Submission No 83

INQUIRY INTO COSTS FOR REMEDIATION OF SITES CONTAINING COAL ASH REPOSITORIES

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Inquiry into costs for remediation of sites containing coal ash repositories

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Introduction

The Electricity Generation transactions commenced in late 2012 and generated more than $2 billion in gross transaction proceeds and reduced State debt by more than $1.2 billion.

By undertaking the transactions, including the termination of the Cobbora coal supply agreements, the State avoided liabilities of approximately $2 billion and removed ongoing exposure to volatile movements in the wholesale electricity market.

As a result of the transactions, more than $850 million (excluding stamp duty) was paid into the Restart NSW Fund for use on priority infrastructure projects across New South Wales.

The transactions were conducted sequentially and included the sale of:

- the Gentrader assets[1] of both Eraring Energy (Eraring coal-fired power station and Shoalhaven power stations) and Delta Electricity (Mount Piper and Wallerawang coal-fired power stations) for combined cash proceeds of $210 million;
- Green State Power's renewable energy assets[2] for gross proceeds of $72 million;
- Macquarie Generation's assets (Bayswater and Liddell coal-fired power stations) for gross proceeds of $1.505 billion;
- Delta Electricity's gas-fired Colongra power station for gross proceeds of $234 million;
- Delta Electricity's Vales Point coal-fired power station for gross proceeds of $1 million; and
- Brown Mountain Power Station and Cochrane Dam for gross proceeds of $4.5 million.

Coal ash is produced primarily from the burning of coal in coal-fired power plants. Two key by-products produced from burning coal are fly ash and bottom ash. Power stations generally dispose of ash into purpose-built emplacement facilities known as ash dams. In Australia, coal ash can be reused for beneficial purposes such as engineering fill, in concrete manufacture and as a soil additive.

New South Wales has a robust environmental regulation framework to protect the community and environment from pollution from ash dams. The Environment Protection Authority (EPA) is responsible for regulating the environmental impact of ash dams and places conditions on licences that require power station operators to manage dust and water pollution from ash disposal. Typically, the private sector operators are obligated to progressively cap ash dams with clean fill and soil and revegetate them to mitigate environmental risk. This is known as a "cap and cover approach" in remediating coal ash dams.

The requirements for discharges from coal ash dams may include limits on the pollutants that can be discharged and monitoring of surface and groundwater.

All NSW coal-fired power stations are subject to stringent legally enforceable conditions outlined in their environment protection licences, as well as requirements under

[1] Gentrader assets refer to the ownership and operation of the underlying power stations without the trading rights as these were already sold to Origin Energy and EnergyAustralia in 2011.
[2] These included three hydro power generators at Hume, Burrinjuck and Keepit, Blayney wind farm and 80 per cent of Crookwell wind farm.

environmental legislation and development consents, to protect the community and environment.

The EPA will take action in response to any operator if environment protection requirements are not met.

Response to Terms of Reference

(a) prospective or current quantum of government liability for remediating contamination at sites associated with:

(a) Mount Piper power station,

(b) Bayswater power station,

(c) Liddell power station,

(d) Vales Point power station,

(e) Eraring power station, and

(f) any other relevant power station

State contractual obligations

The State's potential liabilities in relation to the cost of remediating contamination at the power station sites arise from contractual obligations (i.e. indemnities) negotiated with the relevant purchaser of the site. The general principle adopted at the time of each transaction was that the State should be responsible for the cost of cleaning up any contamination it had caused whilst it owned the relevant power station, and the purchasers would be responsible for the costs associated with cleaning up any contamination they caused thereafter.

In general terms, for any liabilities to materialise in relation to the indemnities covering pre-existing contamination, the purchasers must successfully lodge a claim with the State for losses incurred as a result of a regulatory or court order to remediate contamination where such contamination is pre-existing as identified in baseline environmental studies (whether undertaken by the State or the purchasers).

The purchasers of the power stations are responsible for managing and satisfying their respective regulatory or legal obligations with respect to plant and ash dam operations, compliance with environment protection licence conditions, and the physical remediation of any site contamination. It should be noted that either the environment protection licences or development consents for each coal-fired power station permit coal ash to be placed and contained in a purpose-built facility (i.e. ash dam).

Under the Electricity Generation transactions, the State provided indemnities to respective purchasers that cover the cost associated with remediating pre-existing contamination at the Mount Piper, Bayswater, Liddell, Vales Point, Eraring, Shoalhaven, Colongra and Wallerawang power stations.

In specific circumstances listed below, the State also provided the following:

- an indemnity to Origin Energy for half of the incremental cost of implementing an alternative arrangement for ash disposal at Eraring power station if the existing

proposal (at the time of the 2013 transaction) for further backfilling at the ash dam cannot be implemented;
- an indemnity to EnergyAustralia for the cost of decommissioning, demolishing and rehabilitating Wallerawang power station, where the total net cost exceeds $10 million. EnergyAustralia is responsible for the initial $10 million;
- an indemnity to Snowy Hydro in relation to the costs of remediating contamination which occurs post-completion on the Colongra site as a result of the adjacent Munmorah power station site; and
- an indemnity to Sunset Power International for the cost of remediating ash dam contamination (i.e. migration of contamination in water from ash dams) as well as legacy contamination (i.e. contamination associated with identified asbestos landfill sites) at Vales Point power station. Where an option is exercised under the Hand Back Deed and the State resumes ownership of the Vales Point site, the State will be responsible for the demolition and remediation of Vales Point and the site land.

Recognition of State contractual obligations

Since the completion of each Electricity Generation transaction, the State has either recognised a liability or disclosed a contingent liability for any indemnity for pre-existing contamination arising from the respective transaction on an annual basis in the publicly-disclosed Crown Entity Financial Statements and Report on State Finances.

Accounting standard *AASB 137 Provisions, Contingent Liabilities and Contingent Assets* is followed in accounting for these contractual obligations and the State's financial statements have been audited by the NSW Auditor-General.

Under AASB 137, a contingent liability is:

> (a) a possible obligation that arises from past events and whose existence will be confirmed only by the occurrence or non-occurrence of one or more uncertain future events not wholly within the control of the entity; or
>
> (b) a present obligation that arises from past events but is not recognised because:
>
> > (i) it is not probable that an outflow of resources embodying economic benefits will be required to settle the obligation; or
> >
> > (ii) the amount of the obligation cannot be measured with sufficient reliability.

Under AASB 137, a provision shall be recognised when:

> (a) an entity has a present obligation (legal or constructive) as a result of a past event;
>
> (b) it is probable that an outflow of resources embodying economic benefits will be required to settle the obligation; and
>
> (c) a reliable estimate can be made of the amount of the obligation.

The contingent liabilities disclosed under the Electricity Generation transactions include the potential costs retained by the State for remediating pre-existing contamination at:

- Mt Piper power station site;
- Colongra power station site;
- Eraring and Shoalhaven power stations;
- Bayswater and Liddell power stations; and

- Vales Point power station.

Review of contingent liabilities

In the preparation of the State's financial statements (reported at Budget, financial year and half-year) the contingent liabilities arising from the Electricity Generation transactions are reviewed and assessed as to whether events and conditions mean a provision should be recognised under AASB 137. This has led to a provision being disclosed on the Crown Entity's balance sheet for the cost (where net costs exceed $10 million) of decommissioning, demolishing and rehabilitating Wallerawang power station site, as that power station ceased operation prior to the end of 2018;

When the State reports on the potential liability relating to these power stations in its audited financial statements, it does so on an aggregated basis (i.e. within a total liability provision for the Crown Entity). The total provision for pre-existing and additional decommissioning commitments is included in the total provisions of $2.19 billion as disclosed in Crown Entity 2018-19 financial statements. The provision amount relating to pre-existing contamination outlined above is included in this aggregate figure.

Disclosure of specific provisions would be commercially harmful to the State, by prejudicing any future negotiations with counterparties if and when payments are required to be made under the environmental indemnities provided by the State. Disclosure of this information would impinge on the State's ability to minimise the financial risk associated with the environmental indemnities.

(b) prospective timing of government expenditure in relation to remediation at those sites

The timing of expenditure in relation to the remediation of various power station sites depends largely on decisions by the private sector operator and actions taken by a relevant authority against the power station operators. One of the most significant decisions by power station operators that could result in some level of remediation of contamination is the closure of a power station. Decisions by private sector owners to close power station sites will be influenced by a range of complex commercial, technical and environmental considerations.

The State maintains active engagement with each of the private sector operators to understand their future plans, however ultimately the private sector Boards will make the final decision on plant closure timeframes. It should be noted that large generators are required to provide the Australian Energy Market Operator (AEMO) with the expected closure year of each of their generating units and at least three years notice of closure.

Given the closure of Wallerawang powers station in 2014 and the impending closure of Liddell in 2022-23, the State has made provisions for the remediation costs in relation to those two sites. As discussed above, disclosure of specific provision amounts would be detrimental to the State's future negotiations with the respective private sector operators.

Aside from the provisions mentioned above and also for a PFAS study requested by the EPA at the Colongra power station, the State has not made a provision at this stage for any of the other contingent liabilities relating to the indemnities provided to the power station purchasers. This is based on Treasury's assessment that there remains sufficient uncertainty as to the timing and cost of the potential liability arising from the State's contractual obligations. However, Treasury is continually monitoring any developments and events related to the indemnities that could trigger a future payment by the State. When these circumstances arise and a reliable estimate of liability can be made, the State will make a provision in relation to the relevant obligation.

(c) economic and employment opportunities associated with coal ash re-use, site remediation and repurposing of land

Coal ash is the waste generated from burning coal to generate electricity. Most of the electricity generated in Australia is produced by power stations in which turbo-generators are driven by steam produced from the burning of coal. The most common fuel used in NSW is black coal. Coal ash is produced from two sources in the electricity generation process:

- Fly ash is the particulate matter produced in gas streams from the combustion process. It is captured by high efficiency fabric filter bags in the flue gas exit path.
- Bottom ash is heavier than fly ash and extracted from the bottom of the boiler.

Coal ash may be pumped from the combustion chamber to coal ash dams in a water slurry, and then stored in the ash dam.

In Australia, coal ash can be reused for beneficial purposes such as engineering fill, in concrete manufacture and as a soil additive. As an additive to concrete, fly ash offers several benefits which can improve its quality and durability including:

- As a void filler to improve density;
- A water reducing agent to reduce cracking; and
- To reduce the heat generated during curing.

According to the Ash Development Association of Australia, approximately 13 million tonnes of coal ash was produced in Australia in 2018 with 47% (or approximately 6 million tonnes) being effectively utilised within various civil and construction applications throughout Australia. The use of coal ash in the manufacture of cement and concrete products represents one of the largest sectors for its beneficial application.

The EPA has issued a resource recovery order (orders) and resource recovery exemption (exemptions) for coal ash and blended coal ash under the Resource Recovery Framework. Orders and exemptions allow some wastes to be beneficially and safely re-used independent of the usual NSW laws that control applying waste to land, using waste as a fuel, or using waste in connection with a process of thermal treatment.

Orders and exemptions are only appropriate if the re-use:

- is genuine, rather than a means of waste disposal
- is beneficial or fit-for-purpose, and
- will not cause harm to human health or the environment

Orders and exemptions are two separate documents that the EPA issues together, as a package. A resource recovery waste means a waste that has a resource recovery order and exemption. The orders contain conditions which generators and processors of waste must meet to supply the waste material for the purposes described above. These conditions may include material specifications, processing specifications, record-keeping, reporting and other requirements. All are made under clause 93 of the *Protection of the Environment Operations (Waste) Regulation* 2014.

Exemptions contain the conditions which consumers must meet to use waste for the purposes described above. These conditions may include requirements on how to re-use or apply the waste, as well as record-keeping, reporting and other requirements. All exemptions

are made under clauses 91 and 92 of the *Protection of the Environment Operations (Waste) Regulation* 2014.

The order and exemption for coal ash outline the regulatory requirements on coal ash producers (including the sampling requirements, chemical limits, test methods and other processor requirements) and consumers in relation to the supply of coal ash for use as a soil amendment, cementitious mixes (e.g. concrete), and non-cementitious mixes (e.g. engineered fill, stabiliser, filter or drainage material or as a sand substitute). Advantages of re-using coal ash include reducing the environmental impacts of the dam and the need to enlarge the footprint of the dam and reducing the need for quarry expansions.

Re-use of ash dams is generally limited given the characteristics of the ash in the ground. However, given the strategic location of ash dams near electricity transmission and distribution networks, there are significant opportunities to re-purpose remediated ash storage areas for large scale solar photovoltaic generation projects (solar farms).

Currently Sunset Power International are progressing the development of a 45MW solar facility on the Vales Point ash dam ponds 1, 2 and 3 which are already capped and vegetated. These ponds represent about 20% of the overall surface area that will eventually be available at this site. Sunset Power International has obtained development consent to construct the solar farm on these rehabilitated ponds, using light weight frames over the previously capped and grassed surface. The typical lifetime of a solar photovoltaic project is 25-35 years. At the end of project life, the land may be re-used for further renewable generation, or some other land use as circumstances emerge.

(d) adequacy and effectiveness of the current regulatory regime for ensuring best practice remediation of coal ash repositories

The EPA has regulatory responsibilities under the *Protection of the Environment Operations Act* 1997 (POEO Act) for surface water pollution, groundwater pollution and air pollution from ash dams in NSW.

Activities listed in Schedule 1 of the POEO Act are regulated by the EPA and require an environment protection licence that focuses on protecting the environment and address air, noise, waste and land contamination issues as well as regulating discharges to waters. Licence conditions relate to pollution prevention and monitoring, and cleaner production through recycling and reuse and the implementation of best practice.

Currently the EPA has issued a licence to the following operating coal-fired power station operators:

1. EnergyAustralia NSW Pty Ltd - Mount Piper power station,
2. AGL Macquarie Pty Limited - Bayswater power station,
3. AGL Macquarie Pty Limited - Liddell power station,
4. Sunset Power International Pty Ltd - Vales point power station,
5. Origin Energy Eraring Pty Ltd - Eraring power station

Power station operators are responsible for managing the environmental risks associated with the licenced activities and ensuring compliance with the licence requirements.

The EPA is responsible for regulating the environmental impact of ash dams and places conditions on licences that require power stations to manage dust and water pollution from ash disposal. Typically, a cap and cover approach is taken, with private sector operators obligated to progressively cap ash dams with clean fill and soil and revegetate them to mitigate environmental risk.

The EPA regulates the investigation, remediation, and ongoing monitoring of contaminated land to protect human health and the environment. Contamination may threaten human health and the environment, limit land use or increase development costs. Contaminated land is typically grouped in areas that have been used for industrial or agricultural activities, or individual sites that store chemicals, such as service stations and dry cleaners.

Depending on its nature, contamination can be regulated under the POEO Act or the *Contaminated Land Management Act 1997* (CLM Act).

Planning authorities deal with other contamination under the planning and development process, including State Environmental Planning Policy No. 55 - Remediation of Land and the Managing Land Contamination - Planning Guidelines (PDF 219KB), on sites which do not pose an unacceptable risk under their current or approved use. This process determines what remediation is needed to make the land suitable for a different use.

Under the CLM Act and the POEO Act the EPA has power to require a regulated entity to provide a financial assurance to guarantee funding for carrying out licensed activities or contaminated land management orders. These powers include requiring an independent cost assessment to calculate the amount of financial assurance required.

(e) mitigation of actual or perceived conflict of interest arising from the state having ongoing liability for remediation costs the quantum of which will be impacted by government policy and regulatory action

As the primary environmental regulator for NSW, the EPA protects the community and our environment. The EPA is an independent statutory authority that sits in the Environment Portfolio as part of the Planning, Industry and Environment cluster.

The State's contractual obligations arising from major transactions are managed within Treasury under the Treasurer. This separation of environmental and commercial management – a demarcation which existed prior to the Electricity Generation Transactions when the State owned the power stations - provides appropriate mitigation to any risk of actual or perceived conflict of interest. There are numerous examples (e.g. the water and ports sector) where the State has effectively managed its dual roles of being a shareholder or owner of a business on one hand, and also having regulatory functions (whether policy, economic or environmental) within the same sector.

The EPA works in partnership with business, government and the community to protect human health, reduce pollution and waste and prevent degradation of the environment. The EPA's regulatory focus ensures that it leads in protecting the environment and guiding our stakeholders and NSW residents to safeguard our natural resources.

The EPA works with businesses to ensure their activities protect the environment and human health by:

- issuing environment protection licences
- enforcing strict operating conditions and pollution reduction programs
- monitoring compliance with licence conditions and investigating pollution reports
- ordering the clean-up of pollution
- imposing fines or prosecuting organisations and individuals who break the law.

The EPA also:

- respond to and manage pollution incidents involving hazardous materials, in collaboration with other government agencies
- develop and inform environmental programs and policy
- deliver education and awareness programs
- support activities that protect the environment through grants and sponsorships
- provide technical support and expertise to other government agencies.

The EPA's work is informed by contemporary scientific evidence, best practice management and feedback from our stakeholders.

In addition to the above, information about industry's regulatory performance and EPA compliance and enforcement action is available on a number of public registers. For example, the POEO Public Register includes details of all environment protection licences. Annual performance information from annual returns, including whether the licensee breached a condition of their licence, is reported on the Public Register. Other information available includes details of statutory notices, penalty notices and prosecutions issued.

To improve community access to information about the performance of its industrial neighbours, the EPA requires all environment protection licensees whose licence includes pollution monitoring conditions to make their pollution monitoring data publicly available, generally via the licensees website. Licensees are also required to develop and implement pollution incident response management plans that include protocols for notifying the community in the event of a pollution incident.

The EPA's Prosecution Guidelines provide details of the basis on which the EPA will make a decision to prosecute. In particular it should be noted that the *Protection of the Environment Administration Act* 1991 separates the prosecution process from the political arena. While, in general terms, the EPA is subject to the control and the direction of the Minister, the EPA is specifically exempted from that control and direction in relation to any decision to institute or approve of the institution of criminal or related proceedings. While the EPA is not subject to Ministerial control or direction in respect of prosecutions, it is guided by the *Premier's Memorandum No. 97-26 Litigation Involving Government Authorities*.

In 2012, the NSW Government established the EPA as an independent statutory authority. An independent skills-based board was appointed to:

- determine the policies and long-term strategic plans of the EPA
- oversee the effective, efficient and economic management of the EPA
- develop and make available for public information, guidelines relating to the institution of criminal and related proceedings
- determine whether the EPA should institute proceedings for serious environment protection offences referred to in section 17 of the POEA Act
- advise the Minister on any matter relating to the protection of the environment.

The Board is comprised of five members: a Chair, and four independent members. The Chair of the EPA is appointed by the Governor and is responsible for managing and controlling the affairs of the EPA in accordance with the policies and decisions of the Board. The Board is not subject to the control and direction of the Minister in the exercise of any of its functions.

The EPA Board is an independent governing body that oversees and monitors the organisation. The Board has five members who are appointed by the Governor of NSW on the recommendation of the Minister for the Environment. EPA Board members have extensive experience in the fields of environmental science, environmental law, transport and infrastructure, business and corporate finance, risk planning and management. They also have established ties to, and understanding of, business and community groups.

(f) risks and liabilities associated with inadequate remediation including community and environmental health impacts, and

As set out above, New South Wales has a robust environmental regulation framework to protect the community and environment from pollution from ash dams including legally enforceable conditions set out in environment protection licences.

The EPA is responsible for regulating the environmental impact of ash dams and places conditions on licences that require power stations to manage dust and water pollution from ash disposal.

During the operational and pre-rehabilitation phase of a coal fired power station, dust from coal ash dams must be controlled due to the potential impacts of airborne particulates and contaminants on human health and the surrounding environment including water quality. Generally, the ash is delivered from the power station to the emplacement area by heavy haulage vehicles or conveyed or piped to the work face of the emplacement, where it is placed into position and then spread, in some situations by a dozer. A dozer and roller may be used to compact the ash. Controls include ensuring the surface is wet, spraying with water and/or suppressants, covering the surface with a veneer or gravel, using silt trap barriers, and compacting and rehabilitating the area as soon as possible.

Monitoring of the quality of air is undertaken at the coal emplacement areas to ensure the controls in place are effective in minimising any dust emissions. The EPA requires ongoing monitoring and reporting of air quality from ash dams by power station operators' as a condition under the Environment Protection Licences.

To manage leachate from ash dams, the EPA also requires power station operators to monitor and report water pollution at certain discharge points as a condition under the Environment Protection Licences.

For rehabilitation, power station operators typically use a cap and cover approach to progressively cap ash dams with clean fill and soil and revegetate them to mitigate environmental risk. Once rehabilitated, vegetated ash dams can have potential alternative uses such as solar farms.

Another important regulatory instrument in assessing and protecting human health and the environment is the National Environmental Protection (Assessment of Site Contamination) Measure 1999 (NEPM). The NEPM is made under the *National Environment Protection Council Act 1994* (Cth) and is given effect by individual legislation and guidelines in each State and Territory.

The purpose of the NEPM - which is given effect in New South Wales as a guideline approved under s105 of the *Contaminated Land Management Act* (1997) – is to provide an adequate level of protection to human health and the environment via the development of a consistent, efficient and effective national approach to the assessment of site contamination. The stated goal of the NEPM is to *"establish a nationally consistent approach to the assessment of site contamination to ensure sound environmental management practices by the community which includes regulators, site assessors, environmental auditors, landowners, developers and industry."*

The NEPM provides a range of investigation and screening levels and associated guidance for use in different environmental settings and land use scenarios and considers a range of factors including the protection of human health, ecosystems, groundwater resources and aesthetics.

In applying generic screening values it is important to note that health effects can be broadly separated into acute and chronic effects. Acute health effects occur within a relatively short period of exposure (hours to days), while chronic health effects occur as a result of prolonged or repeated exposures over months or years and symptoms may thus not be apparent during the period of assessment. Contaminated land assessments generally focus on chronic health effects and the NEPM screening values relate only to chronic effects.

It is also important to note that the NEPM very clearly states that *"Investigation and screening levels are not clean-up or response levels nor are they desirable soil quality criteria. Investigation and screening levels are intended for assessing existing contamination and to trigger consideration of an appropriate site-specific risk-based approach or appropriate risk management options when they are exceeded."*

Health Investigation Levels (HILs) are described within the NEPM as scientifically based, generic assessment criteria intended to be used as the first stage of an assessment of potential risks to human health from chronic exposure to contaminants. As they are designed to be intentionally conservative they are based on a reasonable worst-case scenario for four generic land use settings being:

- HIL A - residential with garden/accessible soil
- HIL B - residential with minimal opportunities for soil access
- HIL C - public open space
- HIL D - commercial/industrial which would include sites such as power stations and their associated ash repositories.

With regard to the management of ash repositories, Groundwater investigation levels (GILs) are typically most applicable in the assessment of potential impacts to groundwater associated with the potential leaching of contaminants from ash. The GILs are defined within the NEPM as *"the concentration of a contaminant in groundwater above which further investigation (point of extraction) or a response (point of use) is required"*. The GIL's presented within the NEPM are sourced from:

- Australian water quality guidelines for fresh and marine water (AWQG) (ANZECC & ARMCANZ 2000)
- Australian drinking water guidelines (ADWG) (NHMRC & NRMMC 2011)
- Guidelines for managing risk in recreational water (GMRRW) (NHMRC 2008).

The NEPM notes that GILs were developed to avoid unacceptable impacts to exposed people or ecosystems under a range of different circumstances. The GILs for protection of freshwater and marine water ecosystems were, for example, calculated at four different protection levels, where the data permitted, and are applied according to the condition of the ecosystem. Similar to the HILs, GILs are not intended to be clean-up levels. The NEPM specifically states that *"concentrations marginally in excess of the GILs do not imply unacceptability or that a significant human health or ecosystem impact is likely to be present."*

Subject to further scientific assessment, a decision not to take further action or to take further action may be justifiable based on the findings.

(g) any other related matters

Other than the EPA, Dams Safety NSW is a statutory authority created under the *Dams Safety Act* 2015 to oversee the safety of dams in NSW and to prevent significant uncontrolled loss of their storages. Dams Safety NSW is a continuation of, and the same legal entity as, the Dam Safety Committee constituted under the now repealed *Dams Safety Act* 1978. Generally, Dams Safety NSW prescribes and sets requirements for dams storing water or other liquefiable materials that pose a significant potential threat to the interests of the community (including environmental effects).

Dam stability and structural integrity is regulated by Dams Safety NSW, which regulates all significant dams in NSW. In general, when a proposal is put forward to rehabilitate a regulated dam, Dams Safety NSW will review the proposal from a public safety standpoint. The proposal will be judged on its technical feasibility and merit, to ensure that any rehabilitation will remain safe and not be at risk of dam failure.

The key issues to be addressed when operating and rehabilitating an ash dam include:

- Safety and integrity of the dam, to ensure the ash dam will not be at risk of breaching;
- Impact upon groundwater, with consideration on how ash water can be removed or treated to ensure it does not impact upon local groundwater resources;
- Dust emissions, as ash deposits dry out over time, they have the potential to emit airborne dust. A self-sustaining vegetation cover is generally required to prevent exposure to wind gusts;
- Surface water issues, where rainfall runoff can transfer sediments. The capping material profile and surface drainage should direct surface water away from the emplacement and avoid contact between the surface water and covered ash; and
- Future monitoring, as any ash dam rehabilitation project has a long-term horizon.