Ash Repository or from the site of the ash placement area at Lamberts North. The model predicted that once the chloride source has been halted, chloride contamination in groundwater is likely to decline rapidly over time.

The model predicted that it would take about 12 years (from the commencement of brine conditioned ash placement in 2000) for the brine leachates to reach the groundwater under the ash. The model also predicted that the brine and water conditioned ash leachate plumes would not degrade the water quality in the GCB and Neubecks Creek to a point where it would exceed the ANZECC (2000) guidelines for metals.

Aurecon (2011) Mt Piper Brine Conditioned Fly ash Co-Placement Water Quality Monitoring Annual Update Report 2010Delta Electricity Western

This report is an annual update of the Mt Piper Power Station brine co-placement surface and groundwater report and covers the period January, 2010 to December, 2010. The 2010 monitoring data found that there has been:

- an increase in the salinity of the water conditioned ash runoff collection ponds;
- a local increase of salinity and chloride in the groundwater bore MPGM4/D10;
- decrease in chloride concentrations in the GCB in 2010;
- a recent increase in the magnitude of chloride spikes at the northern seepage detection bore, located just outside the ash placement area; and
- further decrease in sulphate and boron in the seepage detection bore D1.

Groundwater monitoring for the first ten years of operation of the brine conditioned flyash co-placement program at Mt Piper Power Station indicates that leachates from the brine conditioned flyash have not yet reached the local groundwater. However, the groundwater modelling indicates that leachates could be expected to reach the groundwater in the near future.

Rainfall runoff from exposed ash batters appears to be the cause of the local increase of salinity and chloride in the groundwater bore MPGM4/D10. This finding suggests that batter runoff controls and liners under the existing runoff collection ponds are required in several areas of the ash placement area to minimise seepage into the local groundwater.

Recent chloride data in the Groundwater Collection Basin shows that the previous trend for increase has changed to a decrease with the return to normal rainfall patterns and has remained well below the local ANZECC (2000) guidelines. The cause of the small increase since 2006 was confirmed as not being due to brine leachates penetrating the groundwater under the water conditioned ash placement, but rather, being due to the movement of nearby high chloride goaf water. The movement of mine water toward the GCB was most likely due to the groundwater level rise caused by the large area of water conditioned ash now placed in the ash placement area.

The seepage detection bore D1 showed a significant decrease in sulphate and boron with the wetter weather in 2010, due to dilution by rainfall runoff. The changes in the water quality characteristics are due to local mine water movement with the groundwater level rise and are not related to the brine conditioned ash placement operations.

The seepage detection bore D3, located north of the brine placement area, showed chloride concentration spikes with rainfall. The spikes appear to be due to the groundwater level rise with water conditioned ash placement and leaching of low levels of chloride from the local mine spoil during rainfall events. However, some of the spikes have recently been higher than expected from the mine spoil, suggesting some input from ash leachates. Accordingly, runoff from exposed batters was suggested to be investigated.

Aurecon (2012) Mt Piper Brine Conditioned Fly ash Co-Placement Water Quality Monitoring Annual Update Report 2011

This report is an annual update of the Mt Piper Power Station brine co-placement surface and groundwater report. The key findings of the 2011 report include the following:

- locally derived and ANZECC (2000) guideline trigger values were not exceeded in receiving waters and there was no evidence of brine leachates migrating beyond two bores adjacent to brine conditioned ash areas;
- increased chloride, salinity and trace metals at bore D10 have not affected concentrations in the Groundwater Collection Basin (GCB);

- Stage I and II brine co-placements have had limited effects on the local groundwater flowing to the northern area seepage detection bores and there were no measureable effects on Neubecks Creek at site WX22;

- there were no significant effects on water quality and trace metals in groundwater at bore MPGM4/D11, inside the ash placement area, in the GCB and in the seepage detection bores. Therefore, the brine co-placement system appears to have effectively contained brine leachates in the ash pores, as predicted by the groundwater model; and

- the chloride and salinity increase at bore D10 have continued in 2011, and are suggested to be due to either brine conditioned ash leachates entering the local groundwater by some unknown flow path or seepage from underground workings or runoff from the local mine spoil and/or coal reject in the adjacent open cut mine.

Based on the findings of the report, several enhancements/controls to collect runoff from the B4 and B5 benches and batters have been recommended to minimise runoff from the brine conditioned ash areas into the local groundwater.

Birch, G., Siaka, M., Owens, C. (2001) The Source of Anthropogenic Heavy Metals in Fluvial Sediments of a Rural Catchment: Coxs River, Australia, Water, Air and Soil Pollution ***126:*** *13-35***.**

Birch et al (2001) investigated the characteristics of fluvial sediments of the Coxs River catchment to determine the extent of impact by industry, mining, and urbanisation. A total of 133 sediment samples were collected along the entire length of the river and were analysed for heavy metals including Pb, Cu, Zn, Mn, Ni, Co, Fe, and Cr.

It was concluded that the surrounding town, sewage treatment plants, and the power stations were sources of elevated concentrations of heavy metals in sediments. Sediments in the Coxs River downstream of Mt Piper power station had elevated concentrations of nickel, cadmium and cobalt.

Birch et al (2001) concluded that sediments in the Coxs River, Lake Wallace and Lake Lyell contained concentrations of heavy metals which were above background conditions. Acid leaching analysis suggested that the heavy metals in sediments were generally not bioavailable (Birch et al, 2001). However, a proportion of sulphide-bound and organic matter-bound metals may become bioavailable under specific physiochemical conditions such as increases in redox potential (Birch et al, 2001). These results were based on laboratory analysis of sediments, and the study did not include monitoring of surface water conditions to determine the likelihood of these conditions occurring at the sampled sites.

Birch et al (2001) concluded that sediments in the Coxs River, Lake Wallace, and Lake Lyell contain concentrations of heavy metals which are higher than background conditions. Concentrations of heavy metals in the Coxs River

downstream of the dam wall at Lake Lyell were close to background levels, and Birch et al (2001) concluded that Lake Wallace and Lake Lyell effectively contain the sediment impacts.

6 SUMMARY OF FINDINGS

6.1 AREAS OF ENVIRONMENTAL CONCERN

Based upon a review of current and historic site operations, previously completed environmental assessments, and chemicals and wastes stored and/or disposed of on the Site, a number of actual and/or potential areas of environmental concern have been identified. The following sections provide an assessment of each of these areas, followed by an assessment of the materiality of the issues identified in the context of the transaction.

6.1.1 Former Mine and Backfilling of Operational Area

Mount Piper's main operational area was constructed on former open cut coal mines. Material used for backfill is not recorded however site management believed that it was most likely to be mine overburden and mine wastes, and this is consistent with typical mine practice. Along with mine overburden, it is feasible that other smaller waste streams used as backfill may be contributing to elevated salt, metals and acidity in groundwater.

It is also feasible that isolated areas of contamination relating to previous mine operation may remain at the facility. Historical activities with the potential to cause isolated contamination issues include maintenance and refuelling.

A former chitter dam associated with the former Ivanhoe Mine is located in the buffer lands acquired by Delta Electricity, to the south-west of the main operational area. The chitter dam is visible in aerial photographs in 1984, with vegetation covering the area in subsequent photographs. The approximate extent of the filled area is indicated in maps of the Mount Piper site (PPK, 2000) and site management believed that it was three to four metres deep. The chitter dam is located upgradient from the former putrescible waste dump described in the following section, with an unsealed road separating the two areas. The position of the chitter dam in a surface water drainage line indicates a potential for saturation and pondage of surface water in this area, and a high potential for seepage. Potential contamination concerns include impact from chitter (that is, coarse carbonaceous wastes) such as acidity, dissolved salts and heavy metals.

The remnants of several large structures are evident in the buffer land to the north. Aerial photographs and old maps suggest that these were water treatment dams, and interview with site staff indicated that these have been filled and are no longer in use. Given that they are within the footprint of the former Huon mine, it is feasible that these are coal washery ponds that present potential contamination concerns associated with acidity, dissolved salts and heavy metals. Site staff also suggested that these may have been sewage ponds however this could not be confirmed, and given the limited population in the area the ponds appear to be relatively large and as such may not relate to that speculated use.

A contractors yard/ staging area was established during the construction of the power station to the south of the current staff carpark. Other former mine infrastructure may be present in the buffer lands and for that reason it is recommended that a broad-scale assessment of potential contamination be undertaken to rule out potential material environmental issues associated with soil and groundwater conditions.

6.1.2 Former Landfills

There are two closed landfills which date from the early years of construction and operation of Mt Piper Power Station. Whilst each landfill was intended for a specific purpose and such practices were not uncommon at that time, the disposal of waste was uncontrolled and a range of potential contaminants may be present:

- the former construction waste landfill was used by contractors for disposal of building waste and materials from the construction of Mt Piper Power Station. The landfill is located in a gully in the western buffer land.

- the former general waste landfill included putrescible waste and site management indicated that it was not used for disposal of restricted wastes (ash or related wastes). The landfill consisted of an unlined trench without controls on landfill gas or leachate. The landfill was reportedly used between 1993 and 1995, when the Power Station changed its policy and disposed of waste off-site. A relatively small proportion of the planned landfill was therefore filled. The landfill is located to the south-west of the main operational area in the western buffer land.

There have been limited investigations into the potential for leaching from the uncontrolled landfills, however, documentation of these investigations was not available at the time of reporting. Two existing groundwater monitoring wells located in the area are monitored on a quarterly basis however it is noted that the analytical suite does not include all of the identified potential contaminants of concern.

Potential contamination concerns include impact from non-inert construction wastes (oils, solvents, paints) and putrescible wastes (leachate). Further assessment of these areas via intrusive assessment is therefore recommended.

6.1.3 Coal Storage Area

The coal storage area is approximately 16 ha in size and is used for stockpiling of coal prior to being transferred via conveyor to the boilers. Potential contamination sources or activities include coal stockpiling, use and maintenance of conveyors, coal truck washdown bays and associated settling ponds, and seepage from contaminated stormwater settling ponds. Refuelling of mobile plant is discussed in a separate section.

While there have been no soil and groundwater investigations completed within the Coal Storage Area, based upon the potential sources of contamination and low likelihood of receptor exposure, and that this area will continue to be used for coal storage, this area is considered to represent a relatively low risk in the context of this assessment.

6.1.4 Electrical Transformers

Transformers and associated oil storage tanks are located on concrete within a contained area. In general, transformers are considered to be "PCB free", with transformers are tested regularly to assess PCB concentrations. There was a marginal exceedance of the statutory limit under the Environmentally Hazardous Chemicals Act 1985 for the notification of PCBs (Unit 2B 11/3.3kV Auxiliary Transformer) of 2 ppm (mg/kg) with 3.1 ppm (mg/kg). Delta did not report any spills within the transformer area and given the general level of housekeeping and monitoring, it is unlikely that a release of sufficient quantity has occurred and not been reported.

While there have been no soil and groundwater investigations completed within and around the transformers, based upon the absence of known historical release and the low likelihood of a pathway to soil and groundwater, this area is considered to represent a relatively low risk in the context of this assessment.

6.1.5 Water Holding Ponds

Site management reported that the open ponds used to store and treat wastewaters are lined with rubber to prevent wastewater loss, and that monitoring bores are located near the ponds to allow detection of leakage. Site management reported that monitoring results indicate that leakage has not occurred. At present, although there have been limited soil and groundwater investigations completed related to the water holding ponds, based upon the management advice that no impact has been registered, these areas are considered to represent a relatively low risk in the context of this assessment.

6.1.6 Workshops

Maintenance workshops are located at:

- the western side of the main plant, behind Unit 2; and
- the south-east corner of the coal handling area (this is a combined workshop and mobile plant refuelling area).

Site management indicated that the workshops have remained in the same location since plant operation commenced. Delta management reported that some chlorinated hydrocarbons such as "Dev-Tap" (1,1,1, Trichloroethane) have been used historically, but that such products are no longer used.

A washdown pit is located adjacent to the day maintenance workshop and the integrity of this in-ground pit is unknown.

Although a covered concrete platform is provided at the mobile plant yard, some staining is evident on surrounding open ground. It is also feasible that the formal wash area was not available historically. A separate known issue relating to fuel storage is discussed in *Section 4.1.2*. There have been no soil and groundwater investigations completed within the workshop areas to achieve a suitable degree of environmental characterisation. Given the absence of previous environmental investigations, and the potential presence of chlorinated solvent use on site, further investigation may be required rule out potentially significant soil and groundwater contamination issues.

6.1.7 Mobile Plant Refuelling Area

The mobile plant refuelling area is located adjacent to the coal storage area and is used by large mobile plant. The infrastructure comprises a shed, small workshop and a wash bay, with a diesel UST and bowser located on the southern side of the wash bay. The wash bay drains to an oil-water separator located on the northern side of the wash bay. The ground immediately surrounding the mobile plant area is unsealed and there was staining observed on bare ground beneath the large plant.

Light non-aqueous phase liquid (LNAPL) was identified in a groundwater monitoring well (MWMP8) on the northern side of the wash bay, adjacent to the oil-water separator in October 2012 (SMEC, 2012). Further investigations were undertaken, including integrity testing and excavation to inspect the UST and lines, which indicated no issues with the UST. Hydrocarbon fingerprint analysis was undertaken on samples of the diesel from the UST and the LNAPL in March 2013. The LNAPL was weathered with an age estimate of 25 years and was unrelated to the diesel currently in the UST.

The presence of LNAPL in perched groundwater with an age estimated at 25 years, unrelated to the current UST, suggests a historic aboveground release of diesel in this area. The extent of the impact has not been delineated and further investigation would be required to rule out potentially significant soil and groundwater contamination issues.

6.1.8 Operational and Decommissioned USTs

Four underground storage tanks (USTs) are present on site, containing diesel and petrol (E10), in the stores, diesel generator and the mobile plant area. The USTs are understood to be approximately 20 years old and no information was available during the assessment on their construction. Site management advised that tank integrity tests are undertaken routinely at the site and have not identified any issues. In addition, site management were not sure whether the programme included underground pipework. Documentation relating to the programme has been requested from the Stores Manager.

The USTs are located as follows:

- Petrol and diesel USTs near the main store (approx. 33 000L and 20 000L);
- Diesel UST for the emergency generator (11 700L) and associated above ground day tank; and
- Diesel USTs at the mobile plant refuelling area (discussed above).

Soil and groundwater investigations have been completed in the areas of below ground tank infrastructure to ensure compliance with relevant underground petroleum storage system (UPSS) legislation, and ensure protection of soil and groundwater receptors. Based upon the environmental characterisation achieved, this area is considered to represent a relatively low risk in the context of this assessment, with the exception of the mobile plant area which is separately discussed in *Section 6.1.7*.

6.1.9 Operational ASTs

The site houses numerous above ground storage facilities, ranging from small roofed stores for minor quantities of maintenance chemicals to very large diesel tanks. The facilities that present a higher contamination risk are described below, based on compliance assessments in the dataroom and discussion with site management.

Site management advised that tank integrity tests are undertaken routinely at the site and have not identified any issues. However documentation relating to the programme was not available during the site visit, and the tanks included within this programme could not be confirmed. In addition, site management were not sure whether the programme included underground pipework. Documentation relating to the programme has been requested from the Stores Manager.

As noted earlier, Mount Piper Power Station uses refined recycled oil (RRO) for its auxiliary fuel requirements at start-up, mill change-over and low load running. The auxiliary fuel is delivered to the station by road tanker (Worley Parsons 2013). The fuel oil installation was installed in 1990/91 and consists of two bunded 1.2 ML steel tanks, an unloading station for unloading two road tankers simultaneously and a small 36 kL overflow tank (Worley Parsons 2013). The fuel tanks are located on the south-east corner of the operational area. The fuel is supplied to the boilers through underground gravity pipes, to dedicated duty and standby ignition oil pumps for each boiler (Worley Parsons 2013). The volume of fuel being stored and transferred across the site represents a significant source of potential contamination. There have been no soil and groundwater investigations completed in the area of the Fuel Oil Installation or associated pipework to achieve a suitable degree of environmental characterisation.

A 28 000 L diesel tank is located near the ash stockpile. Previous investigations (Premier Engineering Services Pty Ltd 2010) have noted housekeeping issues and disposal of contaminated bund water to the ground.

The sulfuric acid, caustic and alum tanks at the demineralisation plant (depots 26 and 27) were reportedly in poor condition and a sulfuric acid tank had suffered an overflow (Premier Engineering Services Pty Ltd 2010).

Given the absence of previous environmental investigations, the volume of stored and transferred fuel and other chemicals, and the potential for historic release events to impact soil and groundwater receptors, further investigation would be required rule out potentially significant soil and groundwater contamination issues.

6.1.10 Ash Repositories

Groundwater-Surface water Context

Groundwater modelling of the impact of placement of brine conditioned fly ash in the current ash repository was undertaken prior to commencement of brine co-placement (NCHM, 2007) and more recently (CDM Smith, 2012). The groundwater modelling undertaken indicated that construction of the Lamberts North Ash Repository would not affect groundwater flow or levels (CDM Smith, 2012). The model predictions suggest that there is a low risk that some trace elements generated from ash disposal will increase background levels by more than guidelines at Huon Creek or Huon Pond but not at Neubecks Creek (NCHM, 2007, CDM Smith, 2012).

Annual groundwater monitoring generally supports the findings of the modelling, with results from 2011 indicating that brine leachates are presently contained to the ash repositories (Aurecon, 2012). Brine leachates were not detected in groundwater beyond the two repository boundary wells and surface water quality in receiving waters (Huon Pond and Neubecks Creek) continued to comply with the applicable guidelines (Aurecon, 2012).

Elevated chloride, salinity and trace metal concentrations continue to be detected at bore D10, however no impacts have been identified in the Huon Pond (Aurecon, 2012). Aurecon (2012) concluded that the impacts identified at bore D10 are likely related to seepage from coal rejects or mine spoil from the adjacent open cut mine, seepage from the underground mine workings and/or migration of the leachates from the brine conditioned ash by an unidentified flow path.

The groundwater modelling also identified the role of the mine goaf zones (former tunnel and pillar extraction mine workings) in contributing some trace elements to the Pond at concentrations above ANZECC guideline levels which is unrelated to the brine-conditioned ash placement (NCHM, 2007). Further, the Huon Pond was shown to act as a groundwater sink, exerting an influence on groundwater flow direction.

Current Ash Repository

The current ash repository is located directly to the north east of the Power Station, in the former Western Main open-cut mine void. The repository covers an area of approximately 40 ha.

The ash disposal site was designed as a dry ash repository, with water addition being limited to water added for ash conditioning prior to disposal and dust suppression following disposal. Ash disposal commenced at the repository when the first power generating unit came on-line at Mount Piper Power Station in 1993.

ERM understands that brine conditioned ash was disposed at the repository following an assessment and modification of development approval of potential impacts to groundwater in 1999. Brine conditioned ash is currently disposed in a designated area as permitted by the EPL license (GHD, 2012). Reportedly, approximately 246 ML of brine has been used to condition fly-ash since the placement of brined conditions ash began in November 2000 up to 31 December 2010 (Aurecon, 2010).

Seepage from the ash repository has the potential to be saline and contain heavy metals. Potential receptors include the Neubecks Creek and Huon Pond (formerly known as the Groundwater Collection Basin, currently being filled as preparation of ash placement at Lamberts North).

Groundwater monitoring is undertaken at the repository for a range of potential constituents of concern including salinity, pH, heavy metals and chloride (used as tracer for brine mobilisation) (Aurecon, 2012). Boron and sulfate concentrations exceeding the ANZECC 95% protection levels for fresh water have been attributed to historical coal mining operations, and a marked increase in chloride concentrations in monitoring bore MPGM4/D10 is considered to be caused by seepage from the coal washery rejects ponds (discussed in the following section) (Aurecon, 2012). A groundwater quality review undertaken in 2011 further found that surface and groundwater quality guidelines in the receiving waters of the Neubecks Creek and Huon Pond continued to be met at the time of writing (Aurecon, 2012).

While considerable environmental assessment has been undertaken in this area, it is not considered that suitable characterisation of environmental conditions has been established. Further assessment of this area via sampling of existing wells and additional intrusive assessment is therefore recommended.

Lamberts North Ash Repository

As noted previously, Delta Electricity is expanding its existing ash repository into land previously used by Centennial Coal for open–cut coal mining activities. Delta Electricity obtained Project Approval from the Minister for Planning in February 2012 for the ash placement in an area known as

Lamberts North. The repository, located to the south-east and adjacent to the existing ash repository, is currently being prepared for ash placement. Seepage from the ash repository has the potential to be saline and contain dissolved salts and heavy metals. Potential receptors include the Neubecks Creek. Whilst disposal of ash has not commenced at Lamberts North, groundwater monitoring associated with the existing ash repository is undertaken in the western section of the Lamberts North area. Constituents monitoring include salinity, pH, heavy metals and chloride (used as tracer for brine mobilisation). Boron and sulfate concentrations exceeding the ANZECC 95% protection levels for fresh water have been attributed to historical coal mining operations, and a marked increase in chloride concentrations in monitoring bore MPGM4/D10 is considered to be caused by seepage from the coal washery rejects ponds (CDM Smith, 2012).

During the site visit, it was noted that two unlined coal washery reject ponds were constructed by Centennial Coal along the former drainage line (known as Huon's Gully). These were constructed on a disturbed creek bed and open cut mine filled with overburden. Seepage from washery rejects ponds has the potential to enter the groundwater aquifer. Potential contamination concerns to groundwater include impact through dissolved salts and heavy metals.

During the site inspection on 20 March 2013 the ponds were observed to be almost filled with washery rejects that had dried into a black sludge with no standing water. There are currently no controls on the free movement of surface water along the former drainage line and hence potentially contaminated sludge material could become entrained in surface water.

A freshwater pond is present below the second washery rejects pond, with a poorly battered dam wall construction composed of excavated materials. Delta management reported that the freshwater pond was temporarily used to direct water from the Huon Void. There is potential for seepage from the washery ponds to migrate into the freshwater dam. The freshwater pond is blocked from down-gradient drainage, and the ultimate receiver of waters from this pond is unclear. A drainage channel is currently being excavated by Delta Electricity to divert current surface water flow away from Huon's Gully, and along the boundary between Lamberts North and the ridge above the facility. The intent of the drainage channel is to divert up-gradient surface water runoff around the proposed ash repository, and the rejects ponds. This will divert any further inflows of water to the freshwater pond.

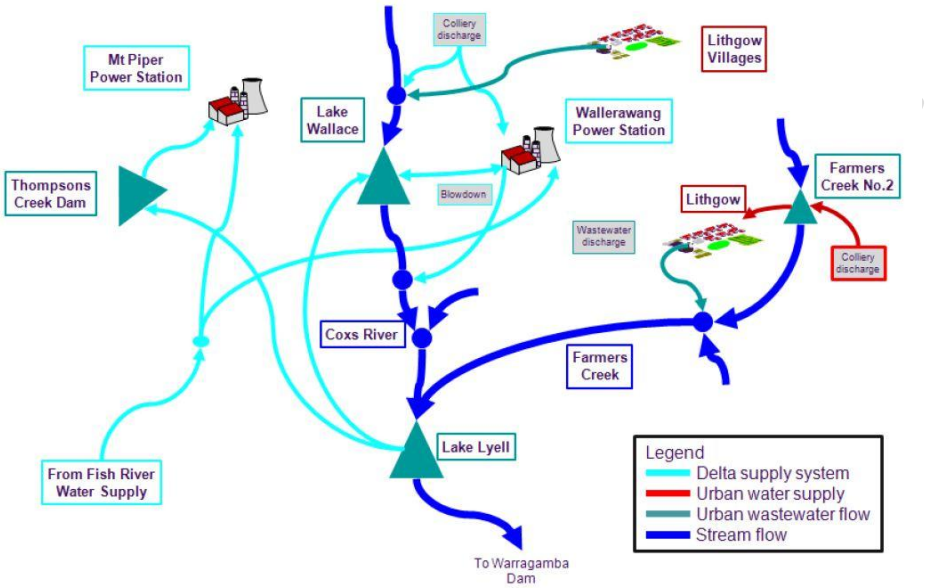
Given the potential for impact to soil and groundwater receptors, further investigation would be required rule out potentially significant soil and groundwater contamination issues associated with the new Lamberts North Ash Repository.

6.1.11 *Water Assets And Receptors (Cox River, Lake Lyell, Thompsons Creek Reservoir)*

Coxs River System

Mount Piper Power Station is situated within the catchment for Neubecks Creek, a tributary of the Coxs River, both of which are potential ecological receptors. The Coxs River catchment includes several current and historical coal mines as well as the Mt Piper Power Station. The Coxs River is dammed at Lake Lyell, with water pumped to off stream storage at Thompsons Creek Reservoir and on to Mount Piper to supply water for the cooling towers. Lake Lyell receives waters from the Coxs River and Farmers Creek, both of which are disturbed river systems. A schematic of the Coxs River water supply scheme, including the location of Lake Lyell, Thompsons Creek Reservoir and Mount Piper is shown in *Figure 6.1* below.

Figure 6.1 Schematic of Coxs River Water Supply (SKM, 2011)



Neubecks Creek

Neubecks Creek (also known as Wangcol Creek) drains from the area west and north of Mt Piper Power Station, and receives waters from Western Drain which is located on the western boundary of the operational area of the Mount Piper site. The two main sources of potential impacts to Neubecks Creek are drainage through former and current coal mine areas and leachates from the ash repositories.

Potential migration pathways for contamination into Lake Lyell include discharges into the Coxs River from Lake Wallace, the Tortuous Watercourse and Farmers Creek upstream of Lake Lyell.

Lake Lyell

Routine surface water sampling in Lake Lyell on one occasion detected low level concentrations of trace elements including molybdenum and uranium at the base of the dam wall (GHD, 2012). These elements were found to be naturally occurring in local igneous rocks used in the construction of the dam wall and were not representative of contamination in surface water. Limited investigations by Birch et al (1999) indicated heavy metals concentrations in sediments in Lake Lyell were slightly elevated above mean concentrations for the Coxs River, with sediment concentrations downstream of Lake Lyell being close to background.

It is noted that the buffer lands around Lake Lyell are used for stock grazing and public camping, however there are not likely to be material environmental issues associated with these uses. Lake Lyell receives water from the Coxs River and Lake Wallace, as well as Farmers Creek and runoff from the buffer lands, all of which may be potential sources of contamination.

Sediment studies on the Coxs River catchment (Birch et al, 1999) have identified elevated concentrations of heavy metals in sediment in the Coxs River, Lake Wallace and Lake Lyell. The Coxs River receives surface water and sediment inputs from both direct discharges from the Wallerawang Power Station as well discharge from several coal mines upstream of Lake Lyell. Wright (2001) demonstrated that discharges of mine water directly alter water geochemistry in freshwater streams, which has the potential to alter the bioavailability of heavy metals in sediments which may otherwise be immobile, thereby contributing to overall heavy metal loads as well as the availability and mobility of heavy metals within the Coxs River system.

Farmers Creek drains the City of Lithgow and heavy metal contamination in sediments (including Cd, Co, Cr, Pb, Ni, Zn) have been identified within and downstream of Lithgow (Birch et al, 1999). Potential historical and current sources of pollutants to Farmers Creek include coal mines, an iron and steel blast furnace (circa 1875), refining of copper, pottery and brick works, a small arms factory, sewage treatment effluent, railway activities (including locomotive workshops) and traffic (Birch et al, 1999).

The investigations by Birch et al (1999) suggest that concentrations of metals in sediments are elevated above background conditions in Lake Lyell. Further investigation is required to assess whether potential material environmental issues exist.

Thompsons Creek Reservoir

Thompsons Creek Reservoir receives runoff from surrounding agricultural lands as well as direct water transfers from Lake Lyell. It is unlikely that any material environmental issues exist at Thompsons Creek Reservoir due to the low risk of impacts from agricultural land use, and the settling of sediments within Lake Lyell prior to water transfers.

Black staining was observed on the gravel surface at the rear of the air compressor building (<5 m^2) however this is not likely to be a material issue. It is noted that the buffer lands around Thompsons Creek Reservoir are used for stock grazing and public access for recreational fishing, however there are not likely to be material issues associated with these uses.

There have been limited investigations into surface water and sediment quality in Lake Lyell and Thompsons Creek Reservoir and therefore an investigation is considered to be required to assess surface water and sediment quality and assess whether potential material environmental issues exist. It should be noted that the Coxs River, and its tributaries including Farmers Creek, receive discharge water from other sources, and it will be necessary to take into account the technical and legal implications of other potential contaminant sources.

6.2 SUMMARY OF KEY ISSUES

Of the potential areas of concern identified in *Section 6*, the following issues have been identified as being potentially the most significant in the context of the transaction:

- Former Mine activities including chitter dam and wastewater treatment ponds;
- Former Power Station landfills (Construction waste and putrescible waste)
- Fuel Oil Installation and Associated Pipeworks and ASTs;
- Workshop areas to assess chemical use, washdown pits and known diesel issue at the mobile plant area;
- Current Ash Repository;
- Lamberts North Ash Repository coal washery reject ponds; and
- Water assets at Lake Lyell and Thompsons Creek Reservoir.

7 *PRELIMINARY REMEDIATION COSTINGS*

Based on the information available at the time of preparation of this report ERM has not identified any actual contamination issues which are currently undergoing or likely to require material remediation, assuming ongoing industrial land use as a coal fired power plant. Preliminary remediation costs have not therefore been prepared at this point in time. As discussed in the previous section, a number of AECs have been identified which further assessment in order to more accurately assess the potential for remediation to be required. It is proposed that the subject of remedial costs be revisited following completion of the proposed Stage 2 investigations.

8 RECOMMENDATIONS FOR STAGE 2 ASSESSMENT

Based on the results of the Phase 1 assessment undertaken by ERM and consideration of Government's intended approach to the assignment of liability relating to soil and groundwater contamination issues, a programme of intrusive (Phase 2) assessment of potential soil and groundwater contamination issues is proposed. The following sections set out the proposed scope for the Phase 2 works in accordance with the requirements set out in NSW EPA (2011).

8.1 DATA QUALITY OBJECTIVES

Prior to commencement of the Phase I works, Data Quality Objectives (DQOs) were established for the project in line with the requirements and process outlined in NSW DEC (2006) *Guidelines for the NSW Site Auditor Scheme (2nd edition).*

These DQOs were developed to define the type and quality of data required from the site assessment program to achieve the project objectives outlined in *Section 1*. The DQOs were selected with reference to relevant guidelines published by the NSW Environmental Protection Authority (EPA), Australian and New Zealand Environment and Conservation Council (ANZECC) and National Environment Protection Council (NEPC), which define minimum data requirements and quality control procedures. The application of the seven-step DQO approach identified in NSW DEC (2006) is presented in full in *Annex C.*

8.2 CONCEPTUAL SITE MODEL

A conceptual site model (CSM) will be prepared during preparation of the SAQP for the Stage 2 works and will then incorporate the findings of the Stage 2 investigations. Based on the Stage 1 investigation a preliminary CSM has been developed and is summarised below in *Table 8.1.*

Table 8.1 Preliminary Conceptual Site Model

Contaminants of Potential Concern	The primary contaminants of concern include: • metals and metalloids (arsenic, boron, cadmium, chromium, copper, nickel, lead, mercury, selenium, zinc, fluoride, manganese); • Major cations and anions (including sulfate and chloride); • Total Recoverable Hydrocarbons (TRH); • Polycyclic Aromatic Hydrocarbons (PAHs); • BTEX - benzene, toluene, ethylbenzene and xylenes (BTEX); • Volatile Organic Compounds (VOCs) including chlorinated hydrocarbons; and • asbestos (presence / absence). Additional contaminants of concern may also be analysed if required based on observations made in the field.
Potential Migration Pathways	• Groundwater • Surface water • Fluvial sediment transport • Leaching from landfills • Aeolian transport of fines (dust)
Potentially Affected Receptors	• Nearby residents • Workers at the site • Waterways – Nuebecks Creek, Coxs River, Lake Lyell

Notes:
1. A detailed conceptual site model will be undertaken during the Stage 2 works.

8.3 SAMPLING RATIONALE

Based on a review of the available data, the most appropriate sampling design is considered to be a combination of systematic (grid based) and judgemental (targeted) sampling. It is noted that intrusive investigations may be limited to areas where access and site activities enable investigations to occur without unacceptable health and safety risks to personnel and / or unacceptable disruption to site operations. The sampling plan will be discussed with site management prior to the commencement of works to assess this risk.

Given the scale of the site (greater than 1000 ha), a tiered systematic sampling approach is proposed with different sampling densities to be adopted relative to the contamination risk and logistical constraints in different areas of the site. The sampling approach is generally in accordance with the NSW EPA (1995) *Sampling Design Guidelines*. The NSW EPA (1995) guidelines do not recommend a minimum number of sampling points for sites larger than 5.0 hectares. The Site has been divided into smaller areas of concern based on a review of historical activities and identified potentially contaminating activities as recommended in the NSW EPA (1995) guidelines.

8.3.1 Systematic Sampling Locations

Boreholes will be advanced on an approximately square grid pattern across the areas to be assessed in order to establish an adequate baseline assessment of soil and groundwater conditions where one does not currently exist. ERM proposes to divide the site into five general areas with sampling approaches to be adopted as outlined in *Table 8.2 (below)*.

Table 8.2 Proposed Systematic Sampling Approach

Area	Approach
Accessible operational areas	Boreholes to be advanced on a 50 x 50 m grid where practical + targeted sampling (see below).
Inaccessible operational areas	Boreholes to be advanced around perimeter where practical
Buffer land with minimal historic disturbance	Visual inspection only.
Buffer land with historic disturbance (e.g. mine workings)	Visual inspection and up to 15 soil / groundwater sampling locations around perimeter of buffer lands + targeted sampling (see below).

8.3.2 Targeted Sampling Locations

It is proposed that additional targeted sampling locations be advanced in or adjacent to areas of potential concern identified during the Phase 1 assessment and site visits. Justification for additional targeted sampling locations is provided in *Table 8.3* (over).

Table 8.3 Proposed Targeted Sampling Approach

Area of Environmental Concern	Issue	Analytes	Proposed Boreholes & Monitoring Wells
Former Mine and Backfilling of Operational Area	Contamination of soil and groundwater from historical activities or use of impacted fill material.	Standard Suite* plus PCBs	To be assessed via systematic sampling programme in the operational and non-operational areas.
Former Landfills	Potential leaching of contaminants from landfilled materials	Standard Suite* plus PCBs and VOCs	12 soil bores / monitoring wells
Coal Storage Area	Potential leaching of contaminants from stockpiled coal	Standard Suite	5 soil bores / monitoring wells
Electrical Transformers	Contamination of soil and groundwater from transformer oil.	Standard Suite* plus PCBs	4 soil bores / monitoring wells (along southern perimeter – highly dependent on access / logistics)
Water Holding Ponds	Contamination of soil and groundwater via leakage	Standard Suite*	Sample from existing monitoring well network Additional 8 soil bores
Workshops	Contamination of soil and groundwater from loss of parts washing solvents	Standard Suite* plus chlorinated hydrocarbons (TCE etc.)	5 soil bores / monitoring wells around perimeter
Mobile Plant Refuelling Area	Contamination of soil and groundwater from loss of fuel	Standard Suite*	4 additional soil bores / monitoring wells downgradient of existing LNAPL detection.
Operational USTs	Contamination of soil and groundwater from loss of fuel	Standard Suite*	Sample from existing monitoring well network.
Operational ASTs	Contamination of soil and groundwater from loss of fuel and other chemicals	Standard Suite*	5 soil bores / monitoring wells around perimeter.
Current Ash Repository	Contamination of soil and groundwater from leachate.	Standard Suite*	Sample from existing monitoring well network and 3 additional soil bores to establish ground conditions
Lamberts North Ash Repository	Contamination of soil and groundwater from leachate.	Standard Suite*	6 soil bores/1 monitoring well (highly dependent on access / logistics) near coal settling ponds, and 3 sediment and surface water samples in the adjacent freshwater pond.
Water Assets (Lake Lyell and Thompsons Creek Reservoir)	Contamination of sediments from upstream sources.	Standard Suite* + PCBs, TOC# and PSD##	Co-located surface water/ sediment sampling at Lake Lyell (6) and Thompsons Creek Dam (6).

Note: * - Standard Suite is as set out in Section 8.3.1; # - TOC – Total Organic Carbon; ## - PSD – Particle Size Distribution.

Existing Groundwater Wells

Where existing groundwater monitoring wells have been identified the locations of these wells is presented on *Figure 3* of *Annex A*.

It is proposed that existing groundwater monitoring wells will be sampled during Phase II soil and groundwater investigation works. Sampling will only occur where the groundwater monitoring well are deemed to be suitable. The suitability of the existing groundwater monitoring wells will be assessed based on the following steps:

- ground truthing of the groundwater monitoring wells;
- bore logs will be reviewed to confirm that the wells were appropriately constructed and screened within the groundwater bearing strata; and
- the groundwater monitoring wells will be gauged to confirm the total depth of the well against the bore logs and the depth of groundwater.

The sampling process and analytical suite for existing wells deemed suitable will be in accordance with that adopted for newly installed wells.

8.3.3 Waterways

Sediment and surface water sampling is proposed to target potential contamination from cooling discharges from the Site and includes sampling within:

- Coxs River;
- Lake Lyell; and
- Thompsons Creek Reservoir

8.4 PROPOSED SAMPLING METHODOLOGIES

The soil, sediment and groundwater investigation works will generally involve the following key steps:

- underground service location and mark-out;
- proposed borehole location mark-out;
- coring of hard standing surfaces;
- drilling and soil sampling of subsurface material using push tube and / or auger drilling;

- installation of 50 mm diameter groundwater monitoring wells in selected boreholes screened appropriately to intersect the aquifer of interest and facilitate measurement of NAPL (if present);
- backfilling of boreholes;
- reinstatement of hardstanding surfaces;
- surveying the location of boreholes and monitoring wells; and
- development, measurement of water levels and sampling of the groundwater monitoring wells.
- Where required, sediment samples will be collected using a remotely operated stainless steel grab unit lowered from a sampling vessel or other equivalent method as deemed appropriate based on site conditions.

A comprehensive methodology providing further details of the intrusive site works investigation process is outlined in *Annex C.*

8.4.1 Laboratory Analysis

Primary samples will be couriered under chain of custody documentation to ALS Environmental Pty Ltd (ALS), a NATA accredited analytical laboratory. Inter-laboratory duplicate samples will be couriered under chain of custody documentation to Envirolab Services Pty Ltd (Envirolab) also a NATA accredited analytical laboratory. Soil and groundwater samples will be analysed for the primary contaminants of concern listed below along with additional contaminants of concern associated with activities undertaken in that area.

- metals and metalloids (arsenic, boron, cadmium, chromium, copper, nickel, lead, mercury, selenium and zinc);
- Major cations and anions (including sulfate and chloride);
- Total Recoverable Hydrocarbons (TRH);
- Polycyclic Aromatic Hydrocarbons (PAHs) and Phenols;
- BTEX - benzene, toluene, ethylbenzene and xylenes -BTEX); and
- asbestos (presence / absence).

Additional contaminants of concern may also be analysed if required based on observations made in the field. Leachate analysis will be undertaken on soil samples based on observations made in the field and preliminary laboratory results. The Australian Standard Leachate Procedure (ASLP) is the preferred analytical method and is considered to be more representative of leachate

potential under site conditions than the Toxicity Characteristic Leaching Procedure (TCLP).

8.5 PROPOSED FIELD SCREENING PROTOCOLS

The following field screening protocols are proposed for the Phase 2 works:

8.5.1 Soil and Sediment

Soils and sediments (if required) will be logged by an appropriately trained and experienced scientist/engineer to record the following information: soil/sediment type, colour, grain size, sorting, angularity, inclusions, moisture condition, structure, visual signs of contamination (including staining and fragments of fibrous cement sheeting or similar) and odour in general accordance with AS 1726-1993.

A duplicate of each soil sample will be collected for field screening and will be placed in a sealed zip lock bag and screened in accordance with ERM Standard Operating Procedures (SOPs – available upon request) using a Photo Ionisation Detector (PID) fitted with a 10.6 eV lamp, calibrated at the beginning of each working day. Where the presence of VOCs or other impact is indicated by field screening, additional laboratory analysis may be undertaken.

8.5.2 Groundwater

Prior to sampling or gauging each monitoring well, the well cap will be partially removed to allow the headspace to be screened using a calibrated PID over a period of one minute. The presence of odours will also be noted following removal of the well cap and described by reference to their intensity and character. Following a period of no pumping (as a minimum 24 hours) all wells will be dipped to gauge the depth to groundwater and, if necessary, the presence and thickness of Non-aqueous Phase Liquids (NAPLs). Wells will be purged using a thoroughly decontaminated peristaltic pump under low flow conditions and during this process a calibrated water quality parameter meter will be used to record field measurements of pH, conductivity, redox potential, temperature and dissolved oxygen.

8.6 BASIS FOR SELECTION OF ASSESSMENT CRITERIA

The adopted assessment criteria have generally been sourced from guidelines made or approved under the Contaminated Land Management (CLM) Act 1997 where alternative sources have been utilised appropriate justification has been provided.

8.6.1 Soil

Soil data will be assessed against investigation criteria published in the following documents:

- National Environmental Protection Council (NEPC) (2013) *National Environment Protection (Assessment of Site Contamination) Amendment Measure 2013 (No. 1)* Schedule B1 Guideline on the Investigation Levels for Soil and Groundwater (NEPM). Health Investigation Level (HIL) 'D' – Commercial/Industrial and Ecological Screening Levels (ESLs) (as applicable); and

- NSW Environment Protection Authority (EPA) (1994) *Guidelines for Assessing Service Station Sites*. Threshold concentrations for sensitive land use – soils.

Where no Australian endorsed assessment criteria is available, reference to the National Institute of Public Health and the Environment (RIVM) (2001) *Technical Evaluation of the Intervention Values for Soil/sediment and Groundwater: Human and Ecotoxicological Risk Assessment and Derivation of Risk Limits for Soil, Aquatic Sediments and Groundwater* - Human Toxicological Serious Risk Concentrations in soil (SRC_{human} soil) will be made it is noted that these guideline values have no regulatory standing in NSW and hence further assessment of any exceedences of these criteria may be required.

8.6.2 Groundwater

Groundwater data will be assessed against investigation criteria published in the following documents:

- Australian and New Zealand Environment and Conservation Council (ANZECC) and Agriculture and Resource Management Council of Australia and New Zealand (ARMCANZ) (2000) *Australian and New Zealand Guidelines for Fresh and Marine Water Quality, Volume 1 The Guidelines*. Trigger values for freshwater, level of protection for 95% of species;

- National Health and Medical Research Council (NHMRC) and National Resource Management Ministerial Council (NRMMC) (2011) *Australian Drinking Water Guidelines Paper 6 National Water Quality Management Strategy*, Commonwealth of Australia, Canberra; and

- National Environmental Protection Council (NEPC) (2013) *National Environment Protection (Assessment of Site Contamination) Amendment Measure 2013 (No. 1)* Schedule B1 Guideline on the Investigation Levels for Soil and Groundwater (NEPM).

Where no Australian endorsed assessment criteria is available reference to the National Institute of Public Health and the Environment (RIVM) (2001) *Technical Evaluation of the Intervention Values for Soil/sediment and Groundwater:*

Human and Ecotoxicological Risk Assessment and Derivation of Risk Limits for Soil, Aquatic Sediments and Groundwater. Human Toxicological Serious Risk Concentrations in Groundwater (SRC_{human} groundwater). It is noted that these guideline values have no regulatory standing in NSW and hence further assessment of any exceedences of these criteria may be required.

8.6.3 *Sediment*

Sediment quality data will be assessed against investigation criteria published in:

- ANZECC / ARMCANZ (2000) *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* - Interim Sediment Quality Guidelines (ISQGs).

9 *CONCLUSIONS*

The Preliminary ESA undertaken by ERM has identified that limited previous intrusive ESAs appear to have been completed on the sites and a number of potential contamination sources were identified as follows:

- Former Mine and Backfilling of Operational Area;
- Former Landfills;
- Coal Storage Area;
- Electrical Transformers;
- Water Holding Ponds;
- Workshops;
- Mobile Plant Refuelling Area;
- Operational and Decommissioned USTs;
- Operational ASTs;
- Current Ash Repository; and
- Lamberts North Ash Repository.

Based on the results of the Preliminary ESA and consideration of Government's intended approach to establishing a baseline of soil and groundwater contamination, a programme of intrusive (Phase 2) assessment of potential soil and groundwater contamination issues is provided. The most appropriate sampling design is considered to be a combination of systematic (grid based) and judgemental (targeted) sampling of soil, groundwater and sediments at locations across the Sites.

Based on the information available at the time of preparation of this report ERM has not identified any actual contamination issues which are currently undergoing or likely to require material remediation, assuming ongoing industrial land use as a coal fired power plant. Preliminary remediation costs have not therefore been prepared at this point in time. It is proposed that the subject of remedial costs be revisited following completion of the proposed Stage 2 investigations.

10 LIMITATIONS

This report is based solely on the scope of work described in *Section 1.3* and performed pursuant to a contract between ERM and NSW Treasury ("Scope of Work"). The findings of this report are solely based on, and the information provided in this report is strictly limited to the information covered by, the Scope of Work.

In preparing this report for the Client, ERM has not considered any question, nor provides any information, beyond the Scope of Work.

This report was prepared between 15 March 2013 and 11 April 2013 and is based on conditions encountered and information reviewed at the time of preparation. The report does not, and cannot, take into account changes in law, factual circumstances, applicable regulatory instruments or any other future matter. ERM does not, and will not, provide any on-going advice on the impact of any future matters unless it has agreed with the Client to amend the Scope of Work or has entered into a new engagement to provide a further report.

Unless this report expressly states to the contrary, ERM's Scope of Work was limited strictly to identifying typical environmental conditions associated with the subject site(s) and does not evaluate structural conditions of any buildings on the subject property, nor any other issues. Although normal standards of professional practice have been applied, the absence of any identified hazardous or toxic materials or any identified impacted soil or groundwater on the site(s) should not be interpreted as a guarantee that such materials or impacts do not exist.

This report is based on one or more site inspections conducted by ERM personnel and information provided by the Client or third parties (including regulatory agencies). All conclusions and recommendations made in the report are the professional opinions of the ERM personnel involved. Whilst normal checking of data accuracy was undertaken, except to the extent expressly set out in this report ERM:

a) did not, nor was able to, make further enquiries to assess the reliability of the information or independently verify information provided by;

b) assumes no responsibility or liability for errors in data obtained from, the Client, any third parties or external sources (including regulatory agencies).

Although the data that has been used in compiling this report is generally based on actual circumstances, if the report refers to hypothetical examples those examples may, or may not, represent actual existing circumstances.

Only the environmental conditions and or potential contaminants specifically referred to in this report have been considered. To the extent permitted by law and except as is specifically stated in this report, ERM makes no warranty or representation about:

a) the suitability of the site(s) for any purpose or the permissibility of any use;

b) the presence, absence or otherwise of any environmental conditions or contaminants at the site(s) or elsewhere; or

c) the presence, absence or otherwise of asbestos, asbestos containing materials or any hazardous materials on the site(s).

Use of the site for any purpose may require planning and other approvals and, in some cases, environmental regulator and accredited Site Auditor approvals. ERM offers no opinion as to the likelihood of obtaining any such approvals, or the conditions and obligations which such approvals may impose, which may include the requirement for additional environmental works.

The ongoing use of the site or use of the site for a different purpose may require the management of or remediation of site conditions, such as contamination and other conditions, including but not limited to conditions referred to in this report.

This report should be read in full and no excerpts are to be taken as representative of the whole report. To ensure its contextual integrity, the report is not to be copied, distributed or referred to in part only. No responsibility or liability is accepted by ERM for use of any part of this report in any other context.

This report:

a) has been prepared and is intended only for the Client and any party that ERM has agreed with the Client in the Scope of Work may use the report;

b) has not been prepared nor is intended for the purpose of advertising, sales, promoting or endorsing any client interests including raising investment capital, recommending investment decisions, or other publicity purposes;

c) does not purport to recommend or induce a decision to make (or not make) any purchase, disposal, investment, divestment, financial commitment or otherwise in or in relation to the site(s); and

d) does not purport to provide, nor should be construed as, legal advice.

11 REFERENCES

Australia and New Zealand Environmental and Conservation Council (ANZECC) (2000) *Australia and New Zealand Guidelines for Fresh and Marine Water Quality*

Birch, G., Siaka, M., Owens, C. (2001) *The Source of Anthropogenic Heavy Metals in Fluvial Sediments of a Rural Catchment: Coxs River, Australia*, Water, Air and Soil Pollution **126:** 13-35**.**

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WorleyParsons, (2013), *Independent Engineer's Report Mount Piper Power Station (January 2013)*

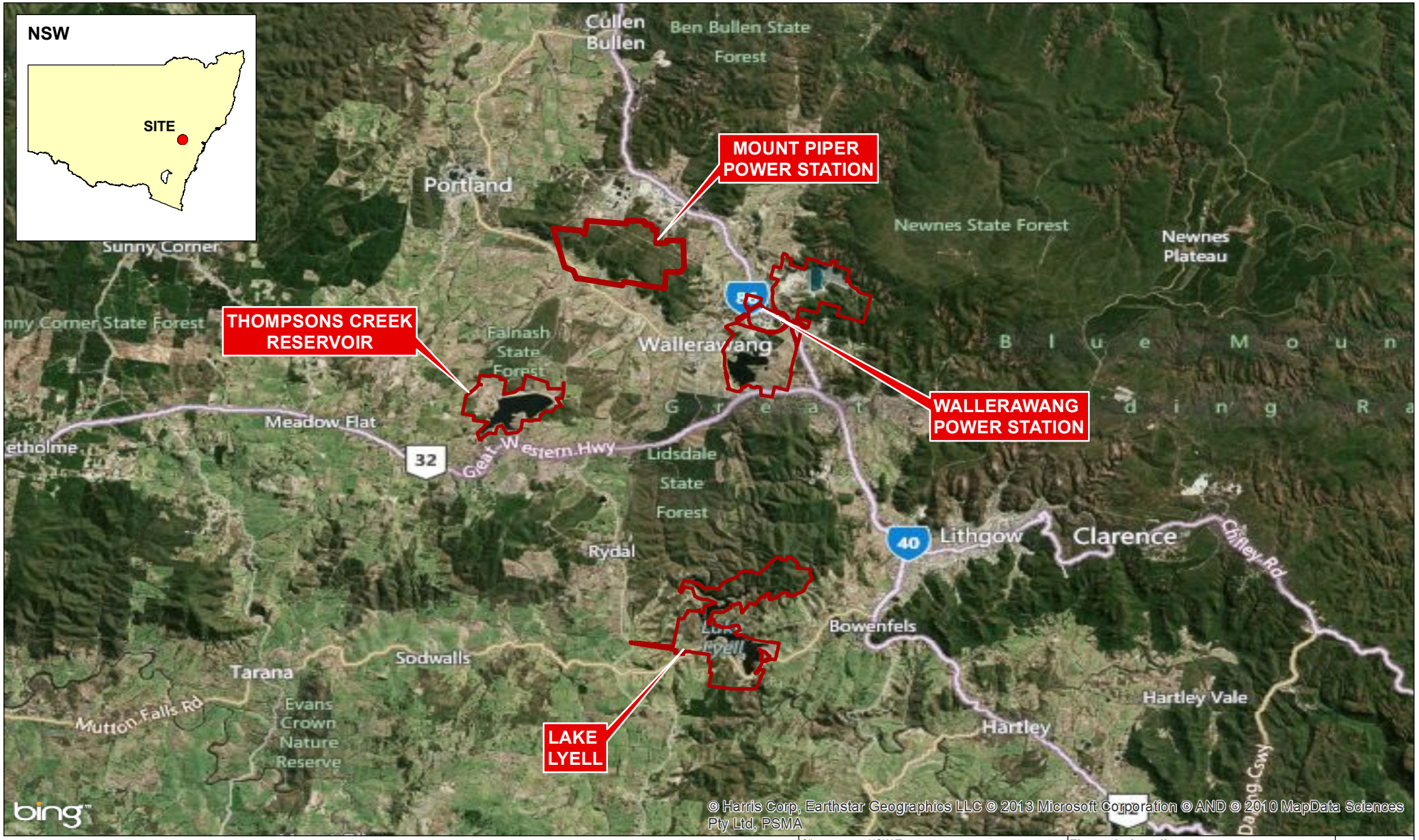
Mount Victoria to Lithgow Alliance, 2011: *Great Western Highway Upgrade, Corridor Study, Groundwater.*

Table 11.1 Dataroom Documents Reviewed

04.01.02.02.19	MP.EQP.01.02 Mt Piper DG License Expiry Date 07.08.2013.pdf [B916990] [GTA1] [1.0].pdf
04.01.07.01.09	MP.DVP.01.01 western rail unloader Director-General's Report Part 1 [A252027] [GTA0] [1.0].pdf
04.01.07.01.10	MP.DVP.01.01 western rail unloader Director-General's Report Part 2 [A252026] [GTA0] [1.0].pdf
04.01.07.01.11	MP.DVP.01.01 western rail unloader Project Approval [A252024] [GTA0] [1.0].pdf
04.01.07.02.27	MP.DVP.01.02 WRCU EA cover contents and executive summary_April07 [A191586] [GTA0] [1.0].pdf
04.01.07.03.02	MP.DVP.01.03 20121123 Groundwater Modelling Report #2 Final [B916213] [GTA1] [1.0].pdf
04.01.07.04.14	MP.DVP.01.04 Fig 3-1 Groundwater MPGM4 series [B897221] [GTA1] [1.0].pdf
04.01.07.04.15	MP.DVP.01.04 Fig 4-1-Site Catchment [B897224] [GTA1] [1.0].pdf
04.01.07.04.16	MP.DVP.01.04 Fig 4-4- SWMonitor [B897223] [GTA1] [1.0].pdf
04.01.09.01.03	MP.ENV.02.01 20090528 Letter from DECCW re changes to Environment Protection Licensing for Mt Piper [B915623] [GTA1] [1.0].pdf
04.01.09.01.05	MP.ENV.02.01 20100121 Licence variation to Mt Piper EPL 13007 [B915679] [GTA1] [1.0].pdf
04.01.09.01.06	MP.ENV.02.01 20100809 Letter from DECCW containing Draft Notice of licence variation 1118174 to Mt Piper EPL 13007 [B915687] [GTA1] [1.0].pdf
04.01.09.01.07	MP.ENV.02.01 20100820 Letter from DECC containing notice of licence variation 1118174 to Mt Piper EPL 13007 [B915684] [GTA1] [1.0].pdf
04.01.09.01.09	MP.ENV.02.01 20121128 Aerial Image of Mt Piper LDPs [B917469] [GTA1] [1.0].jpg
04.01.09.02.01	MP.ENV.02.02 Mt Piper EPA Licence 13007 - Downloaded from EPA Website 19-04-2012 [B576884] [GTA1] [5.0].pdf
04.01.10.03.20	MP.ENV.03.03 Scan of Phase 1 Environmental Site Assessment, Uncontrolled Landfill Sites, Mt Piper Power Station, Portland, NSW (December 2000)
04.01.11.01.264	MP.ENV.04.01 130219 Signed Cover Letter and CLM Notification re MP CHP [B938134] [GTA1] [2.0].pdf
04.01.11.03.01	MP.ENV.04.03 Mt Piper Power Station Water Overview Diagram [B918460] [GTA1] [1.0].pdf
04.01.11.04.01	MP.ENV.04.04 121130 MP Groundwater Monitoring results Jul2010 - Jul2012 (RFI 148MP) [B918268] [GTA1] [1.0].xlsx
04.01.11.04.02	MP.ENV.04.04 121210 MP Groundwater Monitoring Results Jul2007-Jul2012 RFI52 [B921088] [GTA1] [1.0].xlsx
04.01.11.04.03	MP.ENV.04.04 Mt Piper Underground Storage Tanks [B917651] [GTA1] [1.0].xlsx
04.01.11.04.04	MP.ENV.04.04 S12382.01_Groundwater Rpt_Final 25-10-2012 [B907483] [GTA1] [1.0].docx
04.01.11.04.05	MP.ENV.04.04 UPSS locations - MP [B917101] [GTA1] [1.0].docx
04.01.11.04.14	MP.ENV.04.04 WX639510__14 - STATION CHEMICAL SUPPLY DANGEROUS GOODS LOCATIONS LAYOUT-Layout1 [B918384] [GTA1] [1.0].pdf
04.03.06.01.01	WR.ENV.01.01 DES EN 001-01 Environmental Management System v 1.6 [A146257] [CIC1] [5.0].pdf
04.03.06.02.32	WR.ENV.01.02 Duty to report Contamination Background Report PB Feb 2010 [D735089] [CIC1] [1.0]_Redacted.pdf
04.03.06.02.55	WR.ENV.01.02 GHD Western Baseline Contaminated Land Report 2012-185826 [D854329] [GTA1] [2.0].pdf
04.03.06.02.56	WR.ENV.01.02 GHD_184556_Summary Report Western Region 14.12.12 [A459822] [GTA1] [1.0].pdf
04.03.06.02.58	WR.ENV.01.02 Land Management Plan Edition 2 August 2012 [B889259] [GTA1] [3.0].docx
04.01.03.01.097	MP.EQP.02.01 Mt Piper Micro Hydro Energy Recovery System [B927818] [GTA1] [1.0]
04.03.04.03.210	WR.PWR.04.03 Coxs River Storages Yield Review - System Reliability and Salinity Report Rev4a [D757477] [GTA1] [1.0]

Annex A

Figures



Legend

Sites

Notes:

Site boundaries are approximate based on correspondence with Delta Electricity and cadastral plans available at time of reporting.

0 1 2 3km

N

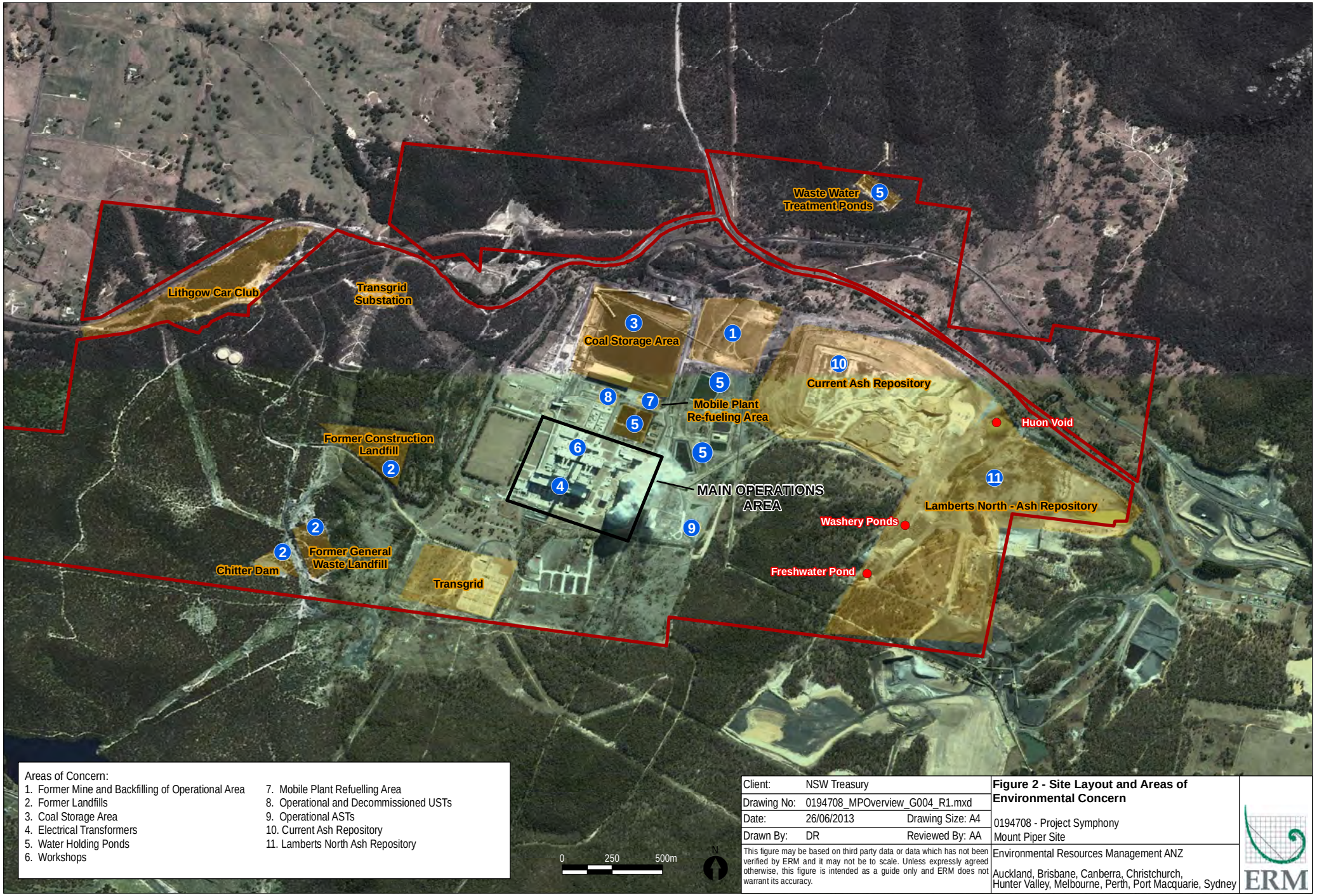
Client:	NSW Treasury		**Figure 1 - Locality**
Drawing No:	0194708s_MP_G000_R0.mxd		
Date:	26/06/2013	Drawing Size: A4	0194708 - Project Symphony Mount Piper Site
Drawn By:	GC	Reviewed By: AA	

This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.

Environmental Resources Management ANZ

Auckland, Brisbane, Canberra, Christchurch, Hunter Valley, Melbourne, Perth, Port Macquarie, Sydney

ERM



Client:	NSW Treasury		
Drawing No:	0194708_MPOverview_G004_R1.mxd		
Date:	26/06/2013	Drawing Size: A4	
Drawn By:	DR	Reviewed By: AA	

This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.

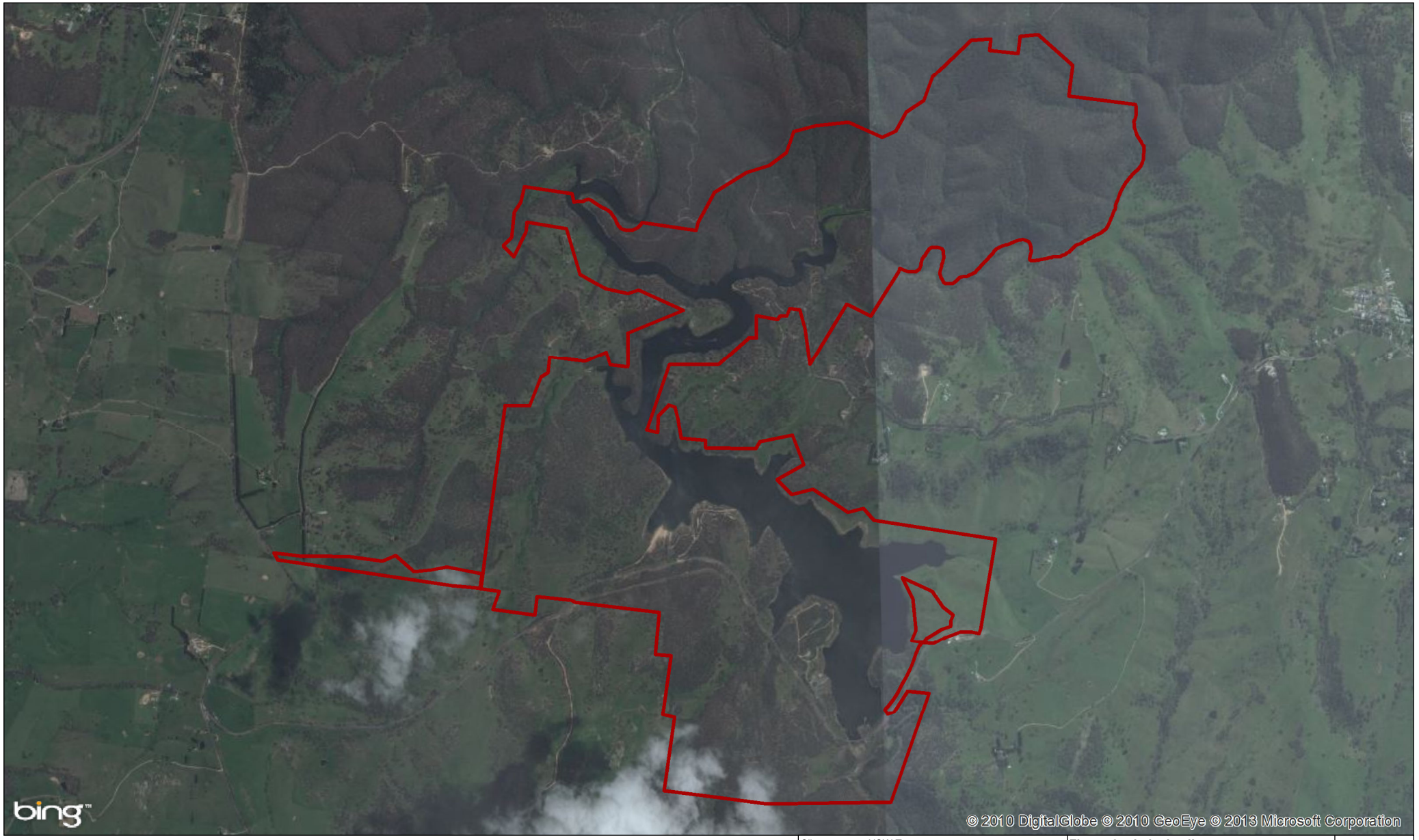
Figure 2 - Site Layout and Areas of Environmental Concern

0194708 - Project Symphony
Mount Piper Site

Environmental Resources Management ANZ

Auckland, Brisbane, Canberra, Christchurch, Hunter Valley, Melbourne, Perth, Port Macquarie, Sydney

ERM



Legend
Site

Notes:
Site boundaries are approximate based on correspondence with Delta Electricity and cadastral plans available at time of reporting.

DRAFT

0 200 400 600m

N

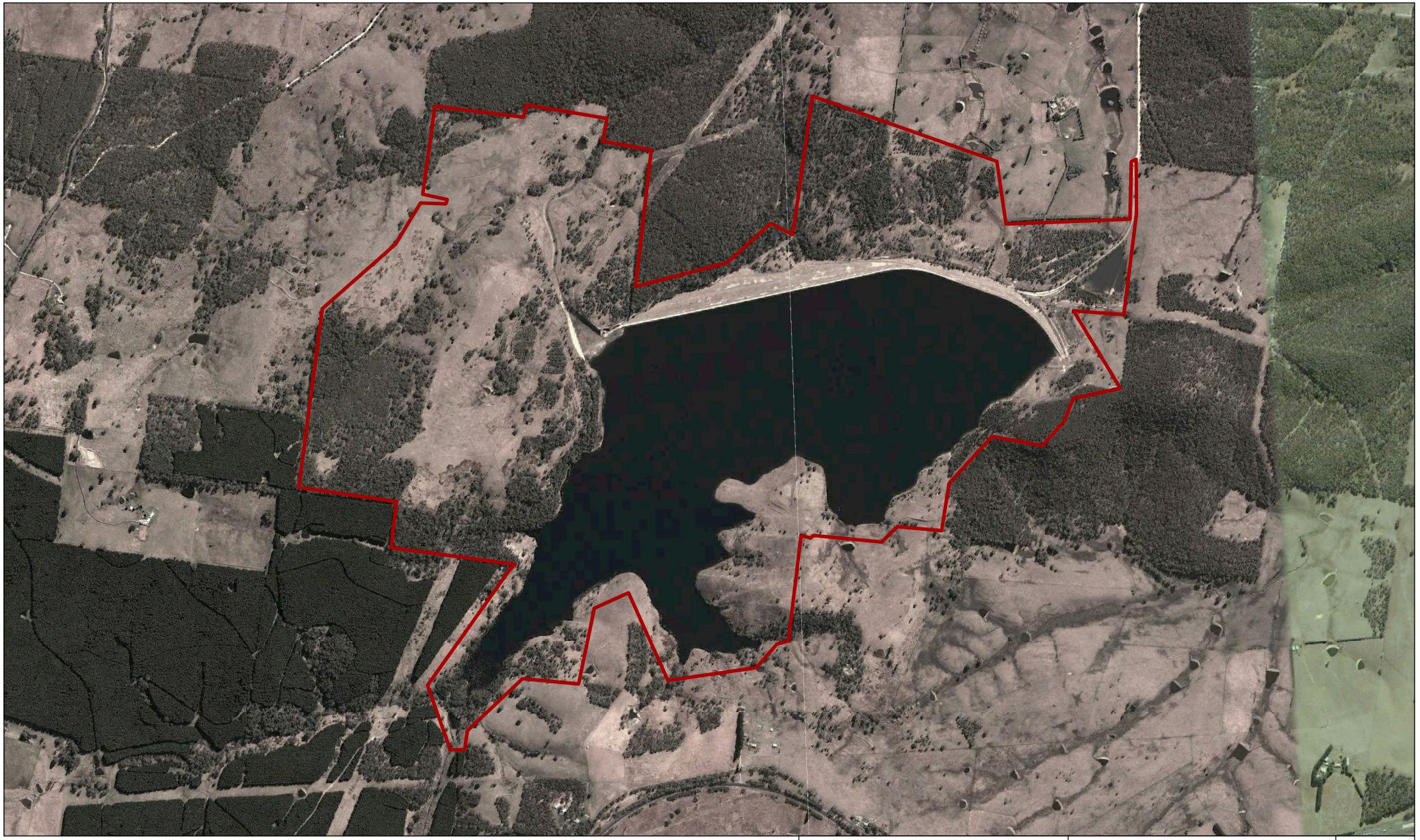
Client:	NSW Treasury		**Figure 3 - Lake Lyell**
Drawing No:	0194708s_MP_G007_R0.mxd		
Date:	26/06/2013	Drawing Size: A4	0194708 - Project Symphony
Drawn By:	GC	Reviewed By: AA	Mount Piper Site

This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.

Environmental Resources Management ANZ

Auckland, Brisbane, Canberra, Christchurch, Hunter Valley, Melbourne, Perth, Port Macquarie, Sydney

ERM



Legend

Site

Notes:

Site boundaries are approximate based on correspondence with Delta Electricity and cadastral plans available at time of reporting.

DRAFT

Source:

- Image (c) 2013 Google TM, Imagery Date: 10/04/2013, DigitalGlobe.

0 100 200 300m

N

Client:	NSW Treasury		
Drawing No:	0194708s_MP_G008_R0.mxd		
Date:	26/06/2013	Drawing Size: A4	
Drawn By:	GC	Reviewed By: AA	

This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.

Figure 4 - Thompsons Creek Reservoir

0194708 - Project Symphony
Mount Piper Site

Environmental Resources Management ANZ

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ERM

Annex B

Photographs

Photograph 1

Concrete wash bay at the Mobile Plant Refuelling Area, adjacent to the Coal Storage Area, looking north-east.

Photograph 2

Looking north from the Mobile Plant Refuelling Area.

Photograph 3

Bowsers and location of diesel UST at the Mobile Plant Refuelling Area, looking north-east.

Photograph 4

Lamberts North Ash Repository, looking south-west.

Photograph 5

Water detention dam, Lamberts North Ash Repository, looking north-east.

Photograph 6

Lamberts North Ash Repository, looking west.

Photograph 7

Coal washery rejects ponds at Lamberts North Ash Repository, looking north-east.

Photograph 8

Former mine void, Lamberts North Ash Repository.

Photograph 9

Coal washery rejects ponds at Lamberts North Ash Repository, looking north-west. Note drainage diversion construction to rear left of image.

Photograph 10

Fuel bowsers and UST adjacent to workshop, looking south-east.

Photograph 11

Covered and revegetated chitter dam looking south-west.

Photograph 12

Fenced compound around the former general waste landfill, looking north-east from access road.

Photograph 13

Dam wall between freshwater dam and the coal washery rejects ponds at Lamberts North Ash Repository.

Photograph 14

Lamberts North Ash Repository.

Photograph 12

Thompsons Creek Reservoir looking east along dam wall from spillway.

Photograph 13

Thompsons Creek Reservoir looking west from spillway.

Photograph 14

Thompsons Creek Reservoir compressor building.

Photograph 15

Black staining on ground at Thompsons Creek Reservoir compressor building.

Photograph 16

Lake Lyell – Coxs River outflow at base of dam wall.

Photograph 17

Lake Lyell dam wall.

Photograph 18

Lake Lyell Cox's River outlet.

Photograph 19

Lake Lyell compressor building.

Photograph 20

Coxs River below Lake Lyell outlet.

Photograph 21

Weather station building at Lake Lyell.

Photograph 22

Transgrid switchyard at Lake Lyell.

Photograph 23

Revegetated hillside quarried for soil/rock for construction of Lake Lyell.

Photograph 24

Transformers at rear of pump house at Lake Lyell.

Photograph 25

Inside pump house at Lake Lyell.

Photograph 26

Lake Lyell spillway looking east from pump house.

Photograph 27

Looking west at Lake Lyell pump house.

Photograph 28

Lake Lyell looking north from dam wall.

Photograph 29

Lake Lyell looking east from public camping area on western shore.

Annex C

Data Quality Objectives and Detailed Investigation Methodology

C.1 STEP 1: STATE THE PROBLEM

Objectives

The objectives of the Preliminary ESA are as stated in *Section 1.2*.

C.2 STEP 2: IDENTIFY THE DECISIONS

Decision Statements

Overall, the principal decision to be made is whether there are actual or potential material contamination issues related the proposed sale of the power generation assets. Additional decisions to be made include:

- Is there sufficient data to provide an environmental baseline at the time of the transaction?
- What is the nature and extent of soil and /or groundwater and/or sediment and/or surface water impact on / beneath the sites?
- Does the impact at the sites represent a risk to human health, based on the current and continued use of the sites?
- Is the impact at the sites likely to warrant regulation under the *Contaminated Land Management Act 1997* and remediation?
- Is material remediation likely to be required?

Assessment Criteria

The proposed sources of site assessment criteria are presented in *Section 8.5*.

C.2.1 *Waste Classification for Off-Site Disposal*

Any excess soil or groundwater generated during the Phase II program will be classified in accordance with the NSW Department of Environment, Climate Change and Water (2009) *Waste Classification Guidelines, Part 1: Classifying Waste* and relevant associated Chemical Control Orders.

C.3 STEP 3: IDENTIFY INPUTS TO DECISION

The inputs required to make the above decisions are as follows:

- Existing relevant environmental data, taking into consideration the number and location of existing soil and groundwater sampling locations, the construction of existing groundwater monitoring wells and the date of the most recent groundwater monitoring event;

- direct measurement of environmental variables including soil type, soil gas concentrations, odours, staining, water strike and groundwater level and water quality parameters;
- laboratory measurement of soil and groundwater samples for one or more of the identified potential contaminants of concern;
- field and laboratory quality assurance/quality control data;
- the relevant soil and water quality criteria outlined previously; and
- assessment of whether the concentrations of the contaminants of concern are greater than or equal to or less than the adopted criteria.

C.4 STEP 4: DEFINE THE STUDY BOUNDARIES

Spatial Boundaries

The site locations and descriptions are provided in *Section 2*.

Constraints within the Study Boundaries

Constraints on the delivery of the Phase II program within the study boundaries may include:

- location of underground services or infrastructure;
- the condition of existing monitoring wells; and
- obtaining permission/access to enter and sample in off-site areas (where deemed necessary.

C.5 STEP 5: DEVELOP A DECISION RULE

The DQOs have been designed to facilitate the collection of adequate soil, sediment and groundwater data to address the decisions in Step 2 of the DQO process. It was noted that some project constraints may impact on the implementation of the Phase II program, for example access to an off-site area may not be granted within the required time frame. Deviations from the Phase II program will be discussed in the Phase II report, acknowledging the source of any available information and any limitations on the assessment.

Field and Laboratory QA/QC

The suitability of soil and groundwater data will be assessed based on acceptable limits for field and laboratory QA/QC samples outlined in relevant guidelines made or endorsed under the *Contaminated Land Management Act* (1997). In the event that acceptable limits are not met by laboratory analyses, the field observations relating to the nature of the samples will be reviewed and if no obvious source for the non-conformance is identified, such as an error in sampling, preservation of sample/s or heterogeneity of sample/s, liaison with the laboratories will be undertaken in an effort to identify the issue that had given rise to the non-conformance.

If the soil and groundwater data is deemed to be unsuitable additional analyses may be undertaken on the original sample/s, on duplicate samples or on other samples, if required to meet the objectives of the assessment. If no explanation for the non-conformance is identified, the concentrations for the affected samples will be considered as an estimate.

Assessment Criteria

The sources of applicable assessment criteria are presented *Section 8.5*. Individual soil, sediment and groundwater data, along with the 95% Upper Confidence Limit (UCL) of the mean concentration (if required) will be compared to the assessment criteria. Exceedence of the assessment criteria will not necessarily indicate the requirement for remediation or a risk to human health and the environment. If individual or 95% UCL concentrations exceed the assessment criteria, consideration of the extent of the impact, the potential for site users to be exposed and regulatory compliance will be considered.

Comparison of the laboratory Limit of Reporting (LOR) to the assessment criteria will be undertaken to confirm that the assessment criteria are less than the laboratory LOR any exceptions to this will be appropriately noted and justified.

C.6 STEP 6: SPECIFY LIMITS ON DECISION ERRORS

The acceptable limits on decision errors applied during the review of the results will be based on the Data Quality Indicators (DQIs) of precision, accuracy, representativeness, comparability and completeness (PARCC) in accordance with the National Environment Protection (Assessment of Site Contamination) Measure 1999, *Schedule B (3) - Guidelines on Laboratory Analysis.*

The potential for significant decision errors will be minimised by:

- completing a robust Quality Assurance/Quality Control (QA/QC) assessment of the validation data and application of the probability that 95% of data will satisfy the DQIs, therefore a limit on the decision error would be 5% that a conclusive statement may be incorrect;
- assessing whether appropriate sampling and analytical density has been achieved for the purposes of providing a baseline of soil, sediment and groundwater conditions at the point of transaction; and
- ensuring that the criteria set was appropriate for the ongoing use of the site as a power generation facility.

C.7 STEP 7: DEVELOP (OPTIMISE) THE PLAN FOR COMPLETING THE WORKS

The DQOs have been developed based on a review of existing data, discussions with the NSW Treasury and Delta Electricity. If data gathered during the assessment indicates that the objectives of the assessment programme are not being met, the sampling design (including sampling pattern, type of samples and analytes) will be adjusted accordingly using feedback (where necessary) from project stakeholders.

C.8 DETAILED SOIL AND GROUNDWATER INVESTIGATION METHODOLOGY

C.8.1 Sub-Surface Clearance

All proposed drilling locations will be cleared of underground and above ground utilities in accordance with ERM's Sub-Surface Clearance (SSC) Procedure. The key steps involved in ERM's SSC procedure include:

- assigning a SSC Experienced Person (EP) who is responsible for all SSC activities;
- obtaining Dial Before You Dig Plans and marking out public utilities if required;
- obtaining site utility plans (where available) and obtaining approval from the site contact for the proposed drilling locations;
- conducting a site walkover to identify any visual clues of site services;
- checking all locations for the presence of underground services using a cable location tool;
- where possible soil bores will be located to avoid working in critical areas, defined as areas with 3 m of a subsurface obstruction; and

- each soil bore will be cleared using a hand auger or Non-Destructive Drilling (NDD) to a depth of 1.2 m bgl in non-critical zones or 2.3 m bgl in areas classed as critical zones.

C.8.2 Soil Bore Drilling

Soil bores will be drilled in accordance with ERM SOPs using the general methodology outlined below

- Where necessary hardstand drilling locations will be penetrated using a concrete corer prior to physical borehole clearance and drilling;
- each soil bore will be cleared using a hand auger or Non-Destructive Drilling (NDD) techniques to the depth required by ERM's SSC Procedure;
- a drilling rig, incorporating direct push-tube methodology will be used to advance the boreholes to the target depth or until deemed refusal is encountered;
- prior to the commencement of drilling and between drilling locations, all down-hole drilling equipment will be decontaminated to minimise potential for cross contamination between the sampling locations.

C.8.3 Soil Sampling Protocol

Soil samples will be collected and logged in accordance with ERM SOPs. In summary the following work procedures will be followed:

- the soil will be logged by an appropriately trained and experienced scientist/engineer to record the following information: soil/rock type, colour, grain size, sorting, angularity, inclusions, moisture condition, structure, visual signs of contamination (including staining and fragments of fibre cement sheeting) and odour in general accordance with AS 1726-1993;
- soil samples will be collected from the surface and at 0.5 m intervals thereafter, or from each lithological unit (whichever is greater);
- suitable PPE including fresh disposable nitrile gloves will be used during sampling and equipment decontamination;
- a duplicate of each soil sample collected for field screening will be placed in sealed zip lock bags and screened in accordance with ERM SOPs using a PID fitted with a 10.6 eV lamp, calibrated at the beginning of each working day. Where the presence of VOCs or other impact is suspected, additional laboratory analysis may be undertaken;

- A representative soil samples will be collected (to the extent practicable) in accordance with techniques described in Australian Standard AS4482 (Part 2) to maintain the representativeness and integrity of the samples. The samples will be placed in pre-treated laboratory supplied sample containers. The containers will be filled, where practical, to minimise headspace, before being sealed and appropriately labelled. Labels will include the following information:
  - sample identification number;
  - job number; and
  - Date of collection.
- field quality control/quality assurance (QA/QC) samples will be collected including field duplicates, inter-laboratory duplicates, rinsate blanks, trip blanks and trip spikes (as required).
- Sample jars will be sealed and immediately placed in a cooler on ice to minimise potential degradation of organic compounds.

C.8.4 Soil Bore Reinstatement

Upon completion soil bores will be backfilled and the surface covering reinstated to match existing.

C.8.5 Waste Materials Generated During Drilling

All non-liquid waste materials generated during drilling works will be stored on-site in drums or other appropriate sealed containers at a designated staging area. If evidence of significant contamination is observed during drilling (e.g. staining or odour) an attempt will be made to store any potentially impacted wastes separately. All wastes will be disposed off-site to an appropriately licenced landfill by an approved and appropriately licensed waste removal contractor

C.9 GROUNDWATER INVESTIGATION

C.9.1 Groundwater Well Installation

Selected boreholes will be converted to groundwater monitoring wells in accordance with ERM SOPs. The following methodology will be implemented to install the new monitoring wells.

- the wells will be constructed of 50 mm diameter factory slotted screen (0.4 mm slots) and blank uPVC well materials. The wells will be screened within groundwater bearing strata and constructed to allow the ingress of non-aqueous phase liquids (NAPLs) which may be present;

- the well casing and screen will be inserted into the borehole. Washed and graded filter sand will be poured into the annulus between the well screen and borehole wall, ensuring that the sand covers the entire screened level and extends at least 0.5 metres above the top of the screen;

- bentonite pellets will then poured on top of the sand at a minimum thickness of one metre and hydrated to effectively seal off the well from surface water or perched / shallow groundwater inflows; and

- each well will be grouted using cement /bentonite grout to within 0.5 m of the surface and the final 0.5 m reinstated with concrete and a heavy duty cover, well casing will be sealed with air-tight, lockable 'envirocaps';

- the well cap will be labelled with the groundwater monitoring well I.D.;

- following monitoring well installation, each well will be developed to remove any fine materials or contaminants potentially introduced during drilling. Wells will be considered developed when either a minimum of 10 well volumes had been removed, or when water quality parameters stabilise or if the well is pumped dry prior to this. Where sufficient well volumes cannot be obtained, attempts will be made to remove fines and construction material by purging the well over several days to allow for recharge.

C.9.2 Groundwater Purging And Sampling Protocol

Where new monitoring wells are installed, groundwater purging and sampling will occur at least one week after well installation and development to allow subsurface conditions to stabilise.

The well cap will be partially removed to allow the headspace to be screened using a calibrated PID over a period of one minute. The presence of odours will also be noted following removal of the well cap and described by reference to their intensity and character. Following a period of no pumping (as a minimum 24 hours) all wells will be dipped to gauge the depth of groundwater and if necessary the presence and depths of NAPLs. Wells will be purged using a thoroughly decontaminated peristaltic pump under low flow conditions until sufficient water has been removed to obtain stabilised readings of pH, conductivity, redox potential, temperature and dissolved oxygen which was calibrated prior to use. The stabilisation criteria are as described in *Table C.1* below.

Table C.1 Water quality parameter stabilisation criteria

Parameter	Stabilisation criteria
pH	± 0.1 pH units
Electric Conductivity (EC)	± 3% (µS/cm or mS/cm)
Temperature	± 0.5ºC
Oxidation Reduction Potential (ORP)	± 10 mV
Dissolved Oxygen (DO)	± 0.3 mg/L

It is noted that both ORP and DO are typically slower to stabilise than the other parameters, and may be particularly unstable when not using a closed flow through cell. In this case, greater weight will be given to pH and EC as the 'stabilising' parameters.

Low-flow sampling techniques will be used to obtain samples that are representative of the local groundwater environment at the site. The inlet of the low-flow pump will be placed approximately 50 cm from the base of the well in order to obtain a representative sample of the aquifer. Water samples will be collected using equipment dedicated to each monitoring well to eliminate the potential for cross-contamination between sample locations.

The following order of sampling will be adopted:

- samples to be analysed for volatile compounds placed into 40 mL amber vials;
- samples to be analysed for semi-volatile compounds placed in 250 mL solvent washed amber bottles; and
- samples to be analysed for metals filtered through disposable cartridges containing 0.45 µm filters and placed in 125 mL plastic bottles preserved with nitric acid.

If NAPL is observed in any groundwater wells, attempts will be made to collect a representative sample of the NAPL for characterisation using a dedicated disposable bailer.

The containers will be filled, where practical, to minimise headspace, before being sealed and appropriately labelled. Labels will include the following information:

- sample identification number;
- job number; and
- date of collection.

Sample jars will be sealed and placed in a cooler on ice immediately to minimise potential for degradation of the sample.

C.9.3 Waste Materials Generated During Groundwater Development/Purging

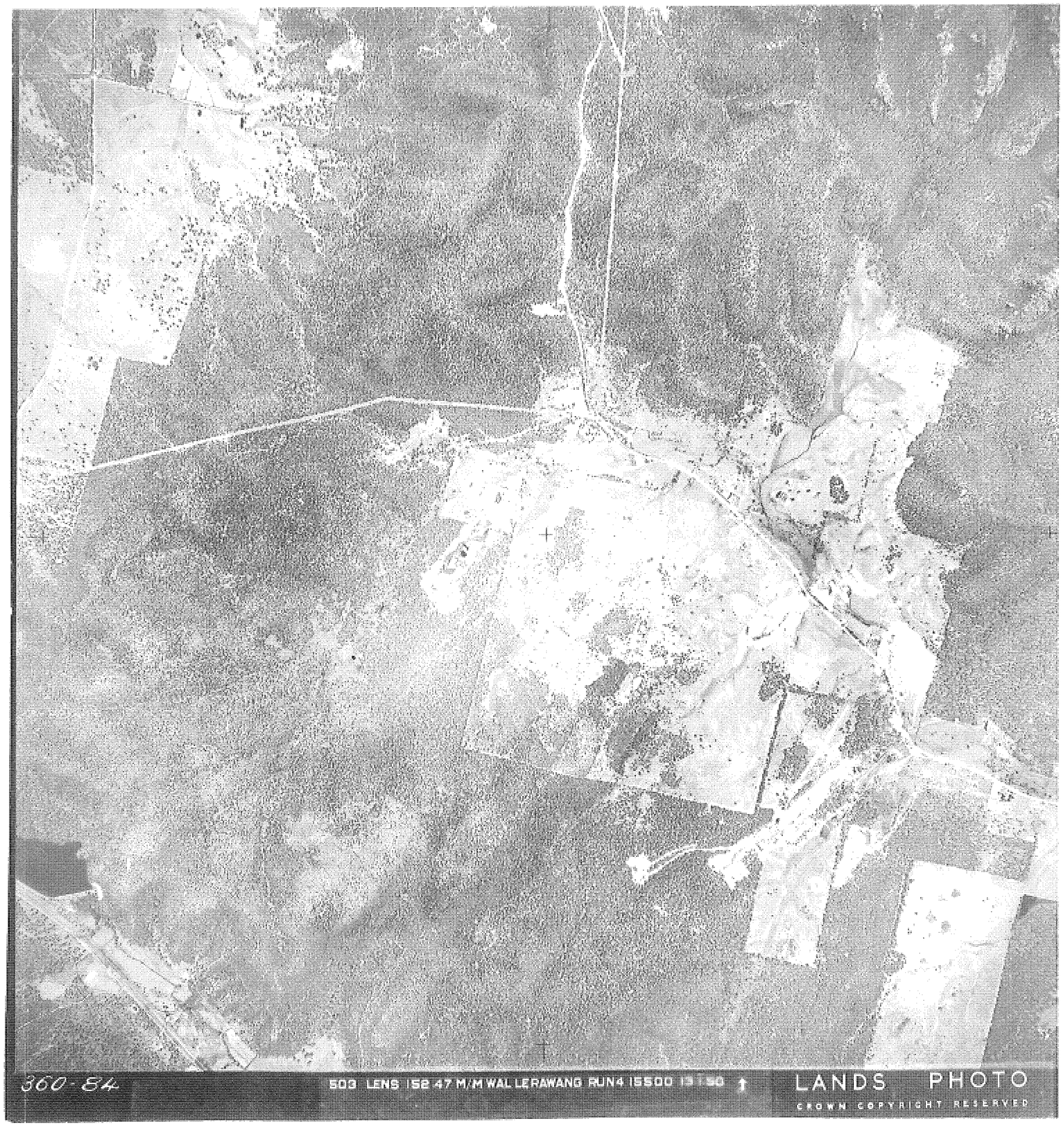
Water from development of the wells will be collected and stored in appropriately labelled dedicated drums or an intermediary bulk container (IBC) within the designated staging area. The water will be classified and disposed off-site in accordance with relevant NSW Waste Classification Guidelines.

C.10 SURVEY

All groundwater wells (excluding existing groundwater monitoring wells) will be surveyed to Australian Height Datum (AHD) for elevation and Map Grid of Australia (MGA) coordinates for location. For groundwater monitoring wells, the elevation of the highest point of the top of the PVC casing will be measured. A notch will be embedded in the casing to indicate the location surveyed. This mark will be the measuring point for future groundwater elevation measurements. This will allow for the appropriate groundwater elevations calculations and groundwater flow direction interpretations.

Annex D

Results of Historical Searches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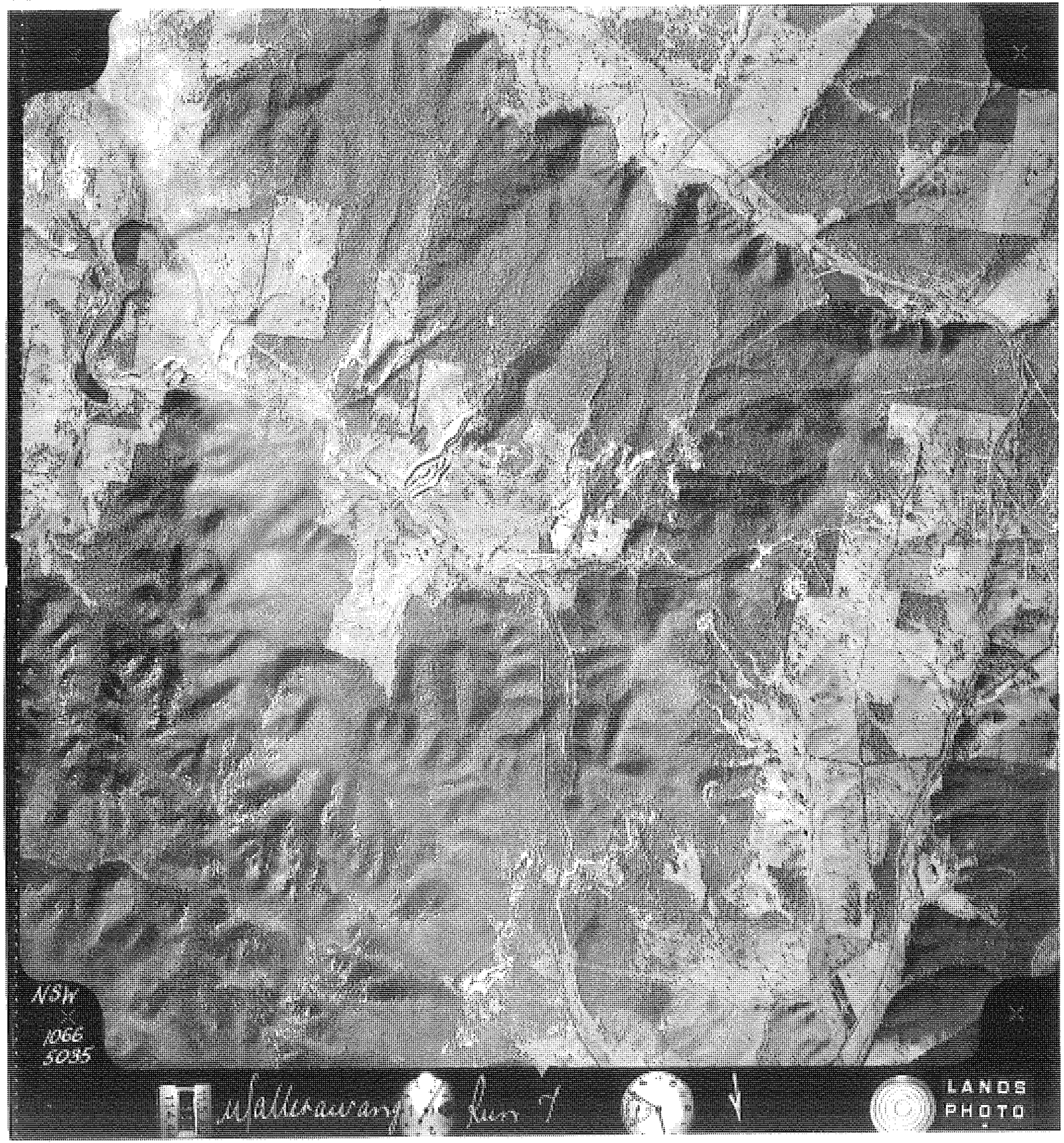

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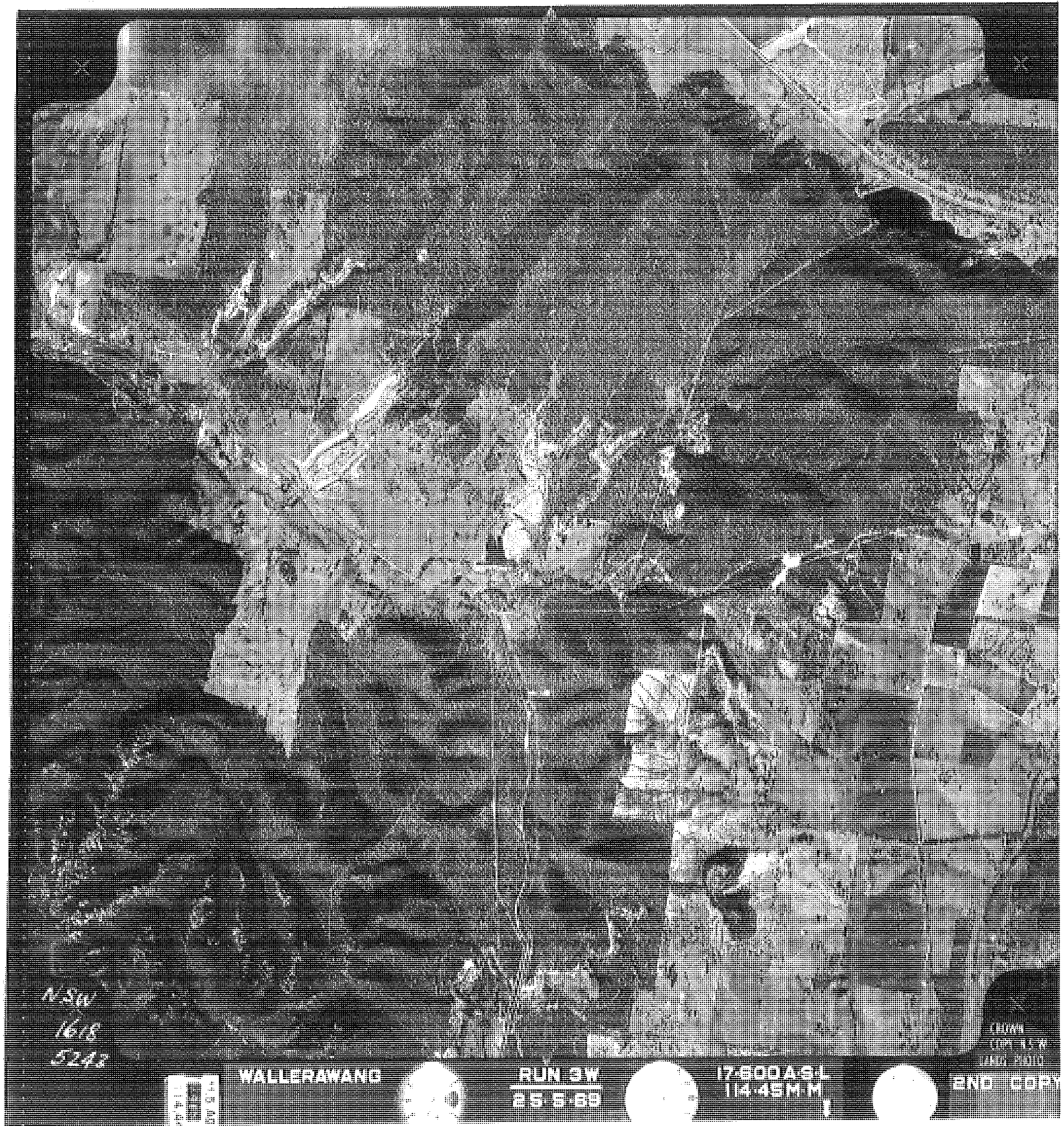
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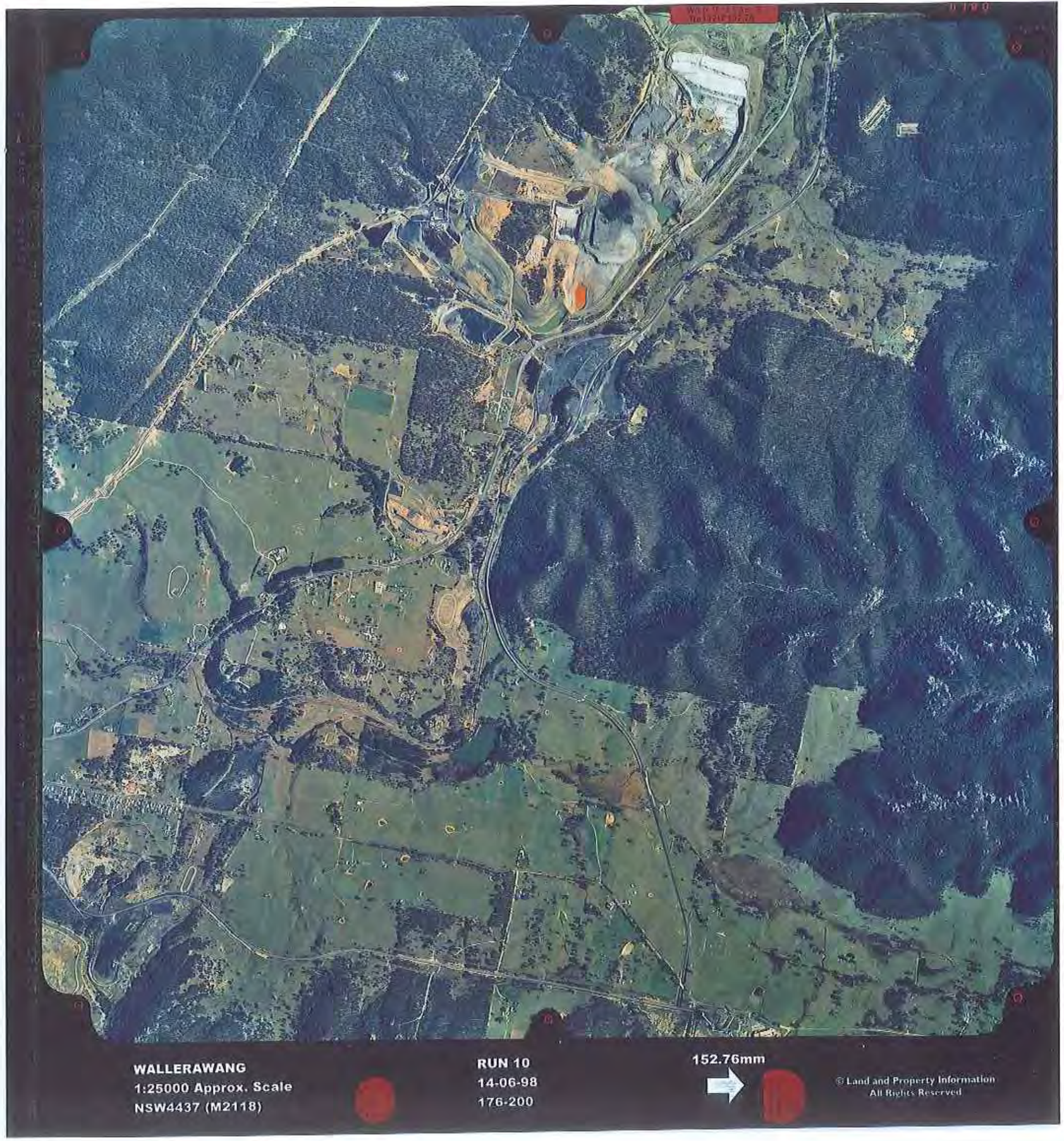
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176-200
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Annex E

Site Dangerous Goods Register

Storage ID	Storage Type	Max Storage Capacity (Kg/L)	UN Number	Product Name	Class/Division	Typical Quantity	Packing Group
1	Above Ground Tank	88414	00C1	COMBUSTIBLE LIQUIDS C1	C1	88414L	
2	Process Vessel	88414	00C1	COMBUSTIBLE LIQUIDS C1	C1	88414L	
3	Process Vessel	119748	00C1	COMBUSTIBLE LIQUIDS C1	C1	88414L	
4	Process Vessel	135660	00C1	COMBUSTIBLE LIQUIDS C1	C1	88414L	
6	Above Ground Tank	6500	2187	CARBON DIOXIDE, REFRIGERATED LIQUID	2.2	6000L	
7	Above Ground Tank	6500	2187	CARBON DIOXIDE, REFRIGERATED LIQUID	2.2	6000L	
8	Roofed Store	18193	2794	BATTERIES, WET, FILLED WITH ACID	8	18193L	III
9	Roofed Store	18193	2794	BATTERIES, WET, FILLED WITH ACID	8	18193L	III
10	Roofed Store	1000	1830	SULFURIC ACID	8	800L	II
11	Roofed Store	1000	1791	HYPOCHLORITE SOLUTION	8	1000L	III
15	Above Ground Tank	6000	1824	SODIUM HYDROXIDE SOLUTION	8	6000L	II
16	Above Ground Tank	6000	1824	SODIUM HYDROXIDE SOLUTION	8	6000L	II
17	Cylinder Store	22704	1049	HYDROGEN, COMPRESSED	2.1	20000L	
18	Above Ground Tank	30000	1005	AMMONIA, ANHYDROUS	2.3	28000L	
19	Cylinder Store	5848	1017	CHLORINE	2.3	4386L	
21	Above Ground Tank	55000	1830	SULFURIC ACID	8	50000L	II
22	Above Ground Tank	55000	1830	SULFURIC ACID	8	50000L	II
24	Above Ground Tank	40000	1824	SODIUM HYDROXIDE SOLUTION	8	35000L	II
25	Above Ground Tank	40000	1824	SODIUM HYDROXIDE SOLUTION	8	35000L	II
26	Above Ground Tank	32000	1830	SULFURIC ACID	8	30000L	II
27	Above Ground Tank	32000	1830	SULFURIC ACID	8	30000L	II
28	Above Ground Tank	24000	1760	CORROSIVE LIQUID, N.O.S.	8	20000L	III
29	Above Ground Tank	41000	1075	PETROLEUM GASES, LIQUEFIED	2.1	35000L	
30	Above Ground Tank	1200000	00C1	DIESEL	C1	500000L	
31	Above Ground Tank	1200000	00C1	DIESEL	C1	500000L	
32	Roofed Store	3000	1223	KEROSENE	3	100L	III
			1300	TURPENTINE SUBSTITUTE	3	100L	III
33	Cylinder Store	695	1001	ACETYLENE, DISSOLVED	2.1	100L	
			1978	PROPANE	2.1	321L	

Storage ID	Storage Type	Max Storage Capacity (Kg/L)	UN Number	Product Name	Class/Division	Typical Quantity	Packing Group
34	Roofed Store	3200	2672	AMMONIA SOLUTION	8	3200L	III
35	Roofed Store	5600	1791	HYPOCHLORITE SOLUTION	8	3200L	III
36	Underground Tank	33000	1203	PETROL	3	15000L	II
37	Above Ground Tank	50000	00C1	COMBUSTIBLE LIQUIDS C1	C1	25000L	
38	Above Ground Tank	20000	00C1	COMBUSTIBLE LIQUIDS C1	C1	10000L	
39	Above Ground Tank	25000	00C1	COMBUSTIBLE LIQUIDS C1	C1	10000L	
40	Above Ground Tank	25000	00C1	COMBUSTIBLE LIQUIDS C1	C1	10000L	
41	Above Ground Tank	25000	00C1	COMBUSTIBLE LIQUIDS C1	C1	10000L	
42	Above Ground Tank	25000	00C1	COMBUSTIBLE LIQUIDS C1	C1	10000L	
43	Above Ground Tank	25000	00C1	COMBUSTIBLE LIQUIDS C1	C1	10000L	
44	Above Ground Tank	25000	00C1	COMBUSTIBLE LIQUIDS C1	C1	10000L	
45	Above Ground Tank	28000	00C1	DIESEL	C1	14000L	
46	Underground Tank	11700	00C1	DIESEL	C1	8000L	
47	Above Ground Tank	5000	00C1	DIESEL	C1	5000L	

Annex F

Registered Titles

Lot	DP	Zoning	DP Land Area (Ha)
1	28230		
1	88503	1(a) Rural (General)	23.0469
1	325532	1(a) Rural (General)	0.4047
1	400022	1(a) Rural (General)	2.023
1	543898		
16	626299		
3	628814		
191	629212	1(a) Rural (General)	27.18
4212	644418		
1	702619	1(a) Rural (General)	33.87
2	702619	1(a) Rural (General)	26.04
362	740604	1(a) Rural (General)	19.13
366	740604	1(a) Rural (General)	36.23
67	751636	1(a) Rural (General)	
159	751638		
160	751638		
163	751638		
164	751638		
165	751638		
166	751638		
13	751651	1(a) Rural (General)	
357	751651	1(a) Rural (General)	
109	751651		
117	751651		
116	751651		
87	751651		
342	751651		
14	751651		
83	751651		
127	751651		
80	751651		
78	751651		
76	751651		
75	751651		
74	751651		
38	751655		
72	751655		
99	751655		
38	751655		
5	786438		
1	800003	1(a) Rural (General)	40.46
2	800003	1(a) Rural (General)	55.67
1	803655	1(a) Rural (General)	3.058
5	804929	1(a) Rural (General)	7.318
7	804929	1(a) Rural (General)	19.57
8	804929	1(a) Rural (General)	14.73
9	804929	1(a) Rural (General)	41.06
15	804929	1(a) Rural (General)	86.35
1	813288	1(a) Rural (General)	20.8
41	827626	1(a) Rural (General)	13.49
40	827626	1(a) Rural (General)	4.293
42	827626	1(a) Rural (General)	6.031
46	827626	1(a) Rural (General)	11.02
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49	827626	1(a) Rural (General)	4.965
50	827626	1(a) Rural (General)	14.8
51	827626	1(a) Rural (General)	2.302
52	827626	1(a) Rural (General)	10.77
44	827626		
10	827679		
1	829065	1(a) Rural (General)	10.22
2	874368		
1	920999	1(a) Rural (General)	0.8094
1	999329	1(a) Rural (General)	4.695
2	999329	1(a) Rural (General)	1.997
3	999329	1(a) Rural (General)	1.821
4	999329	1(a) Rural (General)	1.898

Lot	DP	Zoning	DP Land Area (Ha)
5	999329	1(a) Rural (General)	1.878
7001	1020468		
101	1053026		
202	1056693		
1	1092737		
2	1092737		
6	1125543		
7	1125543		
9	1125543		
10	1125543		
31	1127089		
12	1151411		
14	1151411		
4	1161461		
6	1161461		
102	1164619		
103	1164619		
101	1164619		
1-2	126336		
294-295	1409.1507		
95	751651		
106	751651		
20	823383		

Lot	DP	Zoning	DP Land Area (Ha)
4211	644418	1(a) Rural (General)	15.51
241	801915	1(a) Rural (General)	0.137
243	801915	1(a) Rural (General)	192.9
242	801915		
341	803500	1(a) Rural (General)	3.135
432	803501	1(a) Rural (General)	2.496
262	803710	1(a) Rural (General)	8.7
254	806025	1(a) Rural (General)	98.72
255	806025	1(a) Rural (General)	135.7

Lot	DP	Zoning	DP Land Area (Ha)
2	246233	1(a) Rural (General)	6.637
3	246233	1(a) Rural (General)	15.68
4	246233	1(a) Rural (General)	18.19
2	260856	1(a) Rural (General)	19.99
2	263511	1(a) Rural (General)	2.45
3	263511	1(a) Rural (General)	35.93
4	263511	1(a) Rural (General)	0.6879
5	263511	1(a) Rural (General)	1.17
12	616071	1(a) Rural (General)	12.3
382	618960	1(a) Rural (General)	2.401
20	619350	1(a) Rural (General)	4.135
21	619350	1(a) Rural (General)	11.06
15	626299	1(a) Rural (General)	15.21
101	631864	1(a) Rural (General)	11.24
4	634322	1(a) Rural (General)	13.43
1	634323	1(a) Rural (General)	9.352
103	751651	1(a) Rural (General)	277.21059
200	757036	1(a) Rural (General)	16.18748
210	757036	1(a) Rural (General)	16.18748
54	757036	1(a) Rural (General)	21.8531
56	791926	Not known	Not known
61	791927	1(a) Rural (General)	32.53
63	791927	1(a) Rural (General)	46.99
62	791927	Not known	Not known
64	791927	Not known	Not known
57	791928	1(a) Rural (General)	21.78
59	791928	1(a) Rural (General)	0.4392
58	791928	Not known	Not known
60	791928	Not known	Not known
51	791929	1(a) Rural (General)	1.303
66	791930	Not known	Not known
2	792415	1(a) Rural (General)	45.71
1	792415	Not known	Not known
13	846364	1(a) Rural (General)	10.53
1	1181411		
2	1181411		
3	1181411		
4	1181411		
5	1181411		
6	1181411		
7	1181411		
8	1181411		
9	1181411		

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