Buckland Dry Creek Pty Ltd

DRY CREEK SALT FIELD

Integrated Program for Environment Protection and Rehabilitation and Mine Operations Plan

Revision 4 v.1 – March 2017

Part 4 – Closure Activities – Text, Figures, Tables

Integrated PEPR / MOP – Holding Pattern, Residual Operations, Investigations, and Closure Operations at the Dry Creek Salt Field

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DRY CREEK SALT FIELDS PEPR REVISION 4 – PART 4

18 Overview of the Closure Strategy

This part of the PEPR / MOP describes the proposed closure activities on the salt field i.e. the operations that will be carried out to prepare the site for the agreed post mining land uses. Mine completion is defined by DSD as the goal of mine closure. A completed mine has been rehabilitated to an extent that the mineral lease / licence can be surrendered, and ongoing responsibility accepted by the next land user.

As closure operations will occur in a staged manner within each section, some parts of sections will still be subject to the holding pattern or residual operations, while others will be undergoing closure activities. In this revision of the PEPR, closure operations will only occur in Section 1. Eventually, all operations within the salt field will come under this Part. The base case closure strategy is discussed below as background context.

This Part describes the environmental impacts of closure operations and outcomes to be achieved. It also sets out the outcomes and criteria that will be used to define mine completion.

18.1 Closure Strategy for Section 1

The future land use for Section 1 of the Salt Field (the part south of Dry Creek) comprises:

- a mixed-use urban development; and
- parts of the land excised for the Norther Connector, and
- potentially a resumption of commercial salt production on parts not being used for either or the above.

Buckland Dry Creek Pty Ltd (BDC) and Renewal SA are collaborating, as adjoining landowners of Section 1, on a review and revision of a Master Plan for the mixed-use urban development. It is envisaged that the mixed-use urban development will include measures for stormwater management and protecting the urban environment from the effects of sea level rise and land subsidence. This is discussed further below.

BDC are in the planning phase for the resumption of commercial salt production and intends to submit a further revision of this PEPR / MOP to DEM for approval when that planning reaches an appropriate stage of development.

Those parts of Section 1 that have been excised for the Northern Connector have achieved mine completion and closure.

Those parts of Section 1 that are prepared for the purposes of the mixed-use urban development will achieve mine completion and closure in a staged manned – see Section 19.

Those parts of Section 1 that become used for the resumption of salt production will have their closure activities deferred. It is also noted that this resumption of salt production in Section 1 could affect the closure strategy and activities in Sections 2 to 4 of the salt field.

18.2 Base Case Closure Strategy for Sections 2 – 4

18.2.1 Need for Base Case Closure Strategy

An integrated PEPR / MOP is required to describe potential land use options for a mine site at mine completion.

For Sections 2 to 4 of the Salt Field, options for land uses are under consideration, and being informed by further discussions and investigations. Such options will be also informed by engagement with the community. The South Australian Government is the owner for the Crown land part of the salt fields and, consequently, is also a key stakeholder. BDC is also a key stakeholder because it is the owner of the Freehold land part of the salt fields and also the holder of mining tenements (private mines and mine lease) that together cover both the Crown and Freehold land parts of the salt fields.

Therefore, a base case closure strategy has been developed for Sections 2 to 4 to:

- provide a framework for investigations and design for the purposes of the PEPR / MOP (and also the referral under the EPBC Act)
- achieve process certainty and a clear definition of closure
- define the outcomes sought in each closure domain at mine completion.

This strategy has been conceived so that:

- It does not exclude any of the range of future land uses for Sections 2 to 4 that BDC considers, on the basis of its knowledge of the site's characteristics and its consultations thus far with third parties, could be found to be feasible in different parts of each Section of the site. For Sections 2 to 4, this includes (but is not limited to):
  - stormwater management
  - nutrient removal from treated sewage effluent
  - protection of the urban environment at St Kilda and also east of the salt fields from effects of sea level rise / land subsidence
  - contribution to the Adelaide International Bird Sanctuary
  - horticulture / agriculture
  - aquaculture
  - salt production
  - urban development
  - landfill for raising ground levels.
  - solar power generation
  - quarrying to provide soil to assist filling Section 1 or parts of Sections 2 to 4 for their rehabilitation and future land uses
  - vegetation management for carbon sequestration

- In the absence of the emergence within a reasonable timeframe of specific and potentially feasible future land uses in Sections 2 to 4, the base case closure strategy will be implemented to achieve mine completion.
- It can be adapted to accommodate specific and potentially feasible future land uses in Section 2 to 4 that emerge within a reasonable timeframe.
- Where feasible, the investigations for the revisions of the integrated PEPR / MOP, that will be needed for mine closure and completion, can be done collaboratively with investigations needed by proponents for future land uses.

18.2.2 Key Issues

Key issues for the base case closure strategy and the design of plans to implement that strategy include:

- the management of water for the sustainable protection and conservation of an appropriate scale of migratory bird habitat
- the prevention and management of risks from acid sulfate soils (ASS) and mono-sulfidic black ooze (MBO) within the ponds – especially risks to the external sensitive coastal environment
- the need to achieve economically, environmentally, and socially sustainable future land uses.
- the need to re-align some of the boundaries between Crown and Freehold portions of the salt field to assist separate future land use and management responsibilities, where this is necessary / desirable.

Due to the complexities and nature of the altered environment and geomorphology of the site, and its adjacent natural coastal areas:

- long term post-mine completion environmental management of the different parts of the site will be unavoidable.
- balanced judgements incorporating a range of perspectives will be required to derive the precise definition of the scope and compliance requirements for mine completion needed to engender confidence and certainty for all key stakeholders.
- achieving mine completion cannot be risk-free, but risks can and must be managed in an adaptable and prudently regulated manner.
- mine completion may not mark the end of rehabilitation processes. The intent is that the site's environmental responses to closure actions is established and on a stable footing at mine completion. However, these environmental responses may continue and evolve into the long term.
- mine completion can provide a prudent waystation along a pathway to future land uses. This means that, for the environment at the site, mine completion is not an end in itself, but a stage in a multi-staged transition to the future uses.

18.2.3 Principles for Design of Closure Plans

The South Australian Government has established a Strategy / Technical Advisory Group (STAG) to provide technical and strategic input to the closure process. This group has agreed the following principles for the design of closure of this site:

- Closure of each part of the site is to involve regulated works that have clear objectives, defined scopes, and measurable completion criteria, and that are capable of completion in a definable period of time.
- Mine completion requires closure works that achieve reasonable compliance (respecting the site specifics) with relevant State and Commonwealth legislation.
- Mine completion for a part of the salt field, when followed by surrender of its mine lease or private mine status, would mark the end of the site's status as a mine and its regulation under the Mining Act; and the start of its regulation and management under other planning and environmental legislation.
- Where a specific future land use **can be defined** for a part of the site, and can be assessed to be feasible and achievable within reasonable time frames and with reasonable certainty, closure works can be designed to progress the relevant part of the site towards that specific option.
- Where a specific future land use **cannot be defined** for a part of the site, or is assessed not to be feasible or achievable within reasonable time frames and with reasonable certainty, the Base Case Closure Strategy is to be implemented for that part of the site; and in such a way that its condition at mine completion is not to unduly constrain its plausible future land uses.

Appendix 13 contains the Base Case Closure Strategy endorsed by the STAG.

18.2.4 Closure Goals and Overarching Environmental Values and Outcomes Sought

Closure works planning and design will aim to achieve the following general environmental, social, and economic outcomes.

Environmental

- Rehabilitation of the land, groundwater, surface water and ecosystems within the site will, in part, necessarily involve some interactive, mutually dependent natural geochemical, physical, and biological processes which take time to occur and reach completion. At the point of mine completion, rehabilitation needs to have ensured these processes are underway, and are progressing in directions that lead to environmental sustainability and sensibly minimal residual environmental risks.
- The protection of air, land, groundwater, and surface water quality outside the site so that the health, safety, and amenity of people and ecosystems that use or depend on these are protected, both during the work to achieve completion and after completion.
- Practicable, risk-based environment monitoring and management plans with clear goals, environmental control measures, inspection and monitoring measures, performance indicators and criteria, reporting and resourcing requirements, to provide ongoing environmental risk management of the land, groundwater, surface water and ecosystems within the site following mine completion.
- Compliance with relevant, applicable, regulatory requirements, as identified in consultations with regulatory government agencies, including DSD, EPA, PIRSA and the Commonwealth Department of the Environment and Energy.
- Application of the precautionary principle, defined as follows:
  - *Environment Protection Act 1993* (SA): to apply a precautionary approach to the assessment of risk of environmental harm and ensure that all aspects of environmental quality affected by pollution and waste (including ecosystem sustainability and valued environmental attributes) are considered in decisions relating to the environment.
  - *Environment Protection and Biodiversity Conservation Act 1999* (Cth): lack of full scientific certainty should not be used as a reason for postponing a measure to prevent degradation of the environment where there are threats of serious or irreversible environmental damage.

Social

- Pro-active consultation to enable stakeholders who are interested in, may be affected by or have influence on, the achievement of rehabilitation and completion outcomes to be well informed about the environmental constraints and opportunities for future uses of the salt field land after closure.
- Protection of the important cultural and geological heritage values of the land at the site.

Economic

- The maintenance of the integrity and functionality of engineered structures at the site which protect land outside the site from adverse economic consequences of inundation from tides and storm surges in the Gulf St Vincent and Barker Inlet.

Table 18-1 summarises the key overarching environmental values and strategic goals sought from rehabilitation and closure. Outcomes and criteria for achieving these goals, relevant to each stage in the rehabilitation and closure process, will be documented in subsequent revisions to this PEPR / MOP.

Table 18-1: Strategic goals for mine completion and principles for outcomes and measurement criteria

(Note: The information in this table is aspirational and intended to guide the investigation and design of closure works to achieve mine completion. Revisions to this integrated PEPR / MOP will contain descriptions of specific operations for the closure works in different parts of the site informed by such investigations and design. Those descriptions will be accompanied by specific environmental outcomes and measurement criteria that are broadly in line with the strategic goals and principles expressed in this table).

Key environmental values	Strategic goals to protect key environmental values	Principles for establishing outcomes and measurement criteria specific to closure works for mine completion

Terrestrial flora and fauna communities and species	▪ No adverse impacts from the condition of the site at mine completion on native flora and fauna communities and species on or off the salt field.
	▪ Compliance with EPBC Act requirements for mitigation and offset of impacts from the controlled action that will form part of the works to achieve mine completion.
	▪ Re-colonisation of native vegetation habitats in drained parts of the site is demonstrably underway, with management measures in place to address any threatening processes (e.g. drainage problems, feral animals, and weeds) and to ensure re-colonisation will continue in the long term.
		Criteria will need to enable demonstration that:
		▪ all clearance of native vegetation for mine completion has been undertaken with appropriate permissions. It is noted that clearance can also include loss from:
		  ▪ physical works
		  ▪ dust / contaminant deposition
		  ▪ fire
		  ▪ other damage.
		▪ no adverse offsite impacts from closure on native flora and fauna have occurred or are likely to occur
		▪ compliance with EPBC Act conditions including demonstrating offset requirements have been met
		▪ performance measures for vegetation re-colonisation, as specified in an environmental management plan, are being or have been met.

Surface water	▪ The land surface within drained ponds at the site is free draining, such that ponding of water from rainfall, outside natural or man-made drainage courses within the site, is temporary and able to disappear within a reasonably short time, from a combination of infiltration, surface runoff, evaporation and evapotranspiration, without human intervention.
	▪ No adverse impacts on the marine environment from the discharge of surface water into the external environment from the site at defined discharge points approved under EPA Licences and Fisheries Management Act exemptions.
	▪ Within ponds on the site that hold or transmit water, the water levels and water quality are maintained to ensure there is no adverse impact on habitat for EPBC Act listed birds, or native vegetation.
		Criteria will need to enable demonstration that:
		▪ In drained ponds:
		  ▪ ponding of water does not occur for a duration that results in unacceptable odour impacts on receptors
		  ▪ salinity of any discharge to the marine environment is at a level that does not result in environmental harm
		  ▪ water quality and depths within natural or artificial water courses within the site are maintained to protect habitat for EPBC Act listed birds, or native vegetation
		  ▪ surface water levels are controlled by the combination of groundwater levels and water levels in the adjacent Gulf St Vincent
		  ▪ surface water levels in natural or artificial water courses are maintained at or above their pre-salt fields level, unless otherwise agreed.
		▪ In inundated ponds:

Key environmental values	Strategic goals to protect key environmental values	Principles for establishing outcomes and measurement criteria specific to closure works for mine completion
	▪ Surface water levels in natural or man-made water courses are maintained, where practicable, at or above their pre-salt fields levels.	▪ water quality and depths are maintained to protect habitat for EPBC Act listed birds, or native vegetation
Air Quality	▪ No adverse impacts on local communities from odours or dusts emanating from the salt fields.	Criteria will need to enable demonstration that: ▪ any organic material remaining in drained ponds is unlikely to result in unacceptable odour impacts as a consequence of either ponding of water, or loss of saturation ▪ ASS are appropriately managed to ensure unacceptable odour impacts do not occur ▪ algal blooms are not of a magnitude that would result in unacceptable odour impacts ▪ performance measures for recolonisation of drained ponds with vegetation are being or have been met, except where alternative land uses have been agreed ▪ other potential dust sources are managed to ensure agreed outcomes for dust impacts on receptors are met.
Contamination / wastes, salinity, acid sulfate	▪ Any contamination or waste is remediated so that it complies with EPA policies and guidelines. ▪ Constraints (if any) on post-closure land uses at the site from residual salt in soils or monosulfidic black ooze caused by salt field operations are understood. ▪ No adverse impacts from acid sulfate soils and monosulfidic black ooze at the site on the external environment.	Criteria will need to enable demonstration that: ▪ remediation of contamination or waste has successfully occurred in any areas that were identified as requiring specific remediation measures ▪ impacts from ASS and MBO at the site comply with the other environmental outcomes in this table.
Infrastructure management to protect public safety and the environment	▪ Existing bunds are maintained at their existing crest heights and with their integrity and functionality intact. ▪ All redundant gates, syphons, connections, or other hydraulic flow control structures between ponds have been removed or blocked off / closed in a durable manner that protects public safety and the environment. ▪ All redundant water pumps have been removed from site. Supporting structures, pipelines, flow control valves and power supplies associated with these pumps have also been removed or appropriately decommissioned in manner that protects public safety and the environment. ▪ All remaining operating pumps, and associated supporting structures,	Criteria will need to enable demonstration that: ▪ the site has been left in a stable and non-polluting condition ▪ all infrastructure has been removed other than that which has been agreed will remain ▪ all remaining operating pumps, and their associated supporting structures, pipelines flow control valves and power supplies, are in operable, well-maintained condition ▪ all bund banks and seepage drains are functional and stable.

Key environmental values	Strategic goals to protect key environmental values	Principles for establishing outcomes and measurement criteria specific to closure works for mine completion
	pipelines flow control valves and power supplies are in operable, well-maintained condition, with an effective care and maintenance plan in place. ▪ All site fences and gates remain intact, with sufficient warning signs advising the public that entry to the site without permission from the landowner is forbidden and that entry carries safety risks. ▪ All seepage drains remain functional.	
Community	▪ Mine completion has broad acceptance by the community.	▪ The Closure PEPR / MOP will need to demonstrate that consultation and engagement with the community has occurred and resulted in their broad acceptance of the proposed works for mine completion
Cultural and geological heritage	▪ No adverse impacts on the cultural heritage values of the site. ▪ Landforms of drained ponds are substantially unaffected by closure works.	Criteria will need to enable demonstration that: ▪ cultural heritage values of the site before and at closure have been documented ▪ landform within drained ponds is within agreed parameters that substantially retain the landforms existing prior to closure of the salt fields.
Protection of third-party infrastructure related to mine completion for ML 6514	▪ Comply with the requirements of the Sixth Schedule Lease Condition 2 in ML 6514, as these apply to the adjacent parts of the Northern Connector, SEA gas pipeline and PM248	The contents of the Closure PEPR / MOP that deal with ML 6514 will need to demonstrate that consultation and engagement with the owners of this adjacent property and infrastructure has occurred and resulted in their broad acceptance of the proposed works for mine completion

19 Proposed Operations Covered by this PEPR / MOP

This chapter describes the closure operations that are included in this revision of the PEPR / MOP.

19.1 Proposed Closure Operations in Section 1

Section 1 of the Dry Creek Salt Field has been identified in Adelaide's 30 Year Plan for Greater Adelaide as a future urban growth area. The eastern half of this land, abutting the western side of Port Wakefield Road and south of Globe Derby Park, is owned by BGC. Land to the west, abutting Barker Inlet and St Kilda Aquatic Reserve, is owned by Renewal SA.

The operations covered in this PEPR / MOP are restricted to the land owned by BGC (PM248). This is shown in Figure 19-1.

Figure 19-1: Location of PM248

Ridley, with Delfin and involvement from Renewal SA and Salisbury Council, previously created a draft master plan for the development of Section 1 for residential and mixed use purposes (Figure 19-2). This is under review and a Master Planning study is about to be implemented. That study will produce a 'high level' and 'strategic' plan to guide the subsequent detailed planning and design of the urban development and the gaining of Development Approvals under the Development Act. The detailed planning and design will, among other matters, refine concepts for the final developed topography.

However, it is clear already that PM248 – the Private Mine part of Section 1 – will require filling to raise ground levels and prepare this area for future development. It is therefore intended that the closure operations for PM248 comprise the raising of the ground levels and the production of land that is suitable for redevelopment in the manner that is envisaged by the agreed revised Master Plan and subsequent Development Approvals.

Figure 19-2: Possible Future Land Uses – the Ridley / Delfin Concept

19.2 Strategy for Bulk Earthworks and its Regulation

The bulk earthworks in PM248 are needed for the following purposes:

- To rehabilitate this land to enable mine completion and closure.
- To prepare this land for subsequent urban (mixed uses and residential) development:
  - by raising the minimum ground levels above levels stipulated by the relevant planning authority to accommodate for factors such as high tides and storm surges, sea level rise, and floods from stormwater flows
  - by creating topography for the urban development that can accommodate stormwater runoff and drainage adequately, allowing for the effects of climate change
  - by elevating and separating the ground, on and in which the landscaping, infrastructure and foundations for the urban development will be built, from the existing salty ground of the floors of the final area ponds, crystallisers, stacking bays, and drains that formed the operational features of PM248. This elevation and separation are to prevent salt rising and adversely affecting the landscaping, infrastructure, and foundations for the urban development.

19.2.1 Management and Regulation of Bulk Earthworks

The bulk earthworks will be conducted in stages, with each stage creating a platform for an area of subsequent urban development.

Figure 19-3 illustrates the process for managing and regulating the bulk earthworks.

Prior to each stage, a Bulk Earthworks Plan with the following information will be submitted to DSD as a Notification of Minor Change:

- a survey plan of existing ground levels
- a plan of intended ground levels after the bulk earthworks
- drawings showing the engineering design and specifications for the bulk earthworks i.e. materials of construction (and their sources and engineering and environmental properties), layer thicknesses and volumes, compaction requirements, quality control requirements, and construction environmental management requirements
- endorsement by a suitable qualified Geotechnical Inspection Testing Authority (GITA) that the Bulk Earthworks Plan is consistent with AS 3798-2007 and, if implemented diligently, will produce a land form that that would be geotechnically suitable for the intended land use (to be considered as "Residential" unless documented otherwise in an approved Master Plan or other suitable document).
- endorsement by an EPA Accredited Auditor that the endorsed Bulk Earthworks Plan, and associated Construction Quality Assurance Plan and Construction Environmental Monitoring and Management Plan, if properly implemented should a) generate sufficient information for an audit of the outcomes to be completed, and b) that there is a reasonable prospect that the outcomes will be environmentally suitable for the intended land use (to be considered as 'Residential' unless documented otherwise in an approved Master Plan or other suitable document).
- endorsement by a suitably qualified and experienced hydrological engineer that the Bulk Earthworks Plan, if implemented diligently, is likely to produce a landform that will accommodate the tidal and stream levels and flows, flood levels and flows and stormwater flows associated with the intended land use (to be considered as 'Residential' unless documented otherwise in an approved Master Plan or other suitable document).
- endorsement by the relevant planning authority that the Bulk Earthworks Plan, if implemented diligently, is likely to produce a land form that is consistent with future land uses (to be considered as "Residential" unless documented otherwise in an approved Master Plan or other suitable document).
- a construction environmental management plan for the bulk earthworks that articulates how the earthworks will be done, monitored, managed, and controlled so that the end result as well as the filling processes comply with the endorsed design and specifications.

Work would not commence until the Notification of Minor Change is approved by DSD.

Figure 19-3: Process to manage and regulate bulk earthworks

After each stage of broadscale bulk earthworks, a completion report will be prepared which contains:

- as-built drawings and other records that demonstrate that the endorsed design and specifications have been complied with.
- endorsements, from review of these documents, supported by such independent checks as have been needed, by:
    a. the qualified party that will be responsible for the engineering / geotechnical supervision of the bulk earthworks. This endorsement will state that the constructed bulk earthworks have complied with the design and specification and is in effect 'fit for engineering purpose' in the context of the planned urban development and anticipated or actuals requirements of the relevant planning authority; the planning authority
    b. an EPA accredited Auditor. This endorsement will state that the constructed bulk earthworks are in effect 'fit for environmental purpose' in the context of the planned urban development and the requirements of the Environment Protection Act (and other Acts with relevant environmental requirements)
    c. a suitably qualified and experienced hydrological engineer confirming that the As Constructed landform will accommodate the tidal and stream levels and flows, flood levels and flows and stormwater flows associated with the intended land use, and; the quality of water within and discharged from the As Constructed landform will not have adverse impacts on the use of land or water within or outside the site.
- an endorsement by the responsible Planning Authority, based on its review of the above. This endorsement will state that the relevant conditions of Development Approval have been satisfied by the constructed bulk earthworks.

DSD approval of the completion report would trigger an application for the area of land containing the filled stage to be excised from the Private Mine tenement and thus from the jurisdiction of the Mining Act.

19.2.2 Design of Proposed Bulk Earthworks

The final structure and dimensions of the bulk earthworks in each Stage will be designed and specified taking account of:

- the results of the Pilot Trial (see Appendix 15). The conduct of this Pilot Trial has been approved by DSD (see Part 1 of this PEPR / MOP)
- the results of the review of the Master Plan, and in particular, what these results mean[1] for, e.g.:
    a. minimum and maximum finished ground surface levels to accommodate planning requirements (e.g. for sea level rise, flood prevention, stormwater management etc.)
    b. maximum finished ground surface levels
    c. minimum and maximum finished ground slopes
- ground surface levels in areas to be filled after undesirable, surplus crystallised salt and salt muds have been removed to provide a 'stripped' ground surface ready for filling
- other constraints and opportunities – such as maximum permissible fill thicknesses over existing gas pipelines; clearance requirements under high voltage power lines etc
- the need to enable the drainage / capillary layer to discharge its water into open swales or waterways within the site

[1] It is noted that the review of the Master Plan may identify specific requirements for bulk earthworks that need to be satisfied in order that the development on the finished surface of the bulk earthworks may obtain and then comply with the necessary further planning and environmental approvals, permits or endorsements.

- the need to accommodate a minimum thickness of 1m of cover fill over the drainage / capillary layer. This 1m thickness is intended to assure physical separation between the drainage / capillary layer and civil works, earthworks, and infrastructure works for the subsequent land development. That is the bottom 0.5m of the cover fill is intended never to be disturbed by such works – without adequate prior planning and control to ensure that the integrity of the drainage / capillary layer is never compromised.

19.3 Closure Operations Elsewhere in Section 1

Once the revised masterplan has been produced, the scope and nature of closure operations elsewhere in Section 1 can be considered. As these operations become defined, they will be embodied in further revisions to this PEPR / MOP.

20 Environmental Assessment and Outcomes

This chapter discusses the environmental impacts of the proposed closure operations, drawing on the impact and risk assessment in Appendix 16.

20.1 Air Quality Impacts

20.1.1 Sources

Sources of dust include:

- transport of fill material to the intended locations in PM248. This includes construction rubble, natural soils and Calsilt
- unloading of fill material
- shaping and compaction of fill
- pick up of dust from the surface of filled areas
- travel on dirt roads in the salt fields

There are no sources of odour associated with bulk earthworks operations in PM248. Odour from exposure of acid sulfate soils will not occur as the cover over these soils will be retained. The design of bulk earthworks will not allow water to pool for an extended period and become stagnant.

20.1.2 Pathways

The pathway for dust impacts is provided by wind moving the air offsite. The critical wind speed for pickup of dust from surfaces is 5 m/s. Above 10m/s, pick-up increases rapidly. Generally, this will occur with winds from the south-west or west.

Once emissions have occurred, only distance and weather conditions ameliorate / disperse concentrations of dust.

20.1.3 Receptors

As discussed in Chapter 12, a range of residential, pastoral, conservation, horticultural, commercial, and other land uses occur adjacent to the salt fields. Those most sensitive to dust impacts from PM248 include:

- residential suburbs and coastal townships (Globe Derby, Mawson Lakes). Housing at Globe Derby is as close as 100 m to the crystallising area of the salt fields and the salinas
- areas of conservation significance, including the Adelaide Dolphin Sanctuary (which extends partly over the salt field) and Barker Inlet Aquatic Reserve
- habitat for flora and fauna on or adjoining the salt fields.

20.1.4 Potential Impacts

Any fill material that is likely to generate dust during transport to the fill site will be moist or covered. In particular, Calsilt will be sufficiently saturated to control dust during transport and unloading. Consequently, dust impacts are expected to be negligible.

The main potential source of dust is from earthmoving operations in shaping and compacting fill. For geotechnical reasons, any fine material capable of producing dust will need to be sufficiently moist to allow adequate compaction. Acceptable soil moisture parameters will be specified in the detailed engineering design and endorsed by a suitable qualified Geotechnical Inspection Testing Authority. In

addition, should weather conditions and the moisture condition of the calsilt, soil or rubble indicate a non-negligible risk of dust, waster sprays will be deployed as a dust preventive measure.

Once bulk earthworks have been completed, there may be a period of time before development occurs in accordance with an approved Master Plan. Consequently, the soil surface will need to be left in a stable condition, either through establishment of vegetation, mulching, or the use of some other appropriate treatment. This will be further considered in the pilot bulk earthworks trial and detailed in the Minor Change Notification for each stage.

If dust is entrained from exposed surfaces or during earthworks, it will be comprised of a wide variety of size fractions. The larger deposited dust is material generally greater than 50 µm in diameter. It poses a nuisance potential due to soiling of surfaces and can cause irritation to eyes and nose. Because it is relatively large in size, deposited particulate usually falls out of the air within a short distance of the source (a few hundred metres).

The finer material is defined as suspended particulate. It is commonly referred to as Total Suspended Particulate or TSP. It is generally less than 20 µm and can travel large distances downwind. The portion of TSP that poses the greatest potential health effect is particulate less than 10 µm in diameter (known as PM_{10}) and particulate less than 2.5 µm (known as $PM_{2.5}$). PM_{10} is able to penetrate the upper respiratory tract and consequently has the potential to impact on public health. $PM_{2.5}$ can penetrate even further into the lung and is suspected of being the fraction of PM_{10} that is responsible for health impacts that can lead to an increase in morbidity and mortality in particular circumstances.

The major source of the finer particulates PM_{10} and $PM_{2.5}$ in the atmosphere is combustion processes, particularly for $PM_{2.5}$. The dust from wind erosion at PM248 is likely to be predominantly made up of larger size fractions (greater than 10µm).

Health impacts from exposure to PM_{10} and $PM_{2.5}$ are related to exposure time. The NEPM specifies an exposure time for PM_{10} of 24-hours with five exceedances of the specified concentration permitted annually. Short term exposure to any PM_{10} that may be entrained in dust from the salt field during a wind event (say over a period of an hour or so) is unlikely to exceed the NEPM 24-hour average concentration standard and, if it does exceed that standard due to unusual and persistent high wind speeds, this would be a rare event that would fall within the permitted annual exceedances.

Finally, it is also noted that the meteorological events that may lead to elevated dust erosion and suspended dust concentrations from the salt field would also result in low background concentrations of fine particulate (e.g. from other sources such as power stations or urban vehicle traffic) at receptors, due to the required wind direction and also the wind speeds occurring at the time.

It is concluded that significant adverse effects on health are therefore unlikely as a result of dust emissions from PM248.

The extensive area of the salt field is serviced by formed embankments. Travel in the salt field is limited to an upper speed of 40km/hr and this serves to reduce dust emissions. The embankments are dressed with a coarse gravel to reduce dust emissions. If tracks need to be used regularly for transport of fill, they will be treated with bitterns as a dust suppressant. Dust from vehicle operations is considered to have minimal impacts on neighbouring receptors.

Dust may also impact adjoining areas of conservation significance and habitat for flora and fauna. Impacts could occur through smothering of habitat, impacts on water quality or dust entering the food chain. Given dust events are episodic and short-lived, and the extent of dilution and dispersion that occurs, such dust impacts are expected to be negligible.

Expected impacts on air quality are summarised in Table 20-1.

Table 20-1: Expected air quality impacts

Event ID	Impact Event	Expected Impact	Significance
A1	Dust from transport and unloading of fill affecting the amenity of adjoining human receptors	No measurable impact expected	Negligible
A2	Dust from transport and unloading of fill affecting the health of adjoining human receptors	No measurable impact expected	Negligible
A3	Dust from earthworks affecting the amenity of adjoining human receptors	No measurable impact expected	Negligible
A4	Dust from earthworks affecting the health of adjoining human receptors	No measurable impact expected	Negligible
A5	Dust from exposed ground surfaces affecting the amenity of adjoining human receptors	Short term episodic impacts	Low
A6	Dust from exposed ground surfaces affecting the health of adjoining human receptors	No measurable impact expected	Negligible
A7	Dust from exposed ground surfaces affecting adjoining areas of conservation significance	No measurable impact expected	Negligible

20.1.5 Control and Management Strategies

The primary strategies for control and management of dust during bulk earthworks entail:

- ensuring fill material is maintained at a sufficient moisture content to minimise dust
- revegetation, mulching, or other treatment of the surface of filled areas to minimise dust pick up
- monitoring of dust at source and the mine boundary.

Dust monitoring will continue as described for the holding pattern and residual operations. In addition, monitoring will occur at the mine boundary when there is visible entrainment of dust at source.

20.1.6 Uncertainties and Limitations

Uncertainties relate to:

- The design of bulk earthworks, noting this will be informed by the pilot filling trial. However, as noted above, Calsit and other fill material will need sufficient moisture content to allow compaction. Consequently, geotechnical requirements will mean there is little likelihood of fine, dry material being handled.
- The surface cover of filled areas and, therefore, the propensity to produce dust. This will be specified in the bulk earthworks plan and Minor Change Notification. Consequently, there will be a high level of certainty regarding any surface treatment by the time fill operations commence.
- Natural background levels of dust, given the mix of land uses adjacent to the BDC site, and the presence of other sources among them. This makes it difficult to use measures of background levels to set realistic quantitative outcome measurement criteria that would be of practical help in preventing and mitigating dust impacts, or that would provide a practicable measure against which to assess the scale of any impact attributable to works on PM248. Consequently, monitoring of whether visible dust leaves the mine boundary, supplemented by the complaints register, is considered the most effective means to measure achievement of environmental outcomes. As with the holding pattern and residual operations, monitoring will

be escalated if necessary, in response to any complaints or if dust is observed leaving the mine boundary.

20.1.7 Risk Assessment

Excessive dust production during bulk earthworks will be immediately noticeable allowing action to be undertaken (such as using water sprays). Consequently, any dust incidents, if they did occur, would be in the order of hours (more likely minutes) in duration and restricted to a small number of receptors.

The risks that could result in greater than expected impacts, are considered to be acceptable. Further action to reduce risk is not considered necessary or practicable.

Table 20-2: Air quality risks

Event ID	Impact Event	Expected Impact	Likelihood of greater impact	Consequence of greater impact	Risk rating
A1	Dust from transport and unloading of fill affecting the amenity of adjoining human receptors	Negligible	Unlikely	Low	Negligible
A2	Dust from transport and unloading of fill affecting the health of adjoining human receptors	Negligible	Unlikely	Low	Negligible
A3	Dust from earthworks affecting the amenity of adjoining human receptors	Negligible	Unlikely	Low	Negligible
A4	Dust from earthworks affecting the health of adjoining human receptors	Negligible	Unlikely	Low	Negligible
A5	Dust from exposed ground surfaces affecting the amenity of adjoining human receptors	Low	Unlikely	Moderate	Low
A6	Dust from exposed ground surfaces affecting the health of adjoining human receptors	Negligible	Unlikely	High	Moderate
A7	Dust from exposed ground surfaces affecting adjoining areas of conservation significance	Negligible	Unlikely	High	Moderate

20.1.8 Proposed Outcomes

Surrounding receptors wish to protect their health and amenity. The very low number of dust complaints in the past indicates that short term episodic impacts on amenity are tolerated. More widespread or longer-term impacts on public amenity would be considered unacceptable. Consequently, BDC considers the following outcome is acceptable for closure operations:

- No adverse public health and or significant nuisance impacts due to air emissions, dust, pest insect species, odour, or noise

(A significant nuisance impact is considered to be one that generates a complaint that is confirmed as attributable to the closure operations and cannot be addressed within the timeframes specified in the measurement criteria.)

At mine completion, land surfaces need to be left in a condition that is stable and resistant to wind erosion. Consequently, the following mine completion outcome is proposed:

- No adverse impacts on adjoining land uses from dust or soil erosion and sediment transport.

20.1.9 Measurement Criteria

As bulk earthworks are not expected to produce significant dust and any incidents are only likely to produce a short-term nuisance impact, ongoing monitoring of dust deposition is not likely to provide useful information. Visual monitoring will be a more reliable way to identify any dust incidents. A complaints register will continue to operate so that any complaints can be investigated, and action taken where necessary. Consequently, the following measurement criteria are proposed:

- no visible dust generated by closure activities in Section 1 leaves the site, or
- register demonstrates that in respect of complaints relating to impacts outside site boundary from dust:
  - complaint initially responded to within 48 hours
  - issues underlying complaint investigated and causes identified within 2 weeks or other time frame agreed by DSD
- complaint closed out within 4 weeks or other time frame agreed by DSD.

Leading indicator criteria will be specified in the endorsed Construction Environment Monitoring and Management Plans for each Stage of Bulk Earthworks.

Minimum completion criteria for soil cover and any other relevant parameters will be defined in the endorsed Construction Environmental Monitoring and Management Plan for each stage of bulk earthworks.

20.2 Flora and Fauna

20.2.1 Sources of Potential Impacts

As the area in PM248 has been cleared of vegetation, there are no sources of direct impacts to flora and fauna.

Sources of potential indirect impacts on flora and fauna include:

- Dust deposition from bulk earthworks (addressed in 20.1)
- Changes to hydrological flows due to bulk earthworks (addressed in 20.4)

The bulk earthworks will not result in any new discharge points from Section 1.

20.2.2 Pathways

As there are no receptors directly affected by bulk earthworks, the pathways are through windblown dust or through changed water flows.

20.2.3 Receptors

The significant receptors are:

- areas of conservation significance adjoining the western boundary of the salt fields, including mangrove forests, tidal mudflats, and salt marshes
- marine life (flora and fauna) in water and sediment in tidal and intertidal parts of Gulf St Vincent, adjacent the site.

20.2.4 Potential Impacts

Dust impacts are discussed in 20.1 and hydrological changes are discussed in 20.4. Consequently, there are no further impacts to discuss in this Chapter or need for additional outcomes.

20.3 Soil Quality

20.3.1 Sources of Potential Impacts

Sources of impact include:

- PASS soils
- Potential contamination of soils from leaks and spills of chemicals or fuel from the bulk earthworks operations
- Exposure to salt impacted soils.

20.3.2 Pathways

The crystallisers have an engineered floor built over the natural ground comprising compacted fill and, over this, a compacted clay / calgrit layer. Salt operations have resulted in some disturbance to this layer through wheel ruts and scraping of salt but to a depth of no more than around 10 cm. Scraping of further salt will have a similar level of disturbance. This means that PASS soils within the natural ground will not be disturbed and there is no pathway for impacts from PASS / ASS to occur.

The pathway for leaks and spills of chemicals or fuels is through the soil. This is unlikely to affect existing use of land but could compromise future uses.

Exposure to salt could impact on future land use as high salinity can degrade infrastructure and inhibit establishment of vegetation.

20.3.3 Receptors

There are no current environmental values within the area to be filled in Section 1. The receptors of concern are those associated with future land uses.

Off-site receptors include:

- areas of conservation significance (Adelaide Dolphin Sanctuary, Barker Inlet Aquatic Reserve)
- adjoining habitat for flora and fauna, in particular, species of conservation significance
- adjoining agricultural / horticultural activities
- adjoining structures and buildings.

20.3.4 Potential Impacts

Spills of oils and fuels can occur in any operation of this type, however the quantities involved would most likely be small. The immediate impacts would be confined within the current salt pans. Additionally, spill containment measures are practiced, and clean-up undertaken if needed. The expected impact from spills is expected to be negligible. Surface and groundwater are vectors for offsite impacts but are discussed in 20.4 and 20.5.

The salt impacted soils from historic works represent a hazard for future development. As discussed in 19.2.2, the proposed design for the bulk earthworks includes a capillary layer to prevent movement of salt into the cover fill. The final design for the bulk earthworks will endorsed by an EPA accredited environmental auditor and a suitable qualified Geotechnical Inspection Testing Authority. Given these design measures, the expected impact from salt impacted soils is expected to be negligible.

Soil quality impacts are summarised in Table 20-3.

Table 20-3: Potential soil quality impacts

Event ID	Impact Event	Expected Impact	Significance
SQ1	Contamination of soil from leaks or spills impacts on current or future land uses	Any spills or leaks expected to be contained and/or of a magnitude that will allow easy clean-up	Negligible
SQ2	Exposure to salt impacted soils compromises future land use	No impact expected	Negligible

20.3.5 Control and Management Strategies

Existing measures to prevent, contain and treat spills of all types will continue:

- a spill kit is available for use in the event of vehicle accidents
- fuel tanks at the workshop are contained within bunds
- a 40km/hr. speed limit is mandatory across the mine site in order to reduce the likelihood of accidents.

As noted above, fill will be designed to prevent upward migration of salt. The Bulk Earthworks Plan will be reviewed by a suitably qualified Geotechnical Inspection Testing Authority as described above.

20.3.6 Uncertainties and Limitations

As fill design has not been finalised, its effectiveness is unknown. However, the use of a capillary break is widely practiced, and the pilot fill trial will inform the detailed design. Consequently, it is expected that the effectiveness of the proposed fill design will have been demonstrated by the time operations commence.

20.3.7 Risk Assessment

The bulk earthworks will not require use of chemicals so fuel and oil spills will be the primary risk. It can reasonably be expected that any spill can be cleaned up and the area remediated, if necessary, within a year. Consequently, the risk is considered to be low.

There is a risk that the design for bulk earthworks may not be effective in preventing upward movement of salt. Design failure could result in the need for moderate repair measures. However, such a consequence is considered to be unlikely.

Table 20-4 summarises the risk of greater than expected impacts relating to soil quality.

Table 20-4: Soil quality risks

Event ID	Impact Event	Expected Impact	Likelihood of greater impact	Consequence of greater impact	Risk rating
SQ1	Contamination of soil from leaks or spills impacts on current or future land uses	Negligible	Unlikely	Low	Negligible
SQ2	Exposure to salt impacted soils compromises future land use	Negligible	Rare	Moderate	Low

20.3.8 Proposed Outcomes

Spills and leaks can potentially compromise future land uses and have offsite impacts. Salt impacted soils could affect future land use. Consequently, the following closure outcomes are proposed:

- No compromise to potential future land use
- No adverse impacts to use of adjacent land or water.

At mine completion, no sources of spills of leaks remain so the remaining risk is that of upward migration of salts. The proposed mine completion outcome is:

- The bulk earthworks have created a landform that is suitable for the intended land use.

20.3.9 Measurement Criteria

Measurement criteria are proposed in Table 21-1. The criteria focus on ensuring endorsement of Bulk Earthworks Plan by appropriately qualified geotechnical, contamination and hydrological experts.

Closure criteria are in Table 21-2 and seek similar review by experts based on the constructed landform and quality assurance/quality control during construction.

20.4 Surface Water

20.4.1 Sources of Potential Impacts

Sources of potential impact include:

- Stormwater entering PM248 from offsite degrading water quality on site
- Changes to surface water flows due to bulk earthworks resulting in impacts on adjoining land uses.

The bulk earthworks do not require discharge of brine to the marine environment (noting that this is occurring as part of the residual operations).

20.4.2 Pathways

The pathway for the impact events above is water.

20.4.3 Receptors

Receptors include:

- residents surrounding PM248
- marine life (flora and fauna) in water and sediment in tidal and intertidal parts of Gulf St Vincent near PM248
- areas of conservation significance near PM248.

There are no environmental receptors for surface water on site.

20.4.4 Potential Impacts

The salt fields are bunded with an external perimeter seepage drain and largely isolated from externally sourced runoff. The one exception is overflow from a Salisbury City wetland outside the south-east boundary of Section 1. The E Row drain, and flap is used to conduct overflow from the wetland through Section 1 to Dry Creek. This function will be preserved and will have no impact on filling works. Consequently, offsite stormwater is not expected to impact water quality on PM248.

The bulk earthworks will change surface water flows within the site and potentially result in offsite impacts. These could include changes to stream flows, flood management and stormwater management outside the site. However, any discharge from Section 1, including PM248, can only occur through a deliberate managed discharge. This is because it lies behind a sea wall and is an isolated surface water system. Unless action is taken to discharge water, the default position is that all surface water remains within Section 1.

Nevertheless, as previously discussed, the Bulk Earthworks Plan for each stage of filling will be reviewed by a qualified hydrologist to ensure any planned offsite impacts are acceptable. As surface water on Section 1 of the salt fields has been a successfully managed system for many years, adverse offsite impacts are not expected.

Surface water impacts are summarised in Table 20-5.

Table 20-5: Expected surface water impacts

Event ID	Impact Event	Expected Impact	Significance
SW1	Stormwater entering PM248 from offsite degrading water quality on site	No impact expected	Negligible
SW2	Changes to surface water flows affecting adjoining land uses.	No unmanaged offsite surface water flows expected	Negligible

20.4.5 Control and Management Strategies

Existing surface water management structures will be maintained where needed during bulk earthworks. This will include external bunding to ensure stormwater from adjoining areas does not enter the site or leave in an uncontrolled way. As noted above, the Bulk Earthworks plan will be reviewed by a hydrologist and any further management measures identified through that review will be implemented.

Erosion and sediment control measures will be used to ensure any runoff from bulk earthworks has low turbidity. If discharge from the site is required, this will be via an EPA licensed point at Dry Creek or North Arm and will be monitored to ensure there is no adverse impact on the marine environment.

20.4.6 Uncertainties and Limitations

Uncertainties relate to the design of the bulk earthworks and these will be addressed through the review process.

20.4.7 Risk Assessment

Any unplanned incursion of external stormwater onto the site would be minor and able to be readily addressed. Unplanned hydrological impacts on surrounding land uses could potentially require longer to rectify, should they occur, and have been assessed as a moderate consequence. Given the site is currently a managed system that prevents impacts occurring without control, and any filling will be reviewed by a hydrology expert, this consequence is assessed as having a rare likelihood.

Table 20-6 summarises the risks of greater surface water impacts than expected.

Table 20-6: Surface water risks

Event ID	Impact Event	Expected Impact	Likelihood of greater impact	Consequence of greater impact	Risk rating
SW1	Stormwater entering the salt fields from offsite degrading water quality on site	Negligible	Unlikely	Low	Negligible
SW2	Changes to surface water flows affecting adjoining land uses.	Negligible	Rare	Moderate	Low

20.4.8 Proposed Outcomes

As there are no environmental values on site relevant to surface water, the outcome for closure operations is to ensure there are no adverse impacts to use of adjacent land or waters.

The proposed mine completion outcome is the final landform ensures no adverse impacts on adjoining land uses from changed surface water flows or quality.

20.4.9 Measurement Criteria

The measurement criteria for the closure operations are based on a review of the Bulk Earthworks Plan by an appropriately qualified and experienced hydrological engineer to confirm there will be no adverse impacts on the use of adjacent land or waters as result of:

- Consequential changes to stream flows, flood management and stormwater management outside the site
- Consequential changes in the quality and quantity of any water discharge from the site
- Erosion or sedimentation caused by the bulk earthworks.

For each stage of Bulk Earthworks, an endorsed Construction Environment Monitoring and Management Plan will set out how, where and when impacts to adjacent land use will be monitored, prevented, and managed.

Mine completion will require a suitably qualified and experienced hydrological engineer to confirm:

- that the As Constructed landform will accommodate the tidal and stream levels and flows, flood levels and flows and stormwater flows associated with the intended land use
- the quality of water within and discharged from the As Constructed landform will not have adverse impacts on the use of land or water within or outside the site.

20.5 Groundwater

20.5.1 Sources of Potential Impacts

Sources of potential impact include:

- Use of groundwater impacting other users
- Contamination impairing quality of infiltration to groundwater at the site
- Changes to groundwater impacting groundwater dependent ecosystems
- Changes to groundwater quality and pressure impacting surface water and/or the marine environment.

20.5.2 Pathways

The pathway for the impact events above is water. Seepage and leaching of water to groundwater also occurs.

20.5.3 Receptors

There are no groundwater environmental values that can be impacted by bulk earthworks. Shallow groundwater in the area is hypersaline and unsuitable for any use. Given the compacted clay / calgrit layer under the crystallising ponds, seepage is minimal and will be further reduced by bulk earthworks.

The only other receptors are current users of groundwater from the T1 aquifer. No further abstraction of groundwater would be required beyond the current licenses for the residual operations and holding operations. Consequently, these receptors will not be impacted.

20.5.4 Potential impacts

Given the absence of groundwater receptors that will be impacted by the bulk earthworks on PM248, no further impact assessment has been undertaken.

20.6 Noise

20.6.1 Sources of Potential Impacts

Sources of noise include:

- earthmoving machinery for bulk earthworks
- trucks transporting fill material.

20.6.2 Pathways

The pathway for transmission of noise is through the air.

20.6.3 Receptors

The main receptors are adjoining residents. Fauna on or near PM248 could also be receptors, however, activities on the site will be away from important roosting and foraging sites. Consequently, fauna are not considered further.

20.6.4 Potential Impacts

Historical noise from salt-making operations has rarely exceeded ambient levels due to the adjoining traffic on Port Wakefield Road and the Port River Expressway. Housing at Mawson Lakes, however, is approximately 200 m away from the boundary of the crystallising area and occasional noise issues have been reported in the past by residential neighbours.

Noise from bulk earthworks will be similar to the historical operations and may potentially cause limited nuisance impacts.

Table 20-7: Expected noise impacts

Event ID	Impact Event	Expected Impact	Significance
N1	Noise from machinery used in bulk earthworks adversely affects adjoining residents	Within regulatory limits and generally within background levels	Low

20.6.5 Control and Management Strategies

All equipment, including that used by contractors, is required to comply with relevant noise control policies and guidelines issued by the EPA. Night operation of construction equipment in investigations and trials is not proposed. A complaints register for noise will be maintained along with action taken.

20.6.6 Uncertainties and limitations

The equipment to be used in bulk earthworks has not yet been determined but can be reasonably assumed. Measures to manage construction noise are well developed and their effectiveness understood.

20.6.7 Risk Assessment

As the levels of uncertainty around existing noise levels are low, there is a negligible risk that greater noise impacts may result.

Table 20-8: Noise risks

Event ID	Impact Event	Expected Impact	Likelihood of greater impact	Consequence of greater impact	Risk rating
N1	Noise from machinery used in bulk earthworks adversely affects adjoining residents	Low	Unlikely	Low	Negligible

20.6.8 Proposed Outcome

Residents near PM248 expect their amenity will be maintained. Consequently, the following outcome is proposed:

- No adverse public health or significant nuisance impacts due to noise.

A mine completion outcome is not proposed as there will be no noise sources.

20.6.9 Proposed Measurement Criteria

Outcomes and proposed measurement criteria are presented in Table 21-1. As noise issues are only sporadic, the measurement criteria rely on maintenance of a complaints register and demonstration of appropriate action to respond to complaints.

20.7 Other Potential Impacts

20.7.1 Heritage

Heritage items could potentially be impacted by any excavation works. There will be no excavation associated with the bulk earthworks other than scraping of salt from the crystallising pans. This will only affect the surface and will not extend to the natural soil below the compacted clay / calgrit layer. Consequently, there are no sources of impacts to heritage items.

20.7.2 Traffic

External traffic access to the bulk earthworks in PM248 is from the Salisbury Highway. This is a major arterial road and salt field traffic accounts for a small percentage of overall traffic. Access to other areas of the salt fields is occasional and vehicle numbers are low. Consequently, the salt fields operations will have a negligible impact on traffic movement in the area around the salt fields.

20.7.3 Public Safety

The salt fields area is fenced, and the public excluded. The operating site is secured with heavy duty gates and padlocking at all road entry points and agricultural fencing along property boundaries that are accessible. Signage is provided along accessible fence lines at regular intervals. Residual operations occur on PM248 meaning there is a consistent presence on site.

While illegal access does occur, there are no significant risks on site other than vehicular traffic (e.g. there are no pit voids or other hazards normally associated with a mining operation). A vehicle speed limit of 40 km/h is enforced across the site. Consequently, no public safety impacts are expected, and risks are considered to be negligible.

20.7.4 Visual Amenity

The bulk earthworks will have an impact on the visual amenity of the site, but it will be observable to a small number of receptors. The more significant changes will occur when the area is developed in accordance with the Master Plan. Whether the loss of the crystallising pans represents an adverse impact on visual amenity depends on the views of the observer. It is an inevitable consequence of the change in land use for the area.

20.7.5 Conservation Areas

The Adelaide Dolphin Sanctuary and Barker Inlet Aquatic Reserve are located to the west of PM248. As they are hydraulically isolated from PM248 by a sea wall, there is no potential for bulk earthworks to impact on these conservation areas.

20.7.6 Waste Management

The bulk earthworks will generate relatively small quantities of waste. Any fuel drums will be recycled. The contractor involved will be responsible for disposal of any unserviceable tyres and other waste

Risks to the environment from management of wastes are considered to be negligible.

21 Environmental Outcomes and Measurement Criteria

This chapter provides the outcomes and measurement criteria for closure operations (Table 21-1) and for mine completion (Table 21-2). As such, this chapter complements the outcomes and measurement criteria for the Holding Pattern and Residual Operations.

This structure:

- enables the tables to be adjusted (in future PEPR Revisions) to include further information as each (part of) a Section as the Salt Field moves from its Holding Pattern and Residual Operations Phase to its Closure and Completion Phase
- allows for different parts of the site (even in the same Section of the site) to be in different phases
  - in the Holding Pattern and Residual Operations Phase
  - Closure Phase
  - Completion Phase.

Table 21-1: Environmental Outcomes and Measurement Criteria – Closure Activities

Environmental Outcome	Outcome Measurement Criteria				Leading Indicator Criteria	Compliance Reporting
	Measurement Criteria	What will be measured and how	Location	Frequency		
No adverse public health and or significant nuisance impacts due to air emissions, dust, pest insect species, odour, or noise (A significant nuisance impact is considered to be one that generates a complaint that is confirmed as attributable to the closure operations and cannot be addressed within the timeframes specified in the measurement criteria.)	**Closure operations in Section 1** **Dust** No visible dust generated by closure activities in Section 1 leaves the site, or Register demonstrates that in respect of complaints relating to impacts outside site boundary from dust: ▪ complaint initially responded to within 48 hours; ▪ issues underlying complaint investigated and causes identified within 2 weeks or other time frame agreed by DSD; ▪ complaint closed out within 4 weeks or other time frame agreed by DSD **Pest Insects** Register demonstrates that in respect of complaints relating to impacts outside site boundary from pests:	**Closure operations in Section 1** **Dust** Observer will monitor and record if dust is visible at the site boundary. Register of complaints received and response actions taken **Pest Insects** Register of complaints received and response actions taken **Odour** Register of complaints received and response actions taken **Noise** Register of complaints received and response actions taken. **Closure Operations in Section 2** TBA **Closure Operations in Section 3** TBA **Closure Operations in Section 4** TBA	**Closure operations in Section 1** **Dust** Dust will be monitored at the mine boundary as specified in the endorsed[2] Construction Environment Monitoring and Management Plans for each Stage of Bulk Earthworks. **Closure Operations in Section 2** TBA **Closure Operations in Section 3** TBA **Closure Operations in Section 4** TBA	**Closure operations in Section 1** **Dust** Monitoring of dust from closure activities in Section 1 is undertaken at the frequency specified in the endorsed Construction Environment Monitoring and Management Plan. **Pest Insects** Entries in register are triggered by complaints **Odour** Entries in register are triggered by complaints **Noise** Entries in register are triggered by complaints **Closure Operations in Section 2**	**Closure operations in Section 1** **Dust** As specified in the endorsed Construction Environment Monitoring and Management Plans for each Stage of Bulk Earthworks **Pest insects** Not required **Odour** Not required **Noise** Not required **Closure Operations in Section 2** TBA **Closure Operations in Section 3** TBA **Closure Operations in Section 4**	**Closure operations in Section 1** **Incident reporting** ▪ any dust, pest insect, odour or noise complaints reported to DSD within 48 hours of receipt ▪ progress reporting on resolution of complaint provided as directed by DSD ▪ report closing out complaint provided to DSD within 4 weeks, or timeframe otherwise agreed. ▪ any non-compliances with Measurement Criteria reported to DSD within 48 hours of occurrence. ▪ progress reporting on remedial action

[2] Reference throughout this table to an 'endorsed' plan means a plan contained in a minor change notification that has been endorsed by DSD or in an approved PEPR.

Environmental Outcome	Outcome Measurement Criteria				Leading Indicator Criteria	Compliance Reporting
	Measurement Criteria	**What will be measured and how**	**Location**	**Frequency**		
	▪ complaint initially responded to within 48 hours; ▪ issues underlying complaint investigated and causes identified within 2 weeks or other time frame agreed by DSD; ▪ complaint closed out within 4 weeks or other time frame agreed by DSD **Odour** Register demonstrates that in respect of any complaints relating to odour received outside the site boundary: ▪ records show that all reasonable and practicable measures have been taken to reduce odour from closure activities in Section 1. **Noise** Register demonstrates that in respect of any complaints relating to noise received outside the site boundary:			TBA **Closure Operations in Section 3** TBA **Closure Operations in Section 4** TBA	TBA	taken as directed by DSD. **Closure Operations in Section 2** TBA **Closure Operations in Section 3** TBA **Closure Operations in Section 4** TBA

Environmental Outcome	Outcome Measurement Criteria				Leading Indicator Criteria	Compliance Reporting
	Measurement Criteria	**What will be measured and how**	**Location**	**Frequency**		
	▪ records show that all reasonable and practicable measures have been taken to reduce noise from closure activities in Section 1. **Closure Operations in Section 2** TBA **Closure Operations in Section 3** TBA **Closure Operations in Section 4** TBA					
No adverse impacts to use of adjacent land or waters	**Closure Operations in Section 1** Internal audits completed at the specified intervals during each stage of bulk earthworks for closure confirm that the requirements of the Construction Quality Assurance Plan are being met and that bulk earthworks are consistent with the endorsed Bulk Earthwork Plan. No discharge from the site occurs other than at the EPA Licensed discharge	**Closure Operations in Section 1** As specified in the Construction Quality Assurance Plan for each stage of bulk earthworks. Parameters for monitoring of any discharge will be as specified in the EPA Licence. **Closure Operations in Section 2** TBA **Closure Operations in Section 3** TBA **Closure Operations in Section 4** TBA	**Closure Operations in Section 1** As specified in the Construction Quality Assurance Plan for each stage of bulk earthworks. The North Arm Creek Discharge compliance point is at: Lat: -34.826173, Long: 138.565533 Dry Creek Discharge compliance point" is at:	**Closure Operations in Section 1** As specified in the Construction Quality Assurance Plan for each stage of bulk earthworks. Monitoring of any discharge at frequency specified in the Construction Environmental Monitoring and Management Plan. **Closure Operations in Section 2** TBA	**Closure Operations in Section 1** As specified in the Construction Quality Assurance Plan for each stage of bulk earthworks. **Closure Operations in Section 2** TBA **Closure Operations in Section 3** TBA **Closure Operations in Section 4** TBA	**Closure Operations in Section 1** **Incident reporting** ▪ Any non-compliances with requirements in the Construction Quality Assurance Plan and Construction Environment Monitoring and Management Plans reported to DSD within 48 hours of occurrence.

Environmental Outcome	Outcome Measurement Criteria				Leading Indicator Criteria	Compliance Reporting
	Measurement Criteria	What will be measured and how	Location	Frequency		
	points. Quality of discharge water meets the EPA Licence criteria. **Closure Operations in Section 2** TBA **Closure Operations in Section 3** TBA **Closure Operations in Section 4** TBA		Lat: -34.826173° Long: 138.565533 **Closure Operations in Section 2** TBA **Closure Operations in Section 3** TBA **Closure Operations in Section 4** TBA	**Closure Operations in Section 3** TBA **Closure Operations in Section 4** TBA		▪ Progress reporting on remedial action taken as directed by DSD. ▪ Any changes to the Bulk Earthworks Plan are reported to DSD within 7 days. **Compliance reporting** ▪ As specified in the Construction Environment Monitoring and Management Plans for each Stage of Bulk Earthworks
No adverse impacts on other groundwater users	**Closure Operations in Section 1** Not required **Closure Operations in Section 2** TBA **Closure Operations in Section 3** TBA **Closure Operations in Section 4** TBA	**Closure Operations in Section 1** Not required **Closure Operations in Section 2** TBA **Closure Operations in Section 3** TBA **Closure Operations in Section 4** TBA	**Closure Operations in Section 1** Not required **Closure Operations in Section 2** TBA **Closure Operations in Section 3** TBA **Closure Operations in Section 4** TBA	**Closure Operations in Section 1** Not required **Closure Operations in Section 2** TBA **Closure Operations in Section 3** TBA **Closure Operations in Section 4** TBA	**Closure Operations in Section 1** Not required **Closure Operations in Section 2** TBA **Closure Operations in Section 3** TBA **Closure Operations in Section 4** TBA	**Closure Operations in Section 1** Not required **Closure Operations in Section 2** TBA **Closure Operations in Section 3** TBA **Closure Operations in Section 4** TBA
No loss of abundance or diversity of native	**Closure Operations in Section 1** Not required	**Closure Operations in Section 1** Not required	**Closure Operations in Section 1** Not required	**Closure Operations in Section 1** Not required	**Closure Operations in Section 1** Not required	**Closure Operations in Section 1** Not required

Environmental Outcome	Outcome Measurement Criteria				Leading Indicator Criteria	Compliance Reporting
	Measurement Criteria	What will be measured and how	Location	Frequency		
vegetation on or off Sections 2 to 4 of salt field through clearance arising from Holding Pattern, unless prior approval under relevant legislation is obtained	**Closure Operations in Section 2** TBA **Closure Operations in Section 3** TBA **Closure Operations in Section 4** TBA	**Closure Operations in Section 2** TBA **Closure Operations in Section 3** TBA **Closure Operations in Section 4** TBA	**Closure Operations in Section 2** TBA **Closure Operations in Section 3** TBA **Closure Operations in Section 4** TBA	**Closure Operations in Section 2** TBA **Closure Operations in Section 3** TBA **Closure Operations in Section 4** TBA	**Closure Operations in Section 2** TBA **Closure Operations in Section 3** TBA **Closure Operations in Section 4** TBA	**Closure Operations in Section 2** TBA **Closure Operations in Section 3** TBA **Closure Operations in Section 4** TBA
No adverse impacts on the environmental values of marine waters due to water discharge	**Closure Operations in Section 1** Compliance with the Environmental Outcome "**No adverse impacts to use of adjacent land or waters"** Closure Operations in Section 2 TBA Closure Operations in Section 3 TBA Closure Operations in Section 4 TBA	**Closure Operations in Section 1** Compliance with the Environmental Outcome "**No adverse impacts to use of adjacent land or waters"** Closure Operations in Section 2 TBA Closure Operations in Section 3 TBA Closure Operations in Section 4 TBA	**Closure Operations in Section 1** Compliance with the Environmental Outcome "**No adverse impacts to use of adjacent land or waters"** Closure Operations in Section 2 TBA Closure Operations in Section 3 TBA Closure Operations in Section 4 TBA	**Closure Operations in Section 1** Compliance with the Environmental Outcome "**No adverse impacts to No adverse impacts to use of adjacent land or waters"** Closure Operations in Section 2 TBA Closure Operations in Section 3 TBA Closure Operations in Section 4 TBA	**Closure Operations in Section 1** Compliance with the Environmental Outcome "**No adverse impacts to use of adjacent land or waters"** Closure Operations in Section 2 TBA Closure Operations in Section 3 TBA Closure Operations in Section 4 TBA	**Closure Operations in Section 1** Compliance with the Environmental Outcome "**No adverse impacts to use of adjacent land or waters"** Closure Operations in Section 2 TBA Closure Operations in Section 3 TBA Closure Operations in Section 4 TBA
No adverse impacts to avifauna using the site beyond internationally recognised impact	**Closure Operations in Section 1** Not required	**Closure Operations in Section 1** Not required **Closure Operations in Section 2** TBA	**Closure Operations in Section 1** Not required	**Closure Operations in Section 1** Not required	**Closure Operations in Section 1** Not required	**Closure Operations in Section 1** Not required

Environmental Outcome	Outcome Measurement Criteria				Leading Indicator Criteria	Compliance Reporting
	Measurement Criteria	What will be measured and how	Location	Frequency		
thresholds, or outside historic ranges of variability in Species and bird numbers	**Closure Operations in Section 2** TBA **Closure Operations in Section 3** TBA **Closure Operations in Section 4** TBA	**Closure Operations in Section 3** TBA **Closure Operations in Section 4** TBA	**Closure Operations in Section 2** TBA **Closure Operations in Section 3** TBA **Closure Operations in Section 4** TBA	**Closure Operations in Section 2** TBA **Closure Operations in Section 3** TBA **Closure Operations in Section 4** TBA	**Closure Operations in Section 2** TBA **Closure Operations in Section 3** TBA **Closure Operations in Section 4** TBA	**Closure Operations in Section 2** TBA **Closure Operations in Section 3** TBA **Closure Operations in Section 4** TBA
No compromise to potential future land use	**Closure Operations in Section 1** Internal audits completed at the specified intervals during each stage of bulk earthworks for closure confirm that the requirements of the Construction Quality Assurance Plan are being met. All chemical and hydrocarbon spills greater than 20 L are remediated within 48 hours of the spill, or a longer time agreed by the Director of Mines. Spills are considered to be remediated when an EPA Accredited Auditor confirms that affected area does not represent site contamination, as defined	**Closure Operations in Section 1** As specified in the Construction Quality Assurance Plan for each stage of bulk earthworks. As determined by an EPA Accredited Auditor for a chemical or hydrocarbon spill. **Closure Operations in Section 2** TBA **Closure Operations in Section 3** TBA **Closure Operations in Section 4** TBA	**Closure Operations in Section 1** As specified in the Construction Quality Assurance Plan for each stage of bulk earthworks. As determined by an EPA Accredited Auditor for a chemical or hydrocarbon spill. **Closure Operations in Section 2** TBA **Closure Operations in Section 3** TBA **Closure Operations in Section 4** TBA	**Closure Operations in Section 1** As specified in the Construction Quality Assurance Plan for each stage of bulk earthworks. As determined by an EPA Accredited Auditor for a chemical or hydrocarbon spill. **Closure Operations in Section 2** TBA **Closure Operations in Section 3** TBA **Closure Operations in Section 4** TBA	**Closure Operations in Section 1** As specified in the Construction Quality Assurance Plan for each stage of bulk earthworks. **Closure Operations in Section 2** TBA **Closure Operations in Section 3** TBA **Closure Operations in Section 4** TBA	**Closure Operations in Section 1** **Incident reporting:** ▪ Any non-compliances with requirements in the endorsed Construction Quality Assurance Plan and Construction Environment Monitoring and Management Plan reported to DSD within 48 hours of occurrence. ▪ Progress reporting on remedial action taken as directed by DSD. ▪ Any changes to the endorsed Bulk Earthworks Plan

Environmental Outcome	Outcome Measurement Criteria				Leading Indicator Criteria	Compliance Reporting
	Measurement Criteria	What will be measured and how	Location	Frequency		
	in the Environment Protection Act 1993. **Closure Operations in Section 2** TBA **Closure Operations in Section 3** TBA **Closure Operations in Section 4** TBA					are reported to DSD within 7 days. **Compliance reporting** As specified in the endorsed Construction Quality Assurance Plan and Construction Environment Monitoring and Management Plan for each Stage of Bulk Earthworks. **Closure Operations in Section 2** TBA **Closure Operations in Section 3** TBA **Closure Operations in Section 4** TBA

Table 21-2: Environmental outcomes and measurement criteria – mine completion, Section 1

Environmental Outcome	Outcome Measurement Criteria		
	Measurement Criteria	What will be measured and how	Locations
The Bulk Earthworks have created a landform that is	**Geotechnical** An As Constructed Report (ACR), prepared by a suitable qualified Geotechnical Inspection	**Geotechnical** The ACR will as a minimum include the following:	As defined in the relevant endorsed Bulk Earthworks Plan and associated Construction Quality

Environmental Outcome	Outcome Measurement Criteria		
	Measurement Criteria	**What will be measured and how**	**Locations**
suitable for the intended land use.	Testing Authority (GITA) consistent with AS 3798-2007, confirms that: ▪ The Bulk Earthworks have been completed in accordance with the appropriate endorsed[3] Bulk Earthworks Plan and associated Construction Quality Assurance Plan and Construction Environmental Monitoring and Management Plan; and ▪ The produced landform is geotechnically suitable for the intended land use (to be considered as "Residential" unless documented otherwise in an approved Master Plan or other suitable document). **Landform** A licensed or registered surveyor confirms the finished ground levels accord with the design finished levels in the appropriate endorsed Bulk Earthworks Plan and associated Construction Quality Assurance Plan **Environmental** An audit of the as constructed bulk earthworks, conducted in accordance with EPA Guidelines (www.epa.sa.gov.au/files/4771800_guidelines_sc_audit.pdf) by an EPA Accredited Auditor using criteria in the National Environment Protection (Assessment of Site Contamination) Measure and other relevant EPA policies and guidance, confirms it is suitable for the intended land use (to be considered as "Residential" unless	▪ All data and information produced by implementation of the Bulk Earthworks Plan, and associated Construction Quality Assurance Plan and Construction Environmental Monitoring and Management Plan ▪ Results of all observations, testing, and calculations necessary to demonstrate the extent to which the constructed bulk earthworks comply with the technical specifications. **Landform** The licensed or registered surveyor will either review and check a survey of the finished ground levels provided by the contractor for the bulk earthworks; or / and will conduct his / her own survey of the finished ground levels. **Environmental** The Auditor's report for each stage of Bulk earthworks for closure is to comply with EPA's guidelines for the conduct of Audits under the Environment Protection Act. It will review data in the ACR and produced by the implementation of the Construction Environmental Monitoring and Management Plan. **Hydrological** A suitably qualified and experienced hydrological engineer will base his / her report on a review of the ACR and the survey of the as constructed landform.	Assurance Plan and Construction Environmental Monitoring and Management Plan for each stage of bulk earthworks

[3] Endorsed as defined in Table 21-1

Environmental Outcome	Outcome Measurement Criteria		
	Measurement Criteria	**What will be measured and how**	**Locations**
	documented otherwise in an approved Master Plan or other suitable document). **Hydrological** A suitably qualified and experienced hydrological engineer confirms: ▪ that the As Constructed landform will accommodate the tidal and stream levels and flows, flood levels and flows and stormwater flows associated with the intended land use (to be considered as "Residential" unless documented otherwise in an approved Master Plan or other suitable document). ▪ The quality of water within and discharged from the As Constructed landform will not have adverse impacts on the use of land or water within or outside the site		
Final landform ensures no adverse impacts on adjoining land uses from changed surface water flows or quality.	Compliance with the Environmental Outcome **"The Bulk Earthworks have created a landform that is suitable for the intended land use"**.[4]		As defined in the relevant endorsed Bulk Earthworks Plan and associated Construction Quality Assurance Plan and Construction Environmental Monitoring and Management Plan for each stage of bulk earthworks

[4] This is because this compliance means that the intent of the endorsed Bulk Earthworks Plan has been achieved; and the endorsements of that plan included one by a suitably qualified and experienced hydrological engineer to the effect that the Bulk Earthworks will not cause adverse impacts on adjacent land uses as result of:

- Consequential changes to stream flows, flood management and stormwater management outside the site; or
- Consequential changes in the quality and quantity of any water discharge from the site; or
- Erosion or sedimentation caused by the Bulk Earthworks.

Environmental Outcome	Outcome Measurement Criteria		
	Measurement Criteria	**What will be measured and how**	**Locations**
No adverse impacts on adjoining land uses from dust or soil erosion and sediment transport	An As Constructed Report (ACR), prepared by a suitable qualified Geotechnical Inspection Testing Authority (GITA) consistent with AS 3798-2007, confirms that the soil surfaces following bulk earthworks have been stabilised in accordance with the endorsed Environmental Monitoring and Management Plan. :	As defined in the endorsed Construction Environmental Monitoring and Management Plan for each stage of bulk earthworks	As defined in Construction Environmental Monitoring and Management Plan for each stage of bulk earthworks