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Water Management and Monitoring Plan – Update for 60 ML Dam

Mt Piper Power Station Brine Conditioned Flyash Co-placement Extension Water Management and Monitoring Plan

28 February 2020

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Water Management and Monitoring Plan – Update for 60 ML Dam

Mt Piper Power Station Brine Conditioned Flyash Co-placement Extension Water Management and Monitoring Plan

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Acronyms and Abbreviations

Name	Description
ABS	acrylonitrile butadiene styrene
AEMR	Annual Environmental Management Report
AHD	Australian Height Datum
ANZECC	Australia and New Zealand Environment and Conservation Council
BCA	Brine Conditioned Ash
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DPIE	NSW Department of Planning, Industry and Environment
EC	Electrical Conductivity
EMS	Environmental Management System
EPA	NSW Environmental Protection Authority
EP&A Act	*Environmental Planning and Assessment Act 1979* (NSW)
EPL	Environment Protection Licence
ERM	Environmental Resources Management Australia NSW Pty Ltd
HDPE	High density polyethylene
LCC	Lithgow City Council
LDP01	Licenced discharge point
LMP01	Licenced monitoring point
LNAR	Lamberts North Ash Repository
m	metres
m^3	metres cubed
MF	Microfiltration
ML	Megalitres
ML/year	Megalitres per year
mm	millimetres
MPAR	Mt Piper Ash Repository
MPPS	Mt Piper Power Station
Mt Piper Consent	Development consent DA80/10060 as modified from time to time
MW	Megawatts
MWh/day	Megawatt hours per day
NFR	non-filterable residue
NSW	New South Wales
OPUS	Optimised Pre-treatment and Unique Separation
Prior WMP	Mt Piper Power Station Brine Conditioned Flyash Co-Placement Extension Water Management and Monitoring Plan prepared by Connell Wagner and dated 26 September 2008
POEO Act	*Protection of the Environment Operations Act 1997* (NSW)
REA	Reject Emplacement Area

Name	Description
RO	Reverse Osmosis
TARP	Trigger, Action, Response Plan
TCR	Thompsons Creek Reservoir
TDS	Total Dissolved Solids
TSS	Total Suspended Solids
VWP	vibrating wire piezometers
WCS	Western Coal Services
WCA	Water Conditioned Ash
WMP	Water Management Plan
SWTP	Springvale Water Treatment Project
SWTP Consent	Development consent SSD-7592 as modified from time to time
µS/cm	microSiemens per centimetre

1. INTRODUCTION

Environmental Resources Management Australia Pty Ltd (ERM) was engaged by EnergyAustralia NSW Pty Ltd (EnergyAustralia) to provide an updated Water Management Plan (WMP) for the Mt Piper Power Station (MPPS) Brine Conditioned Flyash Co-placement Project (the Project) under the conditions of DA80/10060 (Mt Piper Consent).

The Mt Piper Consent was originally granted under the *Environmental Planning and Assessment Act 1979* (NSW) (EP&A Act) on 1 April 1982 and has since been modified on eight occasions.

The Mt Piper Consent, as currently modified, authorises the MPPS and ancillary activities, including the Mt Piper Ash Repository (MPAR). Condition 43 of the Mt Piper Consent requires the preparation and approval of a Water Management Plan for the MPAR, which includes:

(a) *Details of the monitoring programs for surface water and groundwater required under conditions 40 and 41.*

(b) *Details of measures to be employed to control surface water run-off from the site.*

(c) *Contingency plans for the mitigation of environmental impacts should run-off or leachate from the site be found to be negatively impacting on natural surface water or groundwater.*

(d) *Brine management objectives and strategies, with specific reference to measures aimed at reducing the volume of brine produced at the Mount Piper Power Station.*

The *Mt Piper Power Station Brine Conditioned Flyash Co-Placement Extension Water Management and Monitoring Plan* prepared by Connell Wagner and dated 26 September 2008 (Prior WMP) was ultimately approved under condition 43 of the Mt Piper Consent. The results of the monitoring carried out under the Prior WMP are reported annually in an Annual Environmental Management Report (AEMR).

The Mt Piper Consent was further modified on 24 July 2019 (Modification 8) to authorise the construction and operation of a new 60-ML pond (hereon referred to as Settling Pond D) at the Power Station. As part of Modification 8, Condition 43A was included on the Mt Piper Consent. Condition 43A requires that the Prior WMP be updated to the satisfaction of the Planning Secretary prior to the commissioning of the new storage pond and the updated plan to be implemented.

This WMP has been updated to incorporate the inclusion of the new storage pond. The aim of the WMP is to minimise the effect of the placement of brine conditioned ash on local natural surface waters and groundwater. The WMP addresses water cycle management associated with the Project. It includes a surface water and groundwater water monitoring program, a requirement for an annual environmental report, trigger and response plans (TARPs), contingency measures, and strategies for brine reduction.

1.1 Project Appreciation

The MPPS is located in the western coalfields of New South Wales (NSW) about 17 kilometres north-west of Lithgow. The site location is presented on Figure 1, Appendix A. The MPPS is owned and operated by EnergyAustralia.

The MPPS is regulated by a number of separate development consents and planning approvals under the EP&A Act, including the Mt Piper Consent. The MPPS is also regulated under the conditions of Environment Protection Licence 13007 (EPL) granted under the *Protection of the Environment Operations Act 1997 (NSW)*.

The Brine Conditioned Flyash Co-placement Project (the Project) incorporates brine management and storage facilities on the footprint of the MPPS and the ash emplacement area within the former Western Main Open Cut void adjacent to the operational area. The ash placement area is comprised of the MPAR which is authorised under the Mt Piper Consent and the separately approved Lamberts North Ash Repository (LNAR), together referred to as the Ash Repositories. The separately approved Springvale Water Treatment Project (SWTP) is located on the MPPS footprint and, in addition to the power station, contributes brine to the Project.

In 2019, EnergyAustralia identified the need for additional water storage capacity at the MPPS and submitted Modification 8 to authorise Settling Pond D. Modification 8 was approved and authorises the development of Settling Pond D immediately adjacent to the existing Blowdown Pond B. The new storage pond will function as a multi-use storage to provide redundancy for a number of process streams. It will receive flows from the Mine Water Buffer Pond (formerly known as Blowdown Pond B), the Coal Settling Pond, and the Ash Repositories. The additional storage is required as a pseudo replacement for Blowdown Pond A which has been transferred for use as part of the SWTP operations.

1.1.1 Relationship to other approvals and plans

While the MPAR is approved under the Mt Piper Consent, the LNAR is separately approved by project approval 09_0186 granted under Part 3 A of the EP&A Act on 16 February 2012 (LNAR Project Approval). The conditions of the LNAR Project Approval relevantly operate to require:

- implementation of an approved Operation Environmental Management Plan. The currently approved plan is the *Lamberts North Ash Placement Project Operation Environmental Management Plan* prepared by CDM Smith and dated May 2013 (LNAR OEMP) which includes a Groundwater Management Plan and a Surface Water Management Plan; and
- the carrying out of groundwater and surface water monitoring programs as specified in the LNAR Water Management Plan. The results of the LNAR monitoring are reported in a separate AEMR prepared in accordance with the conditions of the LNAR Project Approval.

As the LNAR is operated in accordance with the separately approved LNAR OEMP under the conditions of the LNAR Project Approval, this WMP does not cover the LNAR.

In addition, the SWTP was separately approved under development consent SSD-7592 (SWTP Consent) granted under the EP&A Act in 2017. The SWTP is currently undergoing commissioning. Once fully operational, the brine stream from the SWTP will be used to condition ash for placement in the Ash Repositories, initially the MPAR and later likely the LNAR.

This WMP updates and replaces the Prior WMP (Connell Wagner, 2008) for the MPAR approved under the conditions of the Mt Piper Consent as required by condition 43A. This WMP also considers the results from an ongoing independent assessment of groundwater and surface water conditions in the vicinity of both the MPAR and the LNAR being carried out in relation to elevated chloride and metal concentrations identified in the AEMRs prepared for the MPAR and the LNAR.

2. REGULATORY REQUIREMENTS

2.1 Project Approval

The Mt Piper Consent was granted for the MPPS in 1982 by the then Minister for Planning and Environment under the EP&A Act as a state significant development.

The Mt Piper Consent was modified by the then Department of Urban Affairs and Planning on 3 April 2000 to authorise the co-placement of brine conditioned ash (BCA) in the existing MPAR placement area. This Stage 1 BCA co-placement activity was approved as Modification 4 to the Mt Piper Consent. As required by the conditions imposed as part of Modification 4, the WMP was developed and implemented.

Due to space limitations in the Stage 1 approval area and to provide for increased brine production due to the upgrade of generating capacity (authorised as Modification 6 to the Mt Piper Consent), a Stage 2 extension to the BCA co-placement area at the MPAR was approved on 23 March 2008 (authorised as Modification 7 to the Mt Piper Consent).

The Prior WMP was prepared and implemented under the conditions of the Mt Piper Consent.

2.2 Regulatory Correspondence

The key stakeholders actively involved in the implementation of the Project include:

- Department of Planning, Industry and Environment (DPIE);
- WaterNSW;
- the EPA; and
- Lithgow City Council (LCC).

In consultation with the stakeholders listed above, approval for Modification 8 was granted subject to conditions, including those specifically related to this updated WMP, as set out in Table 2-1. A record of regulatory correspondence and consultation associated with this updated WMP is provided in Appendix B.

Table 2-1 Current conditions of the Mt Piper Consent relevant to this WMP

Condition	Consent requirements	Relevant Section in this WMP where conditions are addressed
40	The Applicant shall, at least one month prior to the first placement of brine-conditioned flyash, consult with the EPA, DPIE Water and WaterNSW to establish the requirements for Water Monitoring Programs for groundwater and surface water. The Water Monitoring Programs shall: i) be based on the monitoring programs presented in the Statement of Environmental Effects for this modification; ii) include water quality testing at a minimum frequency of every three months; iii) be at the expense of the Applicant.	Water Monitoring Program presented in Chapter 6 and Appendix C.

Condition	Consent requirements	Relevant Section in this WMP where conditions are addressed
41	The Applicant shall expand the groundwater and surface water monitoring programs, including, if so required, the establishment of additional groundwater monitoring bores and surface water sampling points, in accordance with any reasonable requirements of the EPA, DPIE Water or WaterNSW.	Water Monitoring Program presented in Section 6 and Appendix C.
42	The Applicant shall, prior to the construction or operation of any monitoring bore on or in the vicinity of the development, consult with DPIE Water regarding the licensing of any bore on or in the vicinity of the development, under the provisions of the Water Act 1912 or Water Management Act 2000.	Current and future updates in the water monitoring program are being / will be undertaken with consultation with DPIE Water.
43	At least one month prior to the placement of brine-conditioned flyash, or within such further period as the Secretary may agree, the Applicant shall prepare and submit for the approval of the EPA, WaterNSW, DPIE Water, LCC, and the Secretary, a WMP which shall include, but not be limited to: a) Details of the monitoring programs for surface water and groundwater required under conditions 40 and 41. b) Details of measures to be employed to control surface water run-off from the site. c) Contingency plans for the mitigation of environmental impacts should run-off or leachate from the site be found to be negatively impacting on natural surface water or groundwater. d) Brine management objectives and strategies, with specific reference to measures aimed at reducing the volume of brine produced at the Mount Piper Power Station.	This WMP addresses addition of Settlement Pond D. Section 4 addresses surface water management and brine management; Section 6 presents the surface water and groundwater monitoring program; Section 7 presents contingency plans for the mitigation of environmental impacts; Section 8 presents a summary of current contingency measures underway.
43A	The Applicant must update the Water Management Plan required by Condition 43 to the satisfaction of the Secretary, prior to commissioning the storage pond associated with Modification 8. The Applicant must implement the approved Water Management Plan.	This WMP.

3. ROLES AND RESPONSIBILITIES

All employees and contractors carrying out work at the MPPS are responsible for managing operations in an environmentally responsible manner; taking action to minimise the environmental impacts from site operations and reporting environmental incidents. They must be familiar with the requirements of this WMP and comply with it in full.

Key roles and responsibilities are shown in Table 3-1; these are also presented in the organisational chart provided as Figure 3.

Table 3-1 Roles and responsibilities for implementation of the WMP

Roles and Responsibilities
1. Owner (EnergyAustralia)
EnergyAustralia NSW is the owner of the MPPS and ultimately responsible for implementation of the Project, including: ■ Authorisation of environmental management strategies and plans; ■ Compliance with EnergyAustralia Environment and Community Policies; ■ Provision of resources to allow the identified environmental risk and community objectives be implemented; ■ Reporting environmental incidents to regulators in accordance with all legal requirements; and ■ Delegate duties during the absence of the Environment and Community Lead.
2. Contract Administrator (EnergyAustralia)
■ Facilitate execution of the contract and manage communications between EnergyAustralia, the Contractor and third parties as required for implementation of the WMP. ■ The Contract administrator is the primary point of contact for communications between EnergyAustralia (including environment and community leads) and the contractor project manager.
3. Project Manager / Site Manager (Contractor)
The contractor's Project Manager/ Site Manager roles and responsibilities include: ■ Managing, implementing and ensuring compliance against the contract administered by EnergyAustralia and reporting back to the contract administrator (EnergyAustralia) about any non-conformances or non-compliances or matters concerning the operation of the ash repository; ■ Overseeing all environmental and operational activities and providing direction; ■ Ensuring overarching systems are provided for risk management, health, safety and emergency measures; ■ Ensuring audits are carried out and outcomes are reviewed and actioned where required; ■ Ensuring procedures are implemented to manage contractor performance; ■ Ensuring community consultation and complaints handling occurs in accordance with relevant procedures and all complaints are resolved satisfactorily; ■ Ensuring environmental incidents are recorded in accordance with procedures and mitigation measures are implemented to minimise the possibility of the same incident happening again; and ■ Notifying the Contract Administrator if a complaint has been received.

Roles and Responsibilities

4. Team Leader – Operations (Contractor)

The Contractor's Operations Team Leader is responsible for supervising the day to day operations of a team of people that work on the ash repository. The Operations Team Leader is also:

- Responsible for overseeing, guiding and training any new staff in day to day ash placement activities;
- Managing the operations personnel;
- Liaising and co-ordinating work on the ash repository in conjunction with other groups i.e. environmental team;
- Overseeing compaction and ensuring that it is completed correctly;
- Dealing with day to day issues on the ash repository including traffic movements;
- Implementing and overseeing safety;
- Working in conjunction with the environmental team and the Project Manager to ensure environmental management aspects and regulatory requirements are incorporated into Project design, procurement, contracts management, planning/ scheduling and construction; and
- Reporting back to the Project Manager.

5. Project Foreman (Contractor)

The Contractor's Project Foreman responsibilities include:

- Co-ordinating machinery and plant operators onsite and in accordance with the team leaders requirements;
- Liaising with team leaders and project manager on a daily basis;
- Ensuring correct mitigation measures are being carried out in accordance with WMP and contractual arrangements; and
- Reporting back to the Team Leader.

6. Operators – mobile and fixed plant (Contractor)

The Contractor's plant operators responsibilities include:

- Driving and / or operating machinery and/or plant on the ash repository in accordance with work place procedures and safety requirements;
- Hauling, placing and compacting ash and operating water carts for dust suppression;
- Operating and maintaining the sprinkler systems across the ash repository for dust suppression and revegetation;
- Operating and maintaining sediment control structures and water pumping systems;
- Pegging out ash placement benches and batters, and conducting ash compaction tests and surface water sampling; and
- Reporting back to the Project Foreman.

4. WATER CYCLE MANAGEMENT

The MPPS and MPAR are located within the catchment of Neubecks Creek, a tributary of the Coxs River, which is a sub-catchment of the Warragamba Catchment (see Figure 2). A schematic of the brine management cycle is shown in Figure 4, with additional details presented in Table 4-1.

4.1 Water Management

4.1.1 Water Supply

4.1.1.1 Current Water Supply

The MPPS currently draws water primarily from Lake Lyell, which forms part of the Coxs River System, under the conditions approved on its Water Access Licence. The water drawn is either pumped directly to the power station cooling water system or directed into Thompsons Creek Reservoir (TCR) as an off-line staging dam. MPPS also has some access to supplementary water from the Oberon Dam which forms part of the Fish River Scheme via a separate Water Access Licence.

Water from the TCR or Oberon Dam is currently pumped to MPPS Blowdown Pond B[1] (via the cooling water system). However, water from the TCR or Oberon Dam will be transferred to the clean water pond under the new pond strategy (i.e. following commissioning of Settling Pond D).

4.1.1.2 Future Water Supply

The separately approved SWTP involves the transfer of up to 42 ML/day of water from existing dewatering facilities on the Newnes Plateau to a new water treatment plant located at the MPPS. Treated water will be beneficially re-used as a priority to meet the demand for make-up water requirements within the MPPS cooling water system.

Treated water from the SWTP is returned to the clean water pond for use in the cooling water system. Any excess treated water will be temporarily stored within TCR (transferred via the cooling water system) for subsequent reuse during periods of high water demand in the MPPS cooling water system.

The SWTP will enable the transfer of underground mine water for treatment and subsequent reuse within the cooling water system to supplement existing catchment supplies. Moving forward, the majority of MPPS cooling water will come from the SWTP rather than the TCR or Oberon Dam.

4.1.2 Storm Water Management

The Eastern Clean Water Drain diverts storm water away from the new 60 ML pond (Settling Pond D). This water then reports to Neubecks Creek via the Final Holding Pond. Similarly, existing clean water drains divert storm water away from MPAR and report to Neubecks Creek.

4.1.3 SWTP Process Water Management

Residuals (liquids and solids) from the SWTP pre-treatment process are separately disposed of in the reject emplacement area (REA) at the neighbouring Springvale Coal Services site (part of Western Coal Services Project, SSD 5579).

[1] To be referred to as Mine Water Buffer Pond under the new pond strategy

Management of brine and residual from the SWTP and associated processes are described in the Brine and Residual Waste Management Plan (GHD, 2019a) separately approved under and required to be implemented by the conditions of the SWTP Consent. The Brine and Residual Waste Management Plan should be read and implemented in conjunction with this WMP and it is proposed to update the Brine and Residual Waste Management Plan to reflect this WMP.

4.1.4 Settling Pond D

Settling Pond D will function as a multi-use storage pond to provide storage redundancy for a number of process streams at MPPS. Settling Pond D will receive flows from the existing Settling Pond A – Settling Pond C, the Coal Settling Pond, from covered areas of the Ash Repositories and the SWTP. The double lining of Settling Pond D will meet or exceed the current standard for the storage of blowdown water and transferred Coal Settling Pond water in the single lined MPPS blowdown ponds (Blowdown Pond A and Mine Water Buffer Pond). Piezometers to monitor the potential for seepage to occur from Settling Pond D will be installed.

The subgrade of Settling Pond D is constructed, compacted and tested to specifications for liquid storage. The subgrade is lined with two new 2 mm impervious HDPE membrane liners designed specifically for the purpose of hydraulic containment. The two lining layers have been installed, welded and tested in accordance with specifications suitable for liquid storage infrastructure. Records of materials testing, construction inspections and other relevant certifications have been maintained for each stage of the Settling Pond D construction. It is considered that the Settling Pond D construction method is in general accordance with the lining method presented by NSW EPA (2016), and is therefore suitable for its intended purpose at the Mt Piper Power Station.

As outlined in Section 1.1, Settling Pond D provides additional storage to replace some of that previously provided by Blowdown Pond A which has been transferred for use as part of the SWTP operations.

The design of Settling Pond D includes a weir that will allow overflow into the Mine Water Buffer Pond during high rainfall conditions, to further reduce the likelihood of water being discharged from the MPPS.

Settling Pond D will provide additional storage capacity to manage storm water runoff from operational areas and flexibility to the operations of existing pond infrastructure for maintenance work (e.g. cleaning, replacement of liners etc.). Furthermore, Settling Pond D will enable the site to continue to operate as a zero process water discharge site. Settling Pond D will also assist EnergyAustralia to continue to meet their environmental obligations for prevention of water pollution in accordance with Section 120 of the POEO Act.

The use of Settling Pond D for brine storage will be assessed based on operational brine storage forecasts. The approach for storage of brine and associated monitoring is intended to be consistent with the existing brine waste ponds (A and B).

4.2 Brine Production and Management

4.2.1 Brine production

Brine is derived from the evaporative cooling process in the cooling towers. As water evaporates from the cooling towers, the concentration of salts contained in the circulating water increases and would eventually impact upon the operation of the cooling system. A portion of the salty water is therefore regularly blown down and replaced with fresh “make up” water.

Blowdown water from the cooling towers will be transferred to the Mine Water Buffer Pond for treatment by the SWTP. The SWTP brine crystalliser system produces a mixed salt and a dewatered lime salt which is transferred to either the crystalliser feed tank, or to the existing Brine Waste Pond A and Brine Waste Pond B for temporary storage. This is used to condition the fly ash disposed of on site in approved areas for brine conditioned ash (BCA) placement areas, above 946 m AHD in the MPAR under the Mt Piper Consent or the separately approved LNAR (which to date has received only WCA) (refer to Figure 5).

The existing EnergyAustralia brine concentrators and micro filtration (MF) infrastructure will be retained for emergency use as required. The EnergyAustralia Reverse Osmosis (RO) system will be operated as required to maintain the conductivity of the cooling tower cooling water by removing salts from the cooling water system and recycling distillate back into the cooling water cycle.

4.2.2 Brine management

As far as is practicable, MPPS and the separately approved SWTP are operated so that the production, handling and storage of the brine is minimised and its management is carried out in a responsible manner. Brine conditioning of the ash occurs within the paved MPPS area, away from the MPAR, to limit the likelihood that brine or brine contaminated material may enter natural waterways. The BCA is transported to the MPAR by conveyor before being loaded on to trucks for placement in designated and approved BCA disposal area.

The pump to transport the brine to the ash conditioning plant is located adjacent to the brine holding ponds, and drainage from the pump area is directed back to the brine ponds. The pipeline is fully welded HDPE and acrylonitrile butadiene styrene (ABS) pipe, located above ground to minimise the possibility of an undetected leak.

The site layout is designed such that a spill of brine may be intercepted at the earliest point. The drainage system is backed up by the Final Holding Pond, so that in the unlikely event of leaked brine, it can be collected and pumped back for treatment via the Brine Concentrators. The brine storage ponds are double lined to minimise the risk of leaks and local groundwater contamination. Monitoring of groundwater in the vicinity of the brine ponds is conducted in accordance with the overview presented in Section 6.

During storage of the brine in the holding ponds, some solids settle out; the settled material cannot be slurried with the brine for mixing with the ash. The settled material (brine sludge) is periodically excavated as required and transported to the ash storage area in trucks, where it is deposited in the BCA placement area. The brine sludge is spread in thin layers and covered by a layer of brine conditioned fly ash in the manner described in the "Mount Piper Power Station Brine Conditioned Flyash Co- placement - Statement of Environmental Effects" (PPI 1999). These solids will continue to be spread in a thin layer in the designated brine conditioned ash disposal area as necessary.

The future generation of brine sludge is dependent on the operational capacity and the associated power generation of the MPPS. The pond clean out procedure and placement of brine sludge is conducted on a campaign basis only; it is not conducted annually. The chemical composition of the brine sludge is generally consistent with the brine stored in the waste ponds. Refer to Appendix D.

4.2.3 Brine Minimisation Strategies

Several strategies for minimising brine production at MPPS have been investigated. The most effective method is to use a greater proportion of the Fish River water supply (i.e. Oberon Dam) allocation and to reduce the use of the more saline Coxs River (i.e. Lake Lyell and TCR) supply. This approach had limited brine production, even when the power station was operated at near full capacity. However, the current prolonged drought has limited access to the Fish River water supply and increased the salinity of the Coxs River supply, so the volume of brine production has increased. The extended area of brine conditioned ash placement (i.e. MPAR Stage 2) has taken this into account for future co-placement requirements as has the construction of the new storage pond which will be available for the storage of brine. Other brine reduction strategies being used include recycling of plant wastewater and using cooling tower water to condition ash (WCA).

SWTP operating activities are likely to increase the volume of brine generated as a result of the increased volume of water to treat, over and above historical volumes. This is compensated for by the implementation of a brine crystalliser unit and a crystallised salt slurry dewatering unit. These implemented measures are intended to limit brine management volumes down to volumes similar to historical levels, but will result in an increase of brine total dissolved solids (TDS – reported as electrical conductivity in GHD, 2019a) from approximately 180,000 mg/L to 500,000 mg/L. Brine will continue to be managed through ash conditioning prior to emplacement in the approved BCA placement areas in the MPAR.

4.2.4 Future Brine Disposal Strategy

To improve controls for management of brine disposal, EnergyAustralia is investigating alternative strategies for disposal of brine to the ash repositories. This will involve assessing future options for the treatment, handling and disposal of brine, including disposal methods and locations. Alternative brine disposal strategies may include:

- brine crystallisation;
- sale of brine;
- encapsulation of brine using liners;
- ocean disposal; and
- co-disposal (as current practice).

4.3 MPAR Surface Water Management

The MPPS weather station data reports an average rainfall of 772 mm annually. Surface water management of runoff from within the MPAR/LNAR is outlined in Figure 5. Surface water runoff management practices in the MPAR include:

- covering non-active or completed surfaces of the ash placement areas with 250 mm of clean soil material. In addition, BCA placement areas are covered with 1 m of WCA prior to application of cover (see Figure 6);
- directing surface runoff from the external batters away from the deposited ash into drains and clean water ponds (CWP01 and CWP02). A series of pumps and pipework will allow connection between Settling Pond D, Pond BWA and Pond BWC (see Figure 5);
- surface water runoff from the exposed ash surfaces of the MPAR is managed by a surface slope of 1% that directs runoff to a series of unlined detention ponds (see Figure 6); and
- directing surface runoff from the internal surfaces of the MPAR to unlined internal detention basins or lined Brine Pond, to be collected and used for dust suppression within BCA placement area only, or transferred to Pond BWB (see Figure 5). The unlined internal detention basins are temporary surface water management controls used to minimse the potential for erosion and scouring of the active ash placement areas.

The three 20 ML ponds (Pond BWA, BWB and BWC) have been double lined with HDPE and may at times be utilised to temporarily store brine and blowdown water from the MPPS.

Table 4-1 Water storage associated with the Mt Piper Ash Repository (includes Settling Pond D)

	Storage Feature	Size (ML)	Liner	
Ash Repositories	CWP01	5	Unlined	Inputs: Catchment for runoff from external batters of the MPAR. Outputs: Source of water for irrigation as needed, to LN Pond 2 as needed.
	CWP02	1	Unlined	Inputs: Catchment for runoff from external batters of the MPAR. Outputs: Source of water for irrigation as needed, to LN Pond 2 as needed.
	Dewatering Sump	-	HDPE, single	Inputs: Placement of brine sludge and other wet materials from MPPS operations. Outputs: Infiltration to the Brine Sump.
	Brine Sump	0.7	HDPE, single	Inputs: Catchment of surface water runoff from MPAR and some infiltration from the BCA placement area. Outputs: Source of water for irrigation of the BCA placement area, to Pond BWB as needed.
	Internal detention basins	Various, unlined		Inputs: Catchment for surface water runoff from the ramped access to the BCA placement area. Outputs: Source of water for irrigation of the BCA placement area, to Pond BWB as needed. Note: these are temporary surface water management controls used to minimise the potential for erosion and scouring of the active ash placement areas.
	LN Pond 2	13.8	HDPE, double	Inputs: Catchment for runoff from external batters of the LNAR, surplus water storage (e.g. CWP01 and CWP02 if needed), source of water for irrigation of MPAR and LNAR as needed. Outputs: Potential overflow would report to DML Dam and Cooks Dam.
	Pond BWA	20	HDPE, double	Inputs: Runoff from the WCA placement areas, transfer from the new storage pond as needed. Outputs: Source of water for irrigation of the WCA placement areas, connection to Settling Pond D.
	Pond BWB	20	HDPE, double	Inputs: Surplus water from the Brine Pond and water pumped from an extraction bore installed to the base of the MPAR. Outputs: Source of water for irrigation of the BCA placement area.
	Pond BWC	20	HDPE, double	To be confirmed (under construction), likely as per New Pond A.

	Storage Feature	Size (ML)	Liner	
Power Station Area	Mine Water Buffer Pond	100	HDPE, single	Input: from MMPS Cooling water system via Settling Pond D. Output: to SWTP Transferred away from operation of the MPPS, to be utilised for the SWTP (input from SWTP, excess water to MPPS Cooling Water System or transferred to TCR) under the new pond strategy.
	Settling Pond A	8	HDPE, single	Inputs: Wash down water from within the power generation units Outputs: Source of water for irrigation of the WCA/BCA placement areas, Ash Plant.
	Settling Pond B	8	HDPE, single	
	Settling Pond C	8	HDPE, single	
	Settling Pond D	60	HDPE, double	Inputs: multi-use storage pond to provide storage redundancy for a number of process streams at MPPS. Settling Pond D will receive flows from the existing Settling Pond A – Settling Pond C, the Coal Settling Pond, from covered areas of the Ash Repositories and the SWTP. Outputs: Mine Water Buffer Pond
	Brine Waste Pond A	20	HDPE, double	Inputs: Brine Concentrators / SWTP Outputs: Ash conditioning for BCA placement in the MPAR
	Brine Waste Pond B	20	HDPE, double	
	Coal Settling Pond	32	unlined	Inputs: Runoff from the coal stockpile area Outputs: Evaporation, discharge to the Final Holding Pond, transfer to the new storage pond

5. WATER QUALITY

The current surface water and groundwater conditions in the vicinity of the MPAR are summarised in the 2018-2019 AEMR for the Mt Piper Brine Conditioned Fly Ash Co-Placement Project (ERM, 2019) (the AEMR).

5.1 Environmental Goals

Environmental Goals for the parameters outlined below are summarised in Appendix E. The Environmental Goals contained in the Prior WMP have been updated consistent with the updated Environmental Goals for groundwater and surface water monitoring applying to the LNAR as approved in the LNAR OEMP and the AEMRs which use these updated Environmental Goals. The updated Environmental Goals were developed by Aurecon (2009) to account for hardness corrected guideline values and were presented by CDM Smith (2013).

The Environmental Goals utilise the 95% ecosystem protection values, stock watering, irrigation water or drinking water values, in combination with 90th percentile pre-brine placement local environmental (groundwater/surface water) data, whichever is greater. The local guideline values incorporated into the Environmental Goals are based upon the 90th percentile pre-ash placement water quality results, as measured at surface water quality point WX22 (for surface water) or the former groundwater collection basin (for groundwater).

5.1.1 Early warning assessment

In addition to comparing results with the Environmental Goals for surface water and groundwater, EnergyAustralia will conduct an early warning assessment of the groundwater and surface water monitoring data. This assessment will comprise assessment of concentration trends through time at each location, including statistical analysis where appropriate. The results of the early warning assessment will be reported in the AEMR.

Refer to Section 7 for actions related to changes in water quality relative to Environmental Goals if indicated by the early warning assessment.

5.2 Surface Water

Surface water in Neubecks Creek is characterised by elevated concentrations of sulfate, iron and manganese. This reflects the nature of the local geology, which includes out cropping coal seams, many of which have been mined in this area. Stream flow in Neubecks Creek is variable due to the small catchment size upstream of the MPAR. Neubecks Creek is considered to be a gaining stream in places, with groundwater recharge contributing to the base flow rate in these reaches.

As reported in the 2018-2019 AEMR, identified exceedances of the Surface Water Environmental Goals, where they occur, are being further investigated as part of a separate and broader investigation into groundwater and surface water conditions in the vicinity of the Ash Repositories. This investigation was triggered as a result of the surface water monitoring program and associated contingency measures.

5.3 Groundwater

Groundwater flow directions are inferred to be generally from west of the MPAR towards the east and north-east. In some areas, the local groundwater is elevated in salts and metals, including sulfate, chloride, nickel, and manganese as well as some trace elements such as zinc and boron.

As reported in the 2018-2019 AEMR, identified exceedances of the Groundwater Environmental Goals, where they occur, are being further investigated as part of a separate and broader investigation into groundwater and surface water conditions in the vicinity of the Ash Repositories. This investigation was triggered as a result of the groundwater monitoring program and associated contingency measures.

6. WATER MONITORING PROGRAM

Water quality monitoring provides important feedback for brine cycle management associated with the Project, including in the vicinity of water and brine holding ponds and the Ash Repositories (the MPAR approved under the Mt Piper Consent and the separately approved LNAR). This groundwater and surface water monitoring program has been designed to supply sufficient information to give a picture of the state of brine cycle management so that decisions can be made as to whether changes in local water quality are due to brine storage, brine movements, and/or the placement of BCA at MPAR. The aim is to identify water quality changes at an early stage so that potential causes can be investigated and, if necessary, effects mitigated.

6.1 Monitoring Locations

Bores are placed inside and adjacent to the MPPS and ash repositories with the intention of monitoring to provide an early warning of potential discharge or release from water storage features associated with brine management and BCA placement activities at the MPAR. Bores have also been established further away to allow detection of groundwater movement toward Neubecks Creek and to monitor background conditions.

Based on results to date from the investigation into groundwater and surface water conditions in the vicinity of the Ash Repositories, additional monitoring locations have been included in the water monitoring program.

Sentinel bores are also included to monitor the brine waste ponds and other water storage features in the MPPS footprint. Three (3) seepage piezometers will be installed adjacent to Settling Pond D.

Groundwater monitoring locations are summarised in Table C-1, Appendix C. Surface water monitoring locations are summarised in Table C-2, Appendix C. The locations of the groundwater and surface water monitoring locations that form part of this monitoring program are shown in Figure 7.

Additionally, stream flows are recorded at WX22 (by WaterNSW) and LMP01 (by EnergyAustralia).

Vibrating wire piezometers (VWPs - which only monitor water level) have been installed within the MPAR to monitor and detect changes in groundwater elevation. Results are reported in the AEMR.

6.2 Monitoring Frequency

Extensive groundwater and surface water monitoring has been ongoing on at least a quarterly basis around the brine storage areas and ash repositories, including in the area of what is now the MPAR, since 1985 to characterise the water quality and hydraulic characteristics of the area.

The proposed groundwater and surface water monitoring program, including locations and monitoring frequency, is presented in Appendix C.

6.3 Monitoring Method

Groundwater monitoring is undertaken using a submersible pump or via bailing. At locations with poor recharge, bores are purged dry 24 hours before sampling to allow sufficient recharge for sampling. Bores with good recharge are purged to remove a minimum of three times the bore volume prior to sampling. Groundwater field parameters are collected at the time of sampling (see Section 6.4 below).

Surface water samples are collected via a grab sampling methodology, with field water quality field parameters collected at the time of sampling (see Section 6.4).

Water quality analyses are undertaken in accordance with methods outlined in the EPA (2004) guidance.

6.4 Monitored Parameters

Groundwater monitoring is undertaken to collect the following monitoring parameters:

- Depth to water (to metres Australian Height Datum [m AHD] - prior to purging);
- Electrical conductivity (µS/cm, field measured);
- pH (field measured);
- Total Dissolved Solids (TDS);
- cations and anions (calcium, chloride, fluoride, potassium, sodium, sulfate);
- alkalinity (total alkalinity, bicarbonate alkalinity, phenolphthalein alkalinity); and
- total and dissolved metals (aluminium, arsenic, barium, beryllium, boron, cadmium, chromium, copper, iron, lead, magnesium, manganese, mercury, molybdenum, nickel, selenium, silver, zinc) – field filtered at 0.45 µm.

Surface water monitoring is undertaken for the above parameters with the exception of depth to water, and the addition of:

- non-filterable residue (NFR, turbidity, or Total Suspended Solids – TSS);
- total phosphorus; and
- nitrogen, nitrate, nitrite, total kjeldahl nitrogen (TKN).

Flow rate, EC and pH are monitored continuously at LMP01 by EnergyAustralia. Flow rate and EC are monitored continuously at WX22 (WaterNSW site #212055) (https://realtimedata.waternsw.com.au/).

6.5 Data Management and Assessment

The monitoring data is compared with the existing historical dataset for an assessment of trends related to potential influence of the brine management and BCA placement activities on surface water and groundwater. Chloride is used as a primary indicator of potential impacts associated with brines because the local area is highly mineralised and it is difficult to distinguish the origin of other trace elements, and chloride is unlikely to undergo chemical alteration in the groundwater. This assessment is conducted for monitoring locations included as part of this management plan, and is reported in the AEMR. Similar data assessment is also conducted as part of the broader investigation currently underway into groundwater and surface water conditions in the vicinity of the Ash Repositories.

If concentrations of target analytes increase above background and approach the relevant Environmental Goals, or show statistically increasing trends, and the increase can be reasonably expected to be due to the placement of BCA or other brine management activities, the contingency plan, described in Section 7 will be implemented.

6.6 Reporting Requirements

An AEMR is prepared in relation to the monitoring and management requirements specified in this WMP. The completion of the AEMR involves the following scope of works:

- Review of surface water and groundwater quality data;
- Review long-term trends in surface and groundwater concentrations, with reference to statistical assessment of concentration trends and triggers;
- Assessment of the data to evaluate potential interactions with the Neubecks Creek water quality;
- Reporting when the Environmental Goals have not been achieved;
- Interpretation and discussion of results;

- Update on the contingency measures currently being implemented in accordance with this WMP; and
- Preparation of a report in accordance with this WMP and the Mt Piper Consent.

It is noted that there are other reporting requirements, including provision of water quality data, included as part of the annual EPL reporting process. The reporting requirements of the EPL will be provided to the regulators separately to the reporting requirements outlined in this WMP.

6.7 Groundwater Model Verification

The Mt Piper Consent requires that the groundwater modelling report contained in the Mount Piper Power Station Extension of Brine Conditioned Ash Placement Area - Statement of Environmental Effects (dated June 2007), as completed by Merrick (2007), be updated.

An update to the Merrick (2007) groundwater model is currently being undertaken to assist in impact assessment studies and the identification of suitable mitigation measures, if required.

7. TRIGGER ACTION RESPONSE AND CONTINGENCY PLANS

Trigger Action Response Plans (TARPs) have been prepared for groundwater quality and surface water quality that outline the triggers and appropriate responses to manage potentially adverse impacts on the environment from the disposal of BCA and management of brine at the MPAR approved under the Mt Piper Consent.

A “trigger” in this instance may be where a statistically significant increasing concentration trend is identified in groundwater or surface water via the early warning assessment OR where concentration data for a sampling location are reported above an Environmental Goal.

7.1 Performance Criteria

The key aim of TARPs is the mitigation and control of impacts, ideally through early detection. Therefore, TARPs for groundwater and surface water quality are based on the Environmental Goals for the monitoring program, as presented in Appendix E. In addition, long-term trends in surface and groundwater concentrations are assessed using the routine monitoring data and with reference to a statistical assessment of water quality data. Should concentrations at a given location indicate a statistically significant increasing concentration trend in groundwater or surface water, or exceed the relevant Environmental Goal, the triggers are considered to have been exceeded and actions are to be implemented based on the information provided in Appendix F.

7.2 Incident Response

An impact to groundwater or surface water is considered to be present when concentrations of a monitoring parameter are recorded above the Environmental Goals. In the event of an impact to groundwater or surface water that is considered to be potentially associated with brine management and/or handling/placement of BCA at MPAR, the following procedure will be implemented:

- Alert the applicable EnergyAustralia site Environmental Representative and/or Contract Manager;
- Identify and comply with legal obligations relating to the triggering of the MPPS Pollution Incident Response Management Plan and the reporting of any pollution incidents;
- Identify the cause and extent of the incident;
- Identify and implement the necessary corrective actions;
- Identify the personnel responsible for carrying out the corrective actions;
- Implement or modify controls necessary to avoid a repeat occurrence; and
- Record any changes in written procedures required (i.e. review this WMP and any related procedures to prevent a reoccurrence of potential future impacts).

7.3 Contingency Measures

Routine monitoring of brine management will continue as proposed in this WMP. Should routine monitoring data suggest that further changes in water quality are being caused by brine management (e.g. brine waste ponds) or other BCA placement and related activities at the MPPS, one or more of the following contingency items may be implemented:

- All relevant groundwater bores and surface water locations will be re-sampled to assess if the increase is real and to evaluate the cause. The frequency of sampling will be increased to monthly until the matter is resolved.

  Additional groundwater or surface water monitoring locations that may be installed as part of contingency measures to further assess site conditions are not included as part of the water monitoring program. They are monitored and reported separately.

- If increases are considered to be associated with brine storage ponds or pipelines, the pond liners or pipeline will be checked for leaks. Any leaks that are detected will be repaired. During the repair period, the brine will be transferred to another pond at the MPPS while the defective liner is repaired. Construction of an additional temporary storage feature could also be considered if the adjacent ponds were not suitable for brine storage.
- The integrity of the surface runoff collection systems in the BCA placement area, which are regularly checked, will be inspected to ensure runoff has not bypassed the detention pond, sump and dam and will be repaired, if necessary, as part of site maintenance activities;
- Water levels in the BCA placement area will be monitored regularly by the VWPs installed in each stage of the BCA placement area. The VWPs would be expected to indicate if saturated conditions exist above the underlying mine spoil below;
- Alternative measures for the placement of BCA (e.g. temporary lined ponds) may be implemented pending the outcome of the above investigations where a suitable alternative is identified for brine storage. The brine waste ponds have the capacity to store 40 ML of brine (predicted annual brine production is 8 to 16 ML). In addition, Pond BWB or another double HDPE lined storage feature may be utilised for the storage of brine if necessary. Settling Pond D may also be able to be used for brine storage.

  There is a potential for some surplus brine to be transported to Wollongong for ocean disposal. Approval for the discharge of brine to the ocean via the Wollongong Sewage Treatment Plant (150 km southeast of the site) was previously granted as a contingency to the on-site BCA placement in the MPAR. It is however noted that the transfer of brine to the Wollongong Sewage Treatment Plant is currently considered impracticable due to the volume of brine generated by the approved SWTP.
- Should the source of contaminant concentrations be identified as brine management activities at MPPS and MPAR, an investigation will be carried out to assess short term and, if required, long term mitigation measures.
- The relevant regulatory stakeholders including the DPIE, Lithgow City Council, WaterNSW and the EPA, will be notified and consulted with on assessment requirements and mitigation options.

As outlined above, consistent with these contingency measures an independent investigation is currently being completed in relation to the exceedances of the Environmental Goals already detected in the vicinity of the MPAR. Further potential short- and long-term management measures are currently being identified and assessed as part of this investigation.

8. IMPLEMENTATION OF CONTINGENCY MEASURES

Review of available data currently suggests that the reported change in water quality characteristics in the vicinity of the Ash Repositories is related to the brine management and BCA placement activities at MPAR. As reported in the 2018-2019 AEMR (ERM, 2019), an independent investigation of the Ash Repositories' influence of groundwater and surface water conditions is ongoing, as is the identification and assessment of potential short- and long-term management measures. Pending finalisation of the independent investigation, and identification and assessment of the further potential short- and long-term management measures in consultation with the DPIE, WaterNSW and the EPA, EnergyAustralia has implemented a number of proactive interim measures to reduce potential impacts as a result of the BCA placement on the MPAR. The key contingency measures implemented to date include:

- increasing the sampling frequency from quarterly to monthly for groundwater and surface water monitoring locations in Connell Wagner (2008) and CDM Smith (2013) (the approved water management and monitoring plans);
- continued monitoring using vibrating wire piezometers in the ash repository to assess water levels within MPAR;
- installation and monitoring of 14 additional groundwater monitoring wells to allow the extent of impact to groundwater to be assess further;
- development of an updated CSM that has informed the update of the numerical groundwater model which is currently in progress;
- integrity testing and subsequent repairs to the liner of LN Pond 2 in 2018;
- integrity inspections of the surface runoff collection systems in the BCA placement area;
- the construction of three, 20 ML, double lined, water storage ponds in the LNAR in 2018 and 2019 (Pond BWA, Pond BWB and Pond BWC);
- the installation of a dewatering bore in MPAR in 2018. The water able to be extracted from this bore was limited, being in the order of 65 kilolitres extracted over 15 months (to May 2019);
- reducing the application of water for the purpose of dust suppression to MPAR as far as practicable to minimise the potential for generation of leachate;
- engaging specialist engineering consultants to advise on the feasibility of disposing of brine in purpose built lined facilities in the Ash Repositories;
- completion of a preliminary options assessment for mitigation options as part of the independent investigation, focusing on source controls, pathway interruption and receptor interception. Specialist remediation contractors are currently building on this work to focus on feasible mitigation options; and
- an additional 11 groundwater monitoring bores are proposed to be installed in early 2020 to further inform the CSM and numerical groundwater model update. These bores are assessment bores and as such, are not included in the groundwater monitoring program.

The numerical groundwater model for the site is being updated to consider the most recent results in order to inform selection and implementation of potential mitigation options in the vicinity of MPAR.

8.1 Timeline for Further Assessments

The currently proposed timeline for the next steps associated with the independent investigation, including numerical groundwater modelling, and further mitigation options assessment being completed by MSA, is as follows:

- completion of drilling and installation of additional monitoring bores by the end of February 2020;
- numerical groundwater modelling utilising the currently available data to be reported by the end of April 2020 (Phase 1). The Phase 1 modelling will consider the “current” condition of the site and would test outcomes, in terms of water volumes and solute concentrations, of specific approaches to potential short to medium term mitigation measures;
- further assessment of mitigation options to be reported by the end of April 2020; and
- if required, Phase 2 groundwater modelling, incorporating results obtained during the additional monitoring bore drilling and associated laboratory analysis, may be carried out.

A timeline for the implementation of preferred mitigation options beyond April 2020 will be provided during planned future workshops with the regulators.

9. SUMMARY OF COMMITMENTS

In closing, EnergyAustralia makes the following commitments in regards to the Project:

- All relevant undertakings will be carried out in accordance with the Mt Piper Consent;
- 3 seepage monitoring bores will be installed around Settlement Pond D;
- Monitoring and reporting will be conducted and reported in accordance with the Water Monitoring Program requirements specified in Section 6;
- TARPS, as outlined in Section 7 and Appendix F, will be implemented such that timely responses, investigations and mitigations may be put in place in response to changing groundwater and/or surface water conditions in the vicinity of MPAR; and
- Update this WMP further once the independent investigation is completed and further potential short- and long-term management measures have been identified and assessed in consultation with the Lithgow City Council, DPIE, WaterNSW and the EPA.

This document should be read in conjunction with the statement of limitations presented in Appendix G.

10. REFERENCES

ANZECC, 2000. Australian Water Quality Guidelines for Fresh and Marine Waters. Australian and New Zealand Environmental Conservation Council, ACT.

Aurecon (2009), Mt Piper Power Station Brine Condition Fly Ash Co-Placement Water Management Plan – Water Quality Monitoring Update Report 2008 to January 2009, Revision 2, Final, 10 July 2009

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EPA, 2004. Approved methods for the sampling and analysis of water pollutants in New South Wales. Department of Environment and Conservation, EPA Branch, Sydney.

NSW EPA (2016), Environmental Guidelines: Solid Waste Landfills, Second Edition, April 2016

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Forster, I, 1999. Mt Piper Ash/Brine Co-Disposal Pilot Field Test. Pacific Power International Report GEO 129, 1999 to Delta Electricity.

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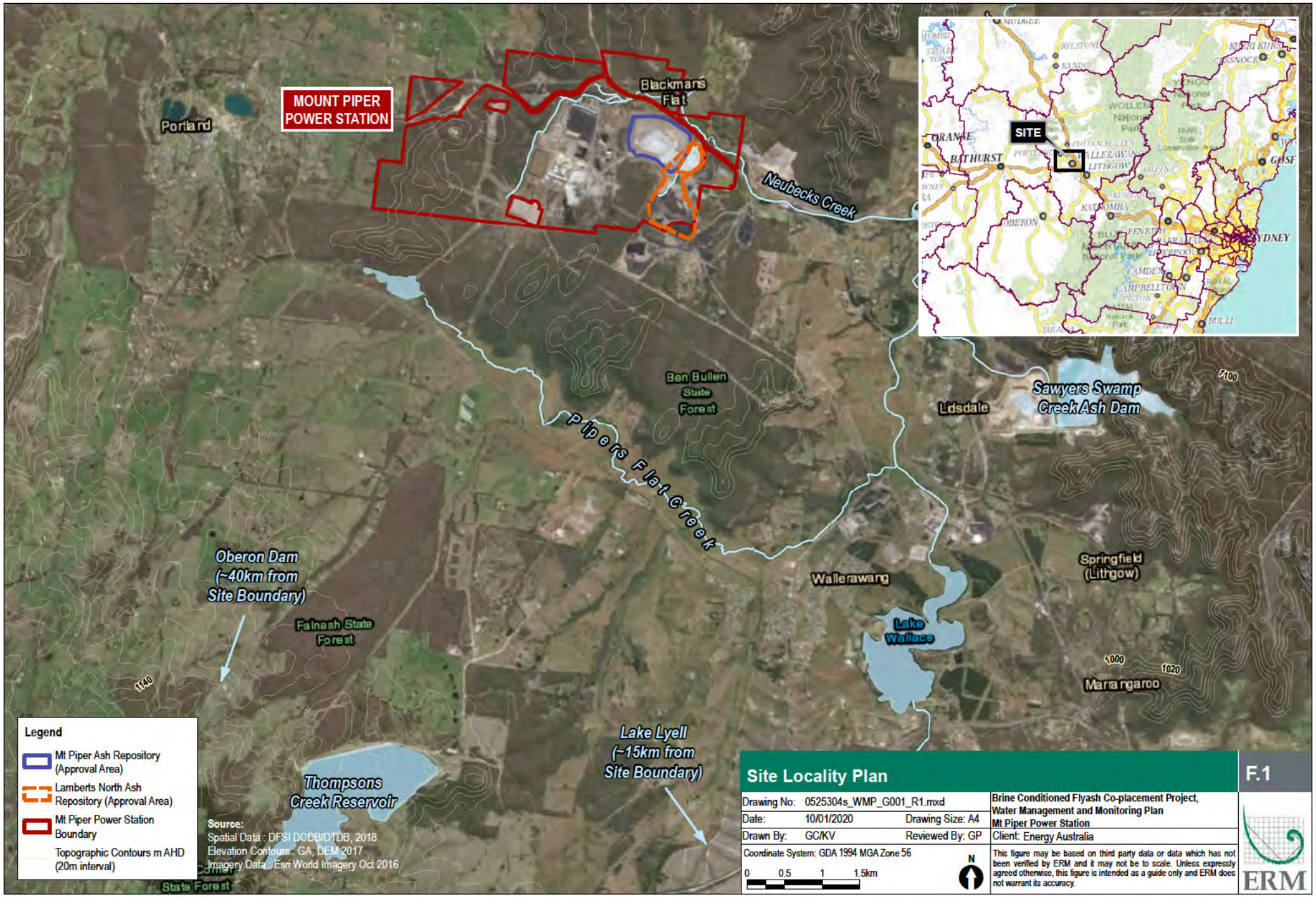
GHD, 2019b. Mount Piper Power Station- Water Storage Pond Modification Report, for EnergyAustralia, April 2019.

Merrick, NP, 2007. Mount Piper Power Station Brine-Conditioned Flyash Co-placement: Groundwater Modelling. AccessUTS report (the University of Technology Sydney, National Centre for Groundwater Management) for Connell Wagner on behalf of Delta Electricity.

Pacific Power International, 1999. Mount Piper Power Station, Brine Conditioned Flyash Co-placement: Water Quality Assessment, August 1999.

APPENDIX A FIGURES



Site Locality Plan

F.1

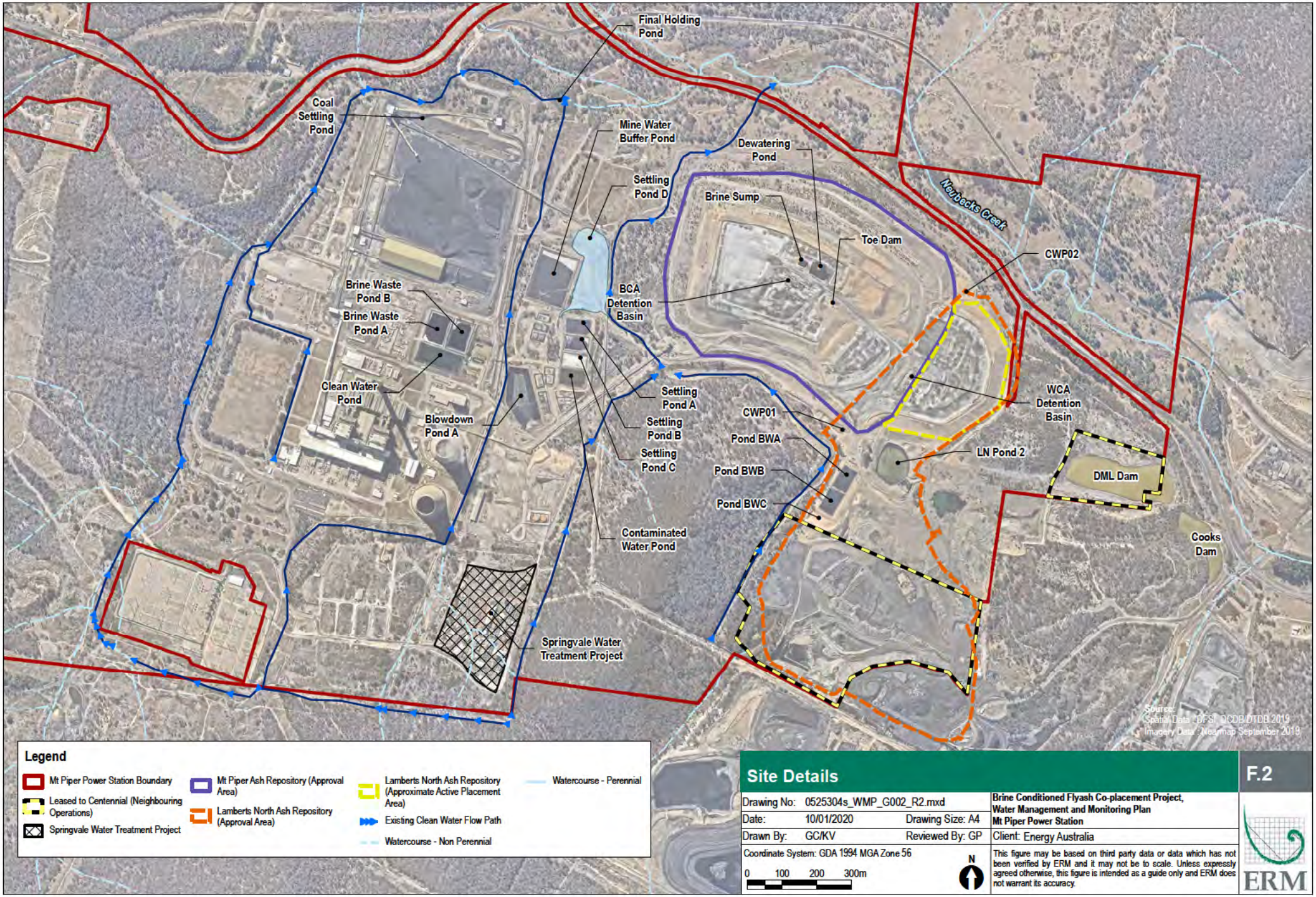
Drawing No:	0525304s_WMP_G001_R1.mxd		
Date:	10/01/2020	Drawing Size: A4	
Drawn By:	GC/KV	Reviewed By: GP	

Coordinate System: GDA 1994 MGA Zone 56

Brine Conditioned Flyash Co-placement Project, Water Management and Monitoring Plan
Mt Piper Power Station

Client: Energy Australia

ERM


Final Holding Pond
Coal Settling Pond
Mine Water Buffer Pond
Dewatering Pond
Settling Pond D
Brine Sump
Toe Dam
Neerbeck's Creek
CWP02
BCA Detention Basin
Brine Waste Pond B
Brine Waste Pond A
Clean Water Pond
Blowdown Pond A
Settling Pond A
Settling Pond B
Settling Pond C
CWP01
Pond BWA
Pond BWB
Pond BWC
WCA Detention Basin
LN Pond 2
DML Dam
Cooks Dam
Contaminated Water Pond
Springvale Water Treatment Project
Sources:
Spatial Data: DPSI, QCDB,QTDB 2019
Imagery Data: Nearmap September 2019
Legend
Mt Piper Power Station Boundary
Leased to Centennial (Neighbouring Operations)
Springvale Water Treatment Project
Mt Piper Ash Repository (Approval Area)
Lamberts North Ash Repository (Approval Area)
Lamberts North Ash Repository (Approximate Active Placement Area)
Existing Clean Water Flow Path
Watercourse - Non Perennial
Watercourse - Perennial
Site Details
Drawing No: 0525304s_WMP_G002_R2.mxd
Date: 10/01/2020
Drawing Size: A4
Drawn By: GC/KV
Reviewed By: GP
Coordinate System: GDA 1994 MGA Zone 56
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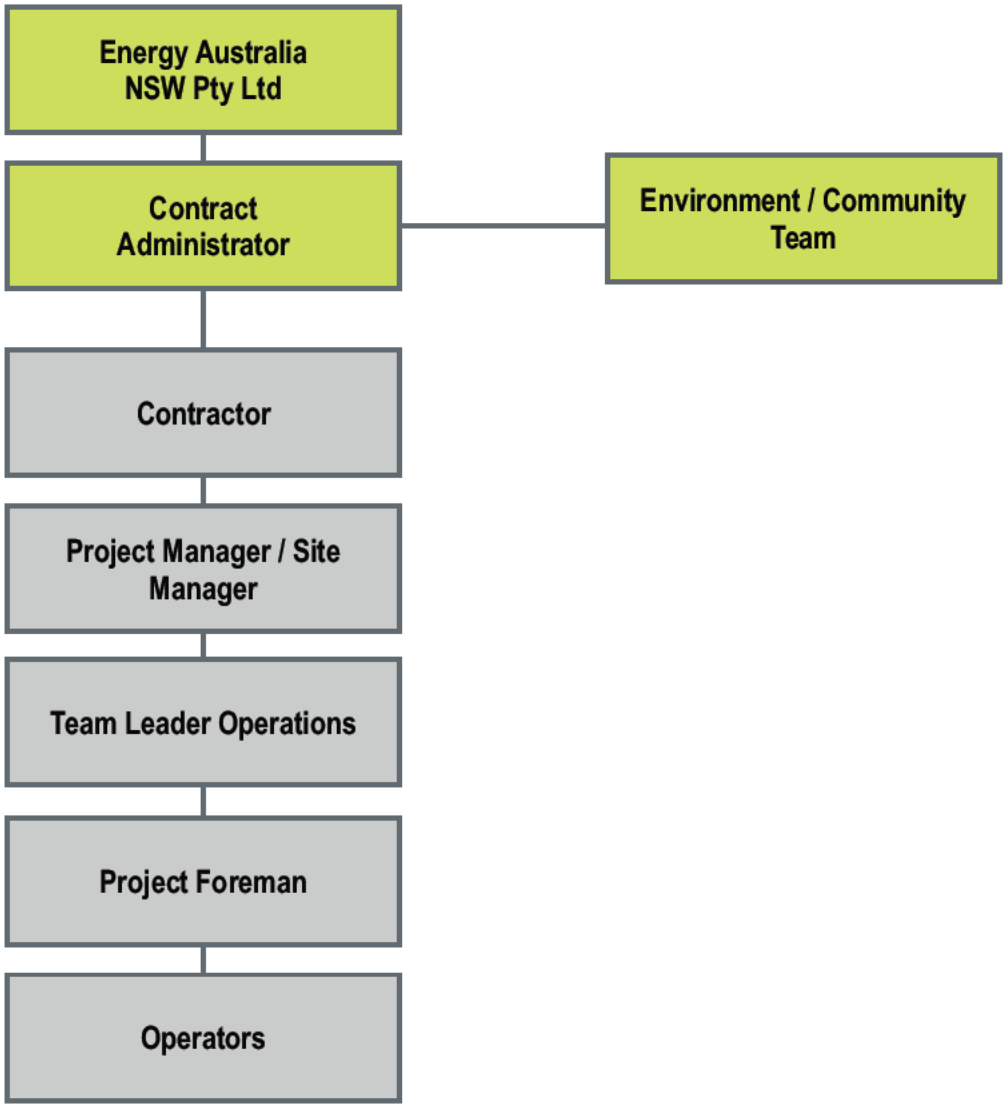
Brine Conditioned Flyash Co-placement Project, Water Management and Monitoring Plan
Mt Piper Power Station
Client: Energy Australia
This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.
F.2
ERM



Organisational Chart

F.3

Drawing No: 0525304s WMP C003 R1.cdr	**Brine Conditioned Flyash Co-placement Project, Water Management and Monitoring Plan Mt Piper Power Station**
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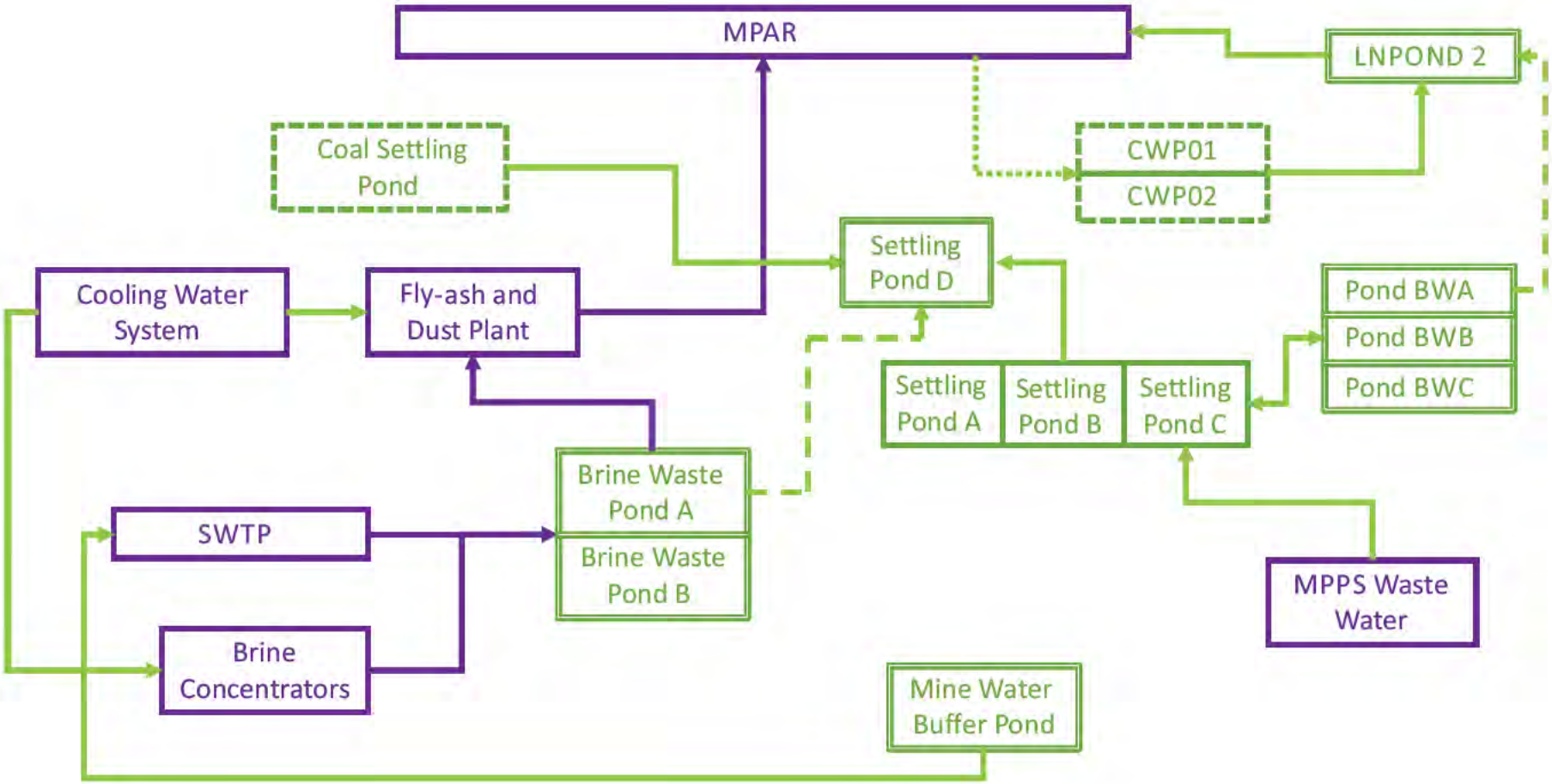
Drawn by: GC/KV Reviewed by: GP	Client: Energy Australia

ERM



Legend

- Txt — Water Storage Infrastructure 1xHDPE
- Txt — Water Storage Infrastructure 2xHDPE
- Txt — Site Feature
- Txt — Unlined Storage Feature
- Process Water
- Future/Option Process
- Treated Water/Brine
- Run off from MPAR external batter cover

MPAR Mt Piper Ash Repository

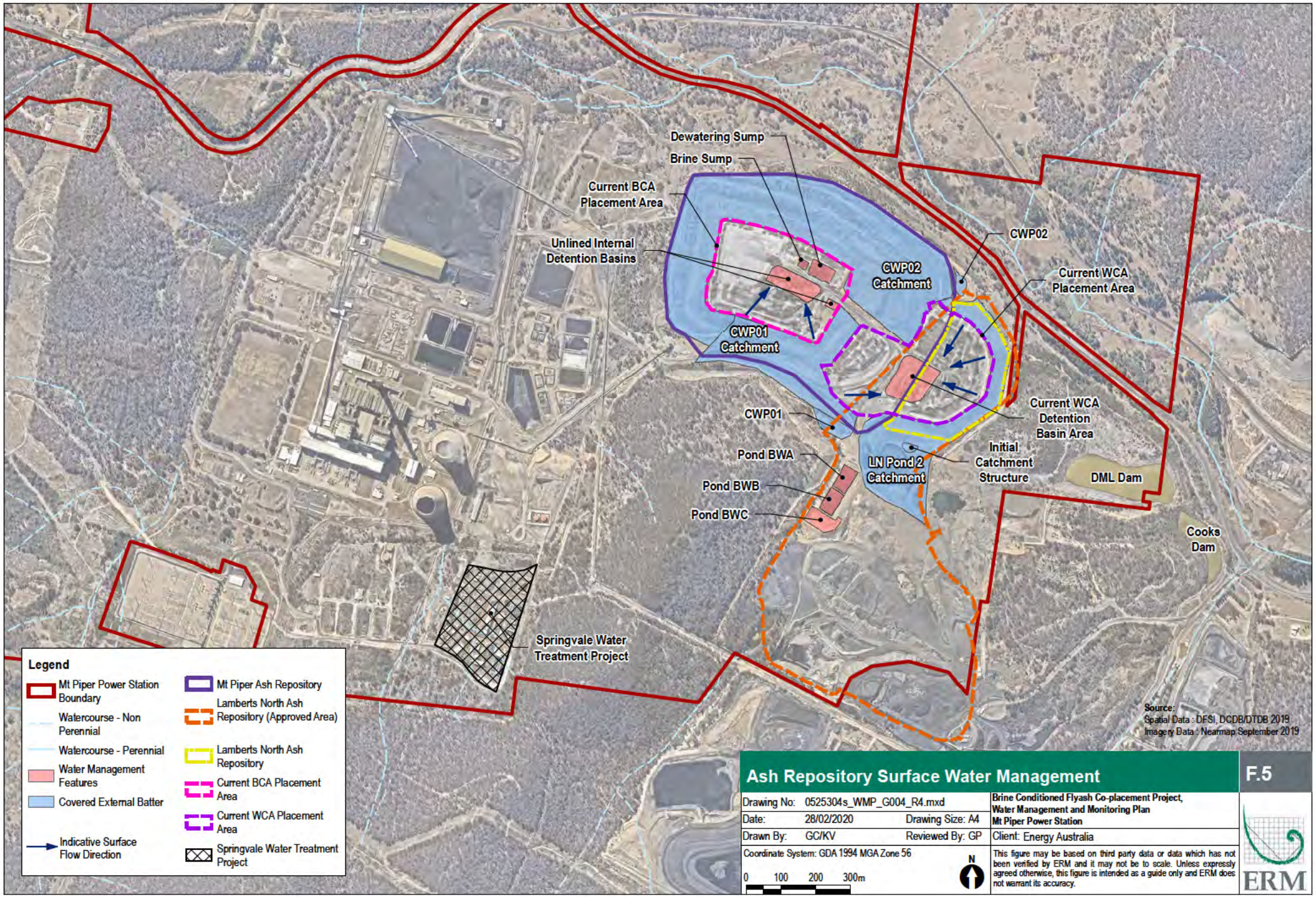
SWTP Springvale Water Treatment Plant

Schematic Water Management Diagram

F.4

Drawing No:	0525304s WMP C002 R6.cdr		Brine Conditioned Flyash Co-placement Project, Water Management and Monitoring Plan Mt Piper Power Station
Date:	10/01/2020	Drawing size: A4	
Drawn by:	GC / KV	Reviewed by: GP	Client: Energy Australia

ERM


Dewatering Sump
Brine Sump
Current BCA Placement Area
Unlined Internal Detention Basins
CWP02
CWP02 Catchment
Current WCA Placement Area
CWP01 Catchment
CWP01
Current WCA Detention Basin Area
Pond BWA
Initial Catchment Structure
LN Pond 2 Catchment
DML Dam
Pond BWB
Pond BWC
Cooks Dam
Springvale Water Treatment Project
Legend
Mt Piper Power Station Boundary
Watercourse - Non Perennial
Watercourse - Perennial
Water Management Features
Covered External Batter
Indicative Surface Flow Direction
Mt Piper Ash Repository
Lamberts North Ash Repository (Approved Area)
Lamberts North Ash Repository
Current BCA Placement Area
Current WCA Placement Area
Springvale Water Treatment Project
Source:
Spatial Data : DFSI, DCDB/DTDB 2019
Imagery Data : Nearmap September 2019
Ash Repository Surface Water Management
F.5
Drawing No: 0525304s_WMP_G004_R4.mxd
Date: 28/02/2020
Drawing Size: A4
Drawn By: GC/KV
Reviewed By: GP
Coordinate System: GDA 1994 MGA Zone 56
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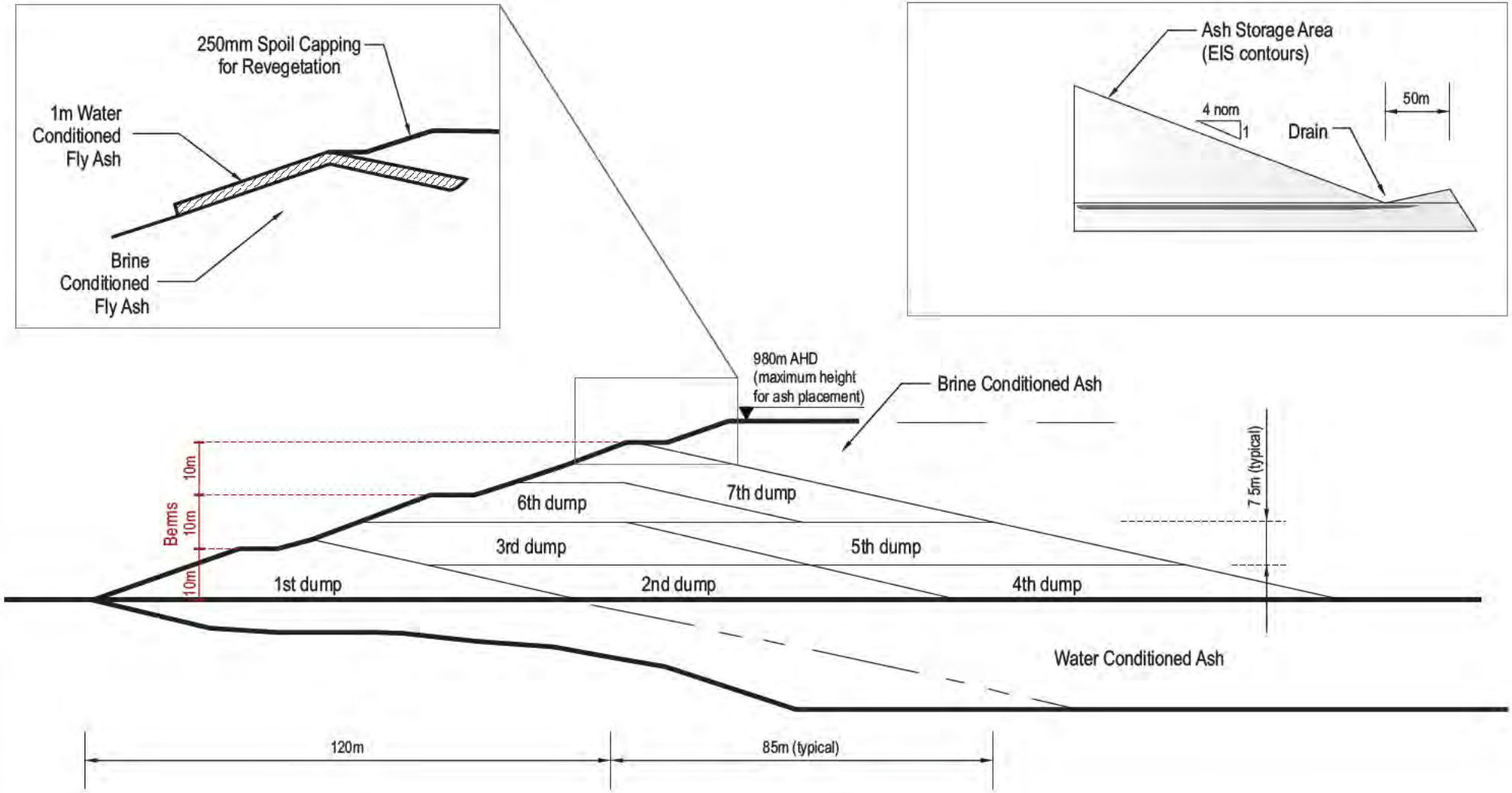
Brine Conditioned Flyash Co-placement Project, Water Management and Monitoring Plan
Mt Piper Power Station
Client: Energy Australia
This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.
ERM



Notes:
Details shown are diagrammatical only.

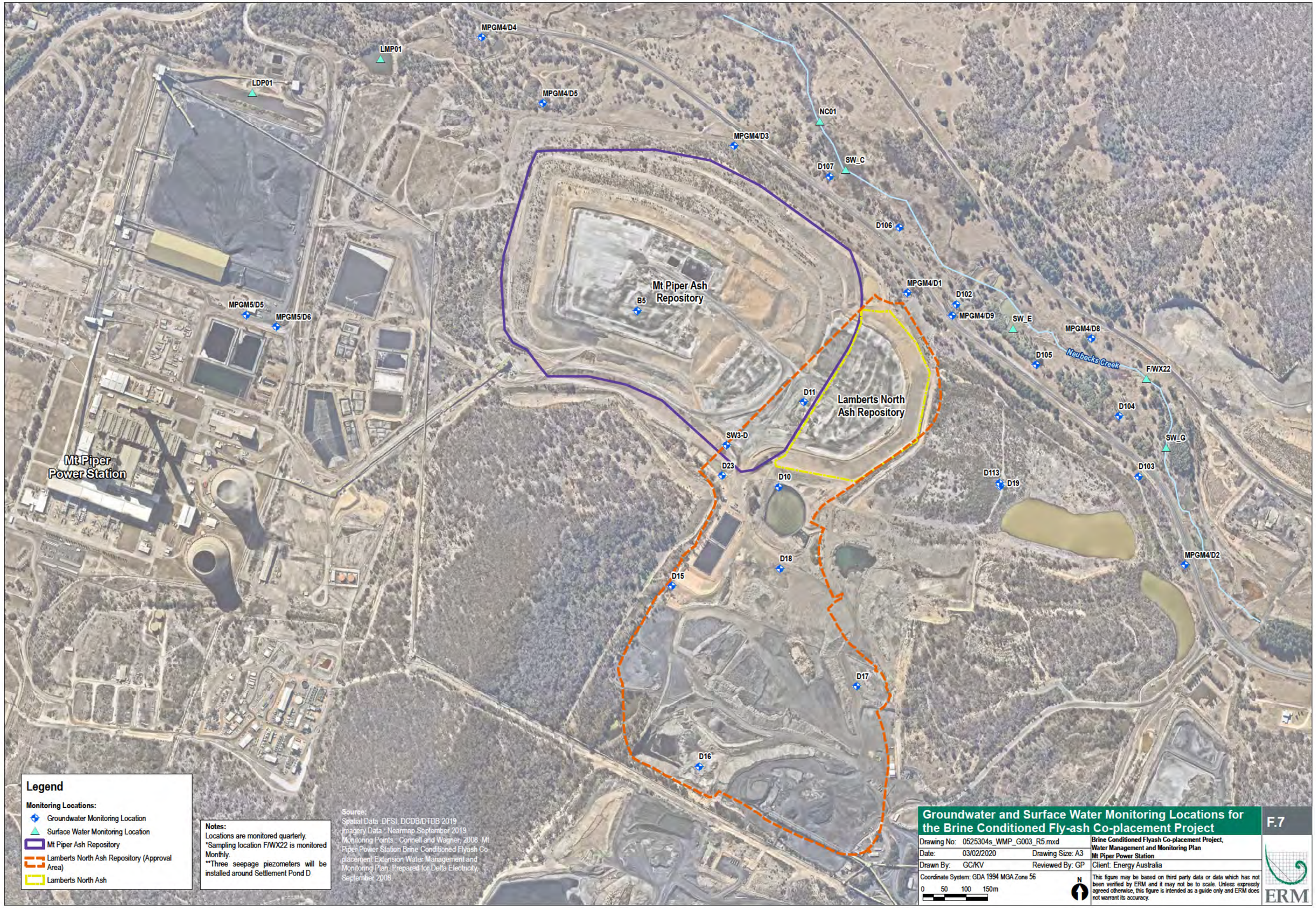
Source:
Connell and Wagner, 2008. Mt Piper Power Station Brine Conditioned Flyash Co placement Extension Water Management and Monitoring Plan. Prepared for Delta Electricity, September 2008.

Schematic of External Batter Placement

F.6

Drawing No: 0525304s WMP C001 R1.cdr			**Brine Conditioned Flyash Co-placement Project, Water Management and Monitoring Plan Mt Piper Power Station**
Date:	10/01/2020	Drawing size: A4	
Drawn by:	GC/KV	Reviewed by: GP	Client: Energy Australia
Drawing Not to Scale			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.

ERM


MPGM4/D4
LMP01
LDP01
MPGM4/D5
NC01
MPGM4/D3
SW_C
D107
D106
MPGM4/D1
D102
MPGM4/D9
SW_E
MPGM4/D8
D105
Neubecks Creek
F/WX22
D104
SW_G
D103
D113
D19
MPGM4/D2
Mt Piper Ash Repository
B5
MPGM5/D5
MPGM5/D6
Mt Piper Power Station
D11
Lamberts North Ash Repository
SW3-D
D23
D10
D18
D15
D17
D16
Legend
Monitoring Locations:
Groundwater Monitoring Location
Surface Water Monitoring Location
Mt Piper Ash Repository
Lamberts North Ash Repository (Approval Area)
Lamberts North Ash
Notes:
Locations are monitored quarterly.
*Sampling location F/WX22 is monitored Monthly.
**Three seepage piezometers will be installed around Settlement Pond D
Source:
Spatial Data :DFSI, DCDB/DTDB 2019
Imagery Data : Nearmap September 2019
Monitoring Points : Connell and Wagner, 2008. Mt Piper Power Station Brine Conditioned Flyash Co-placement Extension Water Management and Monitoring Plan: Prepared for Delta Electricity, September 2008.
Groundwater and Surface Water Monitoring Locations for the Brine Conditioned Fly-ash Co-placement Project
F.7
Drawing No: 0525304s_WMP_G003_R5.mxd
Date: 03/02/2020
Drawing Size: A3
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Reviewed By: GP
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Brine Conditioned Flyash Co-placement Project, Water Management and Monitoring Plan
Mt Piper Power Station
Client: Energy Australia
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.
ERM

APPENDIX B REGULATORY CORRESPONDENCE

From: [redacted]
To: [redacted]
Cc: [redacted]
Subject: FW: Mt Piper Brine Conditioned Flyash Co-placement Extension Project - Water Management and Monitoring Plan
Date: Wednesday, 12 February 2020 3:29:53 PM
Attachments: image002.png
image001.png

Hi [redacted],

Water NSW reviewed the Water Management and Monitoring Plan for above project. Water NSW noted that the monitoring and management plan is consistent with the consent conditions and the existing requirements from Water NSW. Hence, we do not have further comments regarding the Plan.
WaterNSW requests to remain as a stakeholder for any updates (e.g. changing the use of the new pond to receive brine wastewater).

Kind regards,

[redacted]
Catchment Assessment Officer

WaterNSW

Level 14, 169 Macquarie Street
PO Box 398
Parramatta NSW 2124
T: 02 9865 2503 **M:** 0418 986 712
[redacted]@waternsw.com.au
www.waternsw.com.au

From: [redacted]energyaustralia.com.au>
Sent: Wednesday, 5 February 2020 12:37 PM
To: [redacted]waternsw.com.au>
Cc: [redacted]energyaustralia.com.au>
Subject: Mt Piper Brine Conditioned Flyash Co-placement Extension Project - Water Management and Monitoring Plan

Hi [redacted]

Please find attached a copy of the draft of the Mt Piper Brine Conditioned Flyash Water Management and Monitoring Plan (WMMP) for your comment.

The WMMP has been updated to satisfy condition 43A of development application 80/10060 to incorporate the use of the new 60ML Pond at the Mt Piper Power Station.

The attached WMMP is generally consistent with the previously approved WMMP. The main

focus of this update is the inclusion of the 60mL pond as required by the consent.

Please provide any comment on the attached plan by Wednesday 19 February 2020.

Let me know if you have any questions relating to the above.

Regards

[redacted]
Senior Environment Officer
Mt Piper Power Station
M. 0468594836
Antony.nolan@energyaustralia.com.au

From: Lithgow City Council
To: [redacted]
Subject: FW: Mt Piper Power Station - Brine Conditioned Flyash Water Management and Monitoring Plan
Date: Monday, 17 February 2020 10:55:11 AM
Attachments: image001.png
200205 Letter to LCC_Mt Piper WMMP.pdf
200203 Mt Piper Brine in Ash Water Mgt Plan_Draft.pdf

Hi [redacted]

In relation to your email below and to the attached documents. Council is satisfied with the WMMP and has no comments or concerns.

Yours Sincerely

[redacted] | Development Planner
Economic Development & Environment | Lithgow City Council
Phone: (02) 6354 9999 | Fax: (02) 6351 4259

From: [redacted] [mailto:[redacted]@energyaustralia.com.au]
Sent: Wednesday, 5 February 2020 1:17 PM
To: Lithgow City Council
Cc: [redacted]
Subject: Mt Piper Power Station - Brine Conditioned Flyash Water Management and Monitoring Plan

The General Manager,

Please find attached a copy of the draft of the Mt Piper Brine Conditioned Flyash Water Management and Monitoring Plan (WMMP) for your comment.

The WMMP has been updated to satisfy condition 43A of development application 80/10060 to incorporate the use of the new 60ML Pond at the Mt Piper Power Station.

The attached WMMP is generally consistent with the previously approved WMMP. The main focus of this update is the inclusion of the 60mL pond as required by the consent.

Please provide any comment on the attached plan by Wednesday 19 February 2020.

Let me know if you have any questions relating to the above.

Regards

[redacted]
Senior Environment Officer
Mt Piper Power Station
M. 0468594836
[redacted]@energyaustralia.com.au

EnergyAustralia
LIGHT THE WAY

From: [redacted]@industry.nsw.gov.au on behalf of Landuse Enquiries
To: [redacted]
Subject: Mt Piper Power Station - Brine Conditioned Flyash Water Management and Monitoring Plan
Date: Thursday, 6 February 2020 11:09:33 AM
Attachments: image004.png

Hi [redacted],

I have forwarded your request for comment onto nrar.servicedesk@industry.nsw.gov.au . All post approval requests relating to water can be directed to that email address.

Kind regards,

[redacted]

From: [redacted] <[redacted]@energyaustralia.com.au>
Sent: Wednesday, 5 February 2020 3:36 PM
To: [redacted]@industry.nsw.gov.au
Cc: [redacted] <[redacted]@planning.nsw.gov.au>; [redacted] <[redacted]@energyaustralia.com.au>
Subject: FW: Mt Piper Power Station - Brine Conditioned Flyash Water Management and Monitoring Plan

Hi [redacted],

Please find attached a copy of the draft of the Mt Piper Brine Conditioned Flyash Water Management and Monitoring Plan (WMMP) for your comment.

The WMMP has been updated to satisfy condition 43A of development application 80/10060 to incorporate the use of the new 60ML Pond at the Mt Piper Power Station.

The attached WMMP is generally consistent with the previously approved WMMP. The main focus of this update is the inclusion of the 60mL pond as required by the consent.

Please provide any comment on the attached plan by Wednesday 19 February 2020.

Let me know if you have any questions relating to the above.

Regards

[redacted]
Senior Environment Officer

Mt Piper Power Station
M. 0468594836
[redacted]@energyaustralia.com.au

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Assessments Team

Water | Department of Planning, Industry and Environment

P 0417 626 567 or | **E** landuse.enquiries@dpi.nsw.gov.au

Level 3 | 26 Honeysuckle Drive | Newcastle | NSW 2300
www.dpie.nsw.gov.au

[redacted]
NSW Environment Leader
Mt Piper Power Station
350 Boulder Road
PORTLAND NSW 2847

3 April 2020

[redacted]

Mt Piper Power Station - Water Management Plan

I refer to the revised Water Management Plan, which was submitted in accordance with Condition 43 of the consent for the Mt Piper Power Station (DA80/10060).

The Department has carefully reviewed the version of this document (dated 28 February 2020) and is satisfied that it addresses the applicable requirements of DA80/10060.

Accordingly, the Secretary has approved the Water Management Plan (Revision 1.1, dated 28 February 2020). Please ensure that the approved plan is placed on the project website at the earliest convenience.

If you wish to discuss the matter further, please contact Philip Nevill on 8275 1036.

Yours sincerely

[redacted]
Director Resource Assessments

As nominee of the Planning Secretary

Report Title	**Station Brine Conditioned Flyash Co-placement Extension Water Management and Monitoring Plan, Reference No: 0525304 dated 3 February 2020 (herein the "WMP")**
Author(s)	**Environmental Resources Management Pty Ltd (ERM)**
Date Comments Received from NSW EPA	**21/02/2020**

Item #	Report Section Reference	NSW EPA Comment	ERM/EnergyAustralia Response	Revision to WMP
1	**Section 1.1.1**	Section 1.1.1 states that the WMP considers the results from an ongoing independent assessment of groundwater and surface water conditions in the vicinity of both Mount Piper Ash Repository (MPAR) and Lambert North Ash Repository (LNAR) The EPA understands that the assessment referred to is that which EANSW commissioned ERM to complete. Provision of a copy of this report would assist in providing comments regarding the WMP.	The reports compiled as part of the independent assessment, including water quality data, have been provided to the EPA and other regulators. In addition, the EPA and other regulators have attended workshops at Mt Piper that present findings of the independent assessment. EA will be providing the EPA with additional reports and data in early 2020 and further at the proposed workshop to be held in April 2020.	No
2	**Section 1.1**	Section 1.1 should detail the method and guidelines used to classify the new pond as a settling pond.	The "Settling Pond" naming convention is used in the WMP as the 60 ML pond will be utilised at times to provide residence time for water that may have elevated sediment loading (e.g. from Coal Settling Pond to mitigate discharge following high rainfall events). The terminology is in line with the naming convention and purpose of the existing Settling Pond A - Settling Pond C of the Mt Piper Water Management System.	No
3	**Section 1.1.1**	Section 1.1.1 should provide the estimated date for commencement of BCFA placement within LNAR.	EA is hesitant to indicate a date as there are to many variables that would influence any estimated date. The arrangements for placement of BCFA in LNAR are currently being reviewed. the commencement of BCFA to LNAR is very dependent on electricity generation and ash production, it is estimated that the MPAR will reach capacity to receive BCFA in approximately 2 – 3 years. This estimate is based on the Mt Power Power Station operating at full electricity generating capacity. The independent water study and modelling will help inform future management of BCFA to the Ash Repositories.	No
4	**Section 1.1.1**	Section 1.1.1 should provide reference(s) to the section(s) of the LNAR Operations Environment Management Plan (OEMP) that address potential impacts to water and management/mitigation options available as a result of BCFA placement within LNAR.	The arrangements for placement of BCFA in LNAR are currently being reviewed. The LNAR OEMP will be updated following completion of the independent assessment and review of arrangements for BCFA within Lamberts North. The Mt Piper Water Management Plan addresses potential environmental impacts from the Mt Piper Brine in Ash Project area as approved under Developement Consent 80-10060 and not the Lamberts North Ash repository. Environmental impacts from other developements are outside the scope of this management plan.	No
5	**Section 4.1.4**	Section 4.1.4 should clarify whether the selected liner option is suitable for all process streams to be received by the pond.	The subgrade of Settling Pond D is constructed, compacted and tested to specifications for liquid storage. The subgrade is lined with two new 2 mm impervious high-density polyethylene (HDPE) membrane liners designed specifically for the purpose of hydraulic containment. The two lining layers have been installed, welded and tested in accordance with specifications suitable for liquid storage infrastructure. Records of materials testing, construction inspections and other relevant certifications have been maintained for each stage of the Settling Pond D construction. It is considered that the Settling Pond D construction method is in general accordance with the lining method presented by NSW EPA (2016), and is therefore suitable for its intended purpose at the Mt Piper Power Station.	Yes, Section 4.1.4 updated in accordance with response provided to EPA comment.
6	**Section 4.2.2**	Section 4.2.2 should justify why other ponds are double lined and the new pond is not.	Refer to previous response. Only ponds utilised currently, or potentially used in the future, for storage of Brine are double lined.	Yes, various sections of the WMP revised to clarify that Settling Pond D is now double lined.
7	**Section 4.2.2**	Section 4.2.2 should provide a typical chemical composition of brine sludge and the volumes produced per annum.	The future generation of brine sludge is dependent on the operational capacity and the associated power generation of the MPPS. The pond clean out procedure and placement of brine sludge is conducted on a campaign basis only, it is not conducted annually. Existing brine ponds have been cleaned out once during the lifetime of the Project and it is likely that future brine sludge volumes will be in line with this historical management approach. The chemical composition of the Brine sludge is generally consistent with the brine stored in the waste ponds. Refer to Appendix D	Yes, Section 4.2.2 and Appendix D updated in accordance with response provided to EPA comment.
8	**Section 4.2.4**	Section 4.2.4 should provide the list of future brine disposal strategies currently under consideration.	This will involve assessing future options for the treatment, handling and disposal of brine including disposal methods and locations. Alternative brine disposal strategies may include: - Brine crystallisation - Sale of brine - Encapsulation of brine using liners - Ocean disposal - Co-disposal (as current practice)	Yes, Section 4.2.4 updated in accordance with response provided to EPA comment.
9	**Section 4.3**	Section 4.3 should provide the estimated date for completion and lining of the Toe Dam	The Toe Dam and Detention Basin structures are temporary surface water management controls used to minimse the potential for erosion and scouring of the active ash placement areas. These structures are not lined, as their elevation and position change routinely as the placement of ash progresses over time and they are not designed to hold water for an extended period. Reference to the "Toe Dam" has been removed from the WMP and revised "...to unlined internal detention basins".	Yes, Section 4.3 updated in accordance with response provided to EPA comment, and Figure 5 revised accordingly.
10	**Section 5.2**	The Surface Water Monitoring Program described in Section 5.2 should include periodic water quality testing of clean water being discharged to Neubecks Creek via the power station clean water diversion system.	The clean water diversion is an ephemeral water course that captures water from areas not subject to Mt Piper Power Station operations. The final holding pond (and LMP01) is connected to the diversion system and is tested as part of routine monitoring historically, and as part of the WMP.	No
11	**Section 9**	Noting the commitment to update the plan given in Section 9; Section 6.1, Table C-1 and Figure 7 (groundwater monitoring program) should include additional monitoring bores to the west of LNAR and downstream of Cook s Dam/Western Coal Services (WCS) Licenced Discharge Point (LDP) 6 in order to ensure east-west ground and surface water flows and impacts from MPAR/LNAR are sufficiently monitored.	The purpose of this WMP is to provide revisions adequate to cover commissioning and ongoing management of the 60 ML pond. Seventeen additional groundwater monitoring bores and five additional surface water monitoring points have been included in this WMP relative to the previous version. This data is included in the Annual Environmental Performance Report which is provided to the EPA and other Regulators and is available via the EA website. The WMP will be updated and revised following completion of the independent assessment.	No
12	**Section 4.2.4**	Adjustment of the wording in Section 4.2.4 should be made to clarify whether the paragraph means alternative locations to dispose of BCFA or alternative methods for placing BCFA within the existing repositories	Options may include methods or locations. Clarified in 4.2.4 above.	Yes, Section 4.2.4 updated in accordance with response provided to EPA comment.
13	**Section 6.6**	Section 6.6 should make reference to the Environmental Protection Licence (EPL) and the relevant requirements.	Agree and updated. It is noted that there are other reporting requirements, including provision of water quality data, included as part of the annual EPL reporting process. The reporting requirements of the EPL will be provided to the regulators separately to the reporting requirements outlined in this WMP.	Yes, Section 6.6 updated in accordance with response provided to EPA comment.
14	**Section 7.3**	Section 7.3 should provide a description of where additional monitoring locations may be installed as part of contingency measures and how they would be monitored and reported.	Selected additional monitoring bores installed as part of the contingency measures implemented to date are shown in Figure 7. This included seventeen additional groundwater monitoring bores and five additional surface water monitoring points. The requirement for, and location of, any further monitoring locations would be assessed and determined based on the findings of routine monitoring data and findings of the independent assessment. EnergyAustralia would be guided in this instance by the recommendations of specialist consultants. The WMP will be updated at the completion of the independent assessment.	No
15	**Section 8**	Section 8 should clarify whether the installation of the 14 additional monitoring bores is complete and if they are shown in the figures provided.	Installation of the additional 14 monitoring bores was for the purpose of informing the revised groundwater model which formed part of the independent assessment. A selection of the monitoring bores installed in 2018 have been included as representative of groundwater conditions in the vicinity of and down gradient of the MPAR and are planned for ongoing monitoring. As above, and in consulatation with specialist environmental consultants, the monitoring program of the WMP has been augmented to include seventeen additional groundwater monitoring bores and five additional surface water monitoring points relative to the previous version of the WMP. The augmented groundwater and surfacewater monitoring network is considered adequate to provide a representative sample to assess the environmental performance of the ash repository.	No

APPENDIX C SUMMARY OF MONITORING LOCATIONS

Table C-1: Groundwater Monitoring Locations

Monitoring well	Location Type	Monitored Feature	Proposed Sampling Frequency[1]	Rationale for Inclusion
MPGM4/D1	Groundwater		Quarterly	Existing monitoring well downgradient of the MPAR and adjacent to Neubecks Creek
MPGM4/D2	Groundwater		Quarterly	Existing monitoring well downgradient of the mine spoil area and adjacent to Neubecks Creek
MPGM4/D3	Groundwater	Background	Quarterly	Existing background well north of the MPAR
MPGM4/D4	Groundwater	Background	Quarterly	Existing background well northwest (upgradient) of the MPAR
MPGM4/D5	Groundwater	Background	Quarterly	Existing background well northwest (upgradient) of the MPAR
MPGM4/D8	Groundwater		Quarterly	Existing background well northeast (downgradient) of the MPAR, on the north side of Neubecks Creek
MPGM4/D9	Groundwater		Quarterly	Existing monitoring well downgradient of the MPAR and adjacent Neubecks Creek
MPGM5/D5	Groundwater	Adjacent Brine Waste Pond A	Quarterly	Existing monitoring well adjacent (downgradient) Brine Waste Pond A
MPGM5/D6	Groundwater	Adjacent Brine Waste Pond B	Quarterly	Existing monitoring well adjacent (downgradient) Brine Waste Pond B
D10	Groundwater		Quarterly	Existing monitoring well downgradient of the MPAR/LNAR and adjacent to LN Pond2.
D11	Groundwater		Quarterly	Existing monitoring well downgradient of the MPAR/LNAR
D15	Groundwater		Quarterly	Existing monitoring well adjacent New Pond C, along the former Huons Gully alignment
D16	Groundwater		Quarterly	Existing monitoring well south of LNAR
D17	Groundwater		Quarterly	Existing monitoring well south of LNAR
D18	Groundwater		Quarterly	Existing monitoring well south of LNAR
D19	Groundwater		Quarterly	Existing monitoring well within the mine spoil area, nested with D113. Located downgradient of the MPAR/LNAR and adjacent to DML Dam.
D23	Groundwater		Quarterly	Existing monitoring well installed beneath former underground mine workings adjacent (south) of the MPAR
SW3-D	Groundwater		Quarterly	Existing monitoring well south corner of MPAR
B5	Groundwater	Within MPAR within ash / spoil	Quarterly	Existing monitoring well installed to the elevated bench of fill beneath the MPAR
D102	Groundwater		Quarterly	New monitoring well downgradient of the MPAR and adjacent Neubecks Creek
D103	Groundwater		Quarterly	New monitoring well downgradient of the mine spoil area and adjacent Neubecks Creek
D104	Groundwater		Quarterly	New monitoring well downgradient of the mine spoil area and adjacent Neubecks Creek
D105	Groundwater		Quarterly	New monitoring well downgradient of MPAR/LNAR, the mine spoil area and adjacent Neubecks Creek
D106	Groundwater		Quarterly	New monitoring well downgradient of MPAR, and adjacent Neubecks Creek
D107	Groundwater		Quarterly	New monitoring well downgradient of MPAR, and adjacent Neubecks Creek
D113	Groundwater		Quarterly	New monitoring well within the mine spoil area, nested with D19 located downgradient of the MPAR/LNAR and adjacent to DML Dam.

1. On an as needed basis select monitoring locations will be monitored more frequently than proposed.
2. Additional monitoring of groundwater conditions is being conducted as part of the additional investigation works (contingency measures) being undertaken at the MPPS.
3. 3 seepage piezometers will be installed at Settlement Pond D.

Table C-2: Surface Water Monitoring Locations

Monitoring Location	Location Type	Monitored Feature	Proposed Sampling Frequency[1]	Rationale for Inclusion	Notes
LDP01	Surface water	Coal Settling Pond Discharge	As required during discharge	Monitoring is required as part of the EPL #13007	Stormwater overflow
LMP01	Surface water	Neubecks Creek	Quarterly	Upstream portion of Neubecks Creek near outflow from main MPPS site	
WX22	Surface water	Neubecks Creek	Monthly	Neubecks Creek, downstream from the MPAR and LNAR	
SW_C	Surface water	Neubecks Creek	Quarterly	Neubecks Creek, adjacent to groundwater well D107	
SW_E	Surface water	Neubecks Creek	Quarterly	Neubecks Creek, downstream section of former open cuts "Area D and Area E"	
SW_G	Surface water	Neubecks Creek	Quarterly	Downstream portion of Neubecks Creek, and downstream of WX22, within former open cut mine working	
NC01	Surface water	Neubecks Creek; Aquatic life background site	Monthly	Upstream to the LNAR and to the north of the MPAR	

1. On an as needed basis select monitoring locations will be monitored more frequently than proposed.
2. Additional monitoring of surface water conditions is being conducted as part of the additional investigation works (contingency measures) being undertaken at the MPPS.

APPENDIX D BRINE COMPOSITION DATA

Sources:

*Connell Wagner (2007),

^Aurecon (2012)

** internal EnergyAustralia database record

Parameter	Unit	1999 (average)*	2003 – 2006*	2009 (average)^	2011 (average)^	2012 (18 July & 16 August)^	Aug 2019 - Feb 2020 Average**
pH	-	7.9	8.1	8.2	7.7	7.6	9.56
Electrical Conductivity (EC)	µS/cm	63,664	127,982	79,409	77,000	52,500	67,074
Total Dissolved Solids (TDS)	mg/L	116,650	137,170	131,240	110,000	49,500	75,519
Chloride (Cl)	mg/L	19,864	23,889	14,122	8,700	5,400	8,355
Sulfate (SO4)	mg/L	49,670	66,767	67,581	62,000	35,000	34,941
Potassium (K)	mg/L	25,678	30,103	4,822	-	-	2144
Magnesium (Mg)	mg/L	5,480	9,010	4,733	-	-	2112
Sodium (Na)	mg/L	25,678	30,103	31,000	-	17,000	25,612
Calcium (Ca)	mg/L	645	606	616	-	-	419
Silver (Ag)	mg/L	0.0014	<0.050	<0.1	-	-	0.0028
Alkalinity (as CaCO3)	mg/L	1,360	1,346	767	650	-	11511
Aluminium (Al)	mg/L			0.45	-	-	0.39
Arsenic (As)	mg/L	0.409	0.143	0.44	-	-	0.31
Boron (B)	mg/L	73.56	115	36	-	-	22
Barium (Ba)	mg/L	0.272	0.03	0.25	-	-	0.17
Beryllium (Be)	mg/L	0.017	0.0058	<0.1	-	-	<0.01
Cadmium (Cd)	mg/L	0.019	0.042	<0.1	-	-	0.006
Chromium (Cr)	mg/L	0.049	<0.050	<0.1	-	-	0.058
Copper (Cu)	mg/L	7.858	7.197	6.8	-	3.1	5.99
Fluoride (F)	mg/L	21.178	125.656	126	-	130	55
Iron (Fe)	mg/L	0.833	-	0.13	-	-	0.15
Mercury (Hg)	mg/L	0.00135	-	<0.005	-	-	0.00007
Manganese (Mn)	mg/L	17.53	34	22.5	-	21	6.05
Molybdenum (Mo)	mg/L	2.6	-	1.5	-	-	2.6
Nickel (Ni)	mg/L	4.187	4.017	2.6	-	2.1	3.1
Lead (Pb)	mg/L	0.006	-	<1	-	-	<0.01
Selenium (Se)	mg/L	0.245	-	0.018	-	0.02	0.11
Strontium (Sr)	mg/L			4.5	-	-	4.2
Zinc (Zn)	mg/L	2.02	-	0.85	-	0.5	1.1
Nitrate (NO3)	mg/L			135	-	-	45

APPENDIX E ENVIRONMENTAL GOALS

Appendix B - Baseline Water Quality

Baseline data – groundwater

The existing baseline groundwater quality criteria approved for the existing Mount Piper Ash Repository has also been adopted for proposed ash placement works at the site. This criteria is based on locally derived monitoring data from Neubecks Creek (WX22) and the Groundwater Collection Basin (Huons Void), and ANZECC (2000) guideline trigger values for the protection of freshwater aquatic ecosystems, and apply as assessment criteria to the receiving waters (Table 7-3) (Aurecon, 2011). Other baseline parameters are provided in Table 7-4.

Table 7-3: Assessment Criteria – Local baseline and ANZECC (2000) Trigger values for Groundwater receiving waters and Neubecks Creek (Aurecon, 2011)

Element	Groundwater Collection Basin Pre-placement 90th Percentile	Groundwater ANZECC or Local Guidelines #	Neubecks Creek at WX22 Pre-placement 90th Percentile	Surface Water ANZECC or Local Guidelines #
General Water Quality (mg/L)				
pH		6.5 – 8.0	6.7-7.8	6.5 – 8.0
Cond/ (uS/cm)	1576	2600^	894	2200
TDS	1306	2000	580	1500^
Cl	31.5	350	22	350+
SO4	824	1000	332	1000 ++
Trace Metals (mg/L)				
As	0.001	0.024	<0.001	0.024
Ag	<0.001	0.00005	-	0.00005
Ba	0.037	0.7	0.029	0.7+++
Be	0.001	0.1	<0.001	0.1
B	0.244	0.37	0.09	0.37
Cd	0.002	0.002	<0.001	0.00085
Cr	0.001	0.005	<0.001	0.002
Cu	0.001	0.005	<0.001	0.0035
F	0.435	1.5	0.338	1.5+++
Fe	0.664	0.664	0.281	0.3+++
Hg	<0.0001	0.00006	-	0.00006
Mn	5.704	5.704	0.72	1.9
Mo	0.001	0.01	<0.001	0.01+
Ni	0.356	**0.5509**	0.005	0.017
Pb	0.001	0.005	<0.001	0.005
Se	0.002	0.005	<0.001	0.005
Zn	0.908	**0.908**	0.061	**0.116**

Notes: * High detection limits used when determining the baseline concentrations. ^ 2000 mg/L TDS/0.77 for groundwater; 0.68 x 2200 uS/cm low land river conductivity protection of aquatic life. # ANZECC (2000) guidelines for protection of freshwaters, livestock, irrigation water or drinking water. Local guideline based upon 90th percentile pre-brine placement (**shown in bold**). Cadmium, Chromium, Copper, lead, nickel and zinc adjusted for effects of hardness: Current Ca, Mg in GCB 147, 113 mg/L: in Neubecks Creek 19.7, 11.8 mg/L, respectively. + Irrigation water moderately tolerant crops; irrigation. Note: Molybdenum drinking is 0.05 mg/L ++ Livestock +++ drinking water.

APPENDIX F TRIGGER ACTION RESPONSE PLANS

Water quality

Aspect	Normal	Incident and Management – Stage 1	Incident and Management - Stage 2	Notification
Groundwater quality	Water quality is below Environmental Goal specified in Appendix E, and statistically increasing concentrations trends are not apparent.	**Trigger:** Concentrations of water quality parameters have increased based on statistical assessment or approach / exceed the relevant Environmental Goal (above current detected levels). **Action**: Review operational data (e.g. major water supply sources and meteorological data). Investigate the source of the change and develop corrective/preventative actions based on outcomes.	**Trigger**: Investigation into Stage 1 trigger identifies that trigger is likely due to an operational activity **Action:** Maintain routine monthly monitoring, undertake an assessment of surface water and groundwater in the vicinity of the trigger exceedance with the objective of identifying and implementing appropriate contingency and mitigation actions (see Section 7.3). For example, pond liners may need to be checked for leaks and any leaks detected will be repaired.	The relevant stakeholders will be notified of the trigger exceedance and involved in discussions on actions needed to mitigate the situation.
Water quality within Neubecks Creek	Water quality is below Environmental Goal specified in Appendix E and statistically increasing concentrations trends are not apparent.	**Trigger**: Concentrations of water quality parameters have increased based on statistical assessment or approach / exceed the relevant Environmental Goal (above current detected levels). **Action:** Investigations into the causes leading to the change of water quality within Neubecks Creek will be undertaken.	**Trigger**: The site operations have been shown to be affecting the water quality in Neubecks Creek. **Action:** Surface water and/or groundwater investigations will be undertaken with the objective of identifying and implementing appropriate contingency and mitigation actions (see Section 7.3). For example, a groundwater investigation including modelling is being undertaken to evaluate the causes of water quality changes and to support mitigation options assessment.	The relevant stakeholders will be notified of the trigger exceedance and involved in discussions on actions needed to mitigate the situation.

APPENDIX G STATEMENT OF LIMITATIONS

IMPORTANT LIMITATIONS AND CONTEXT

1. This report is based solely on the scope of work described in proposal P0524850_Rev1 (**Scope of Work**) and performed by Environmental Resources Management Australia Pty Ltd (**ERM**) for Busways Group Pty Ltd (the **Client**). The Scope of Work was governed by a contract between ERM and the Client (**Contract**).
2. No limitation, qualification or caveat set out below is intended to derogate from the rights and obligations of ERM and the Client under the Contract.
3. The findings of this report are solely based on, and the information provided in this report is strictly limited to that required by, the Scope of Work. Except to the extent stated otherwise, in preparing this report ERM has not considered any question, nor provides any information, beyond that required by the Scope of Work.
4. This report was prepared between 19-09-2019 and 28-02-2020 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.
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