OPAL VALE SALT VALLEY ROAD CLASS II LANDFILL

LOT 11 CHITTY ROAD, TOODYAY

LANDFILL MANAGEMENT PLAN

Prepared for

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Table of Contents

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1. Introduction

This Landfill Management Plan (LMP) has been compiled as a guide to the ongoing development and operation of the Salt Valley Road Class II Landfill facility in order to ensure that the facility is operated in a safe and environmentally sustainable manner to maximise the efficiency of the operation as well as minimise the environmental impact on the surrounding area.

1.1. Background

Following an extensive planning approval process, on 13 June 2013, the State Administrative Tribunal (SAT) approved the facility development, subject to a number of conditions (Matter N. DR292 2012).

On XYZ (*date to be inserted once the Works Approval has been issued*), the Department of Environment Regulation (DER) issued the Works Approval No. XYZ (*to be inserted*) enabling the facility to be constructed.

Following construction of the necessary site infrastructure and the first landfill cell (Cell 1), on XYZ (*date to be inserted once the Licence has been issued*) the DER issued the facility operating Licence No. XYZ (*to be inserted*) enabling the facility to commence operations.

1.2. Aim

The aim of this LMP is to provide clear direction to the facility operators on how to best develop, operate and close the landfill facility so as to optimise landfill availability, while minimising any potential environmental impacts.

1.3. Reference Documents

The development, operation and closure of the facility is controlled by the following reference documentation:

<u>Planning Approval</u>

- Environmental Management for Rehabilitation of Clay Pit Class II Licence Landfill, Lot 11 Chitty Road, Toodyay – Landform January 2012; and,
- SAT Decision – DR292 of 2012, dated 13 June 2013.

Environmental Approval

- Works Approval Submission documents:
    - Opal vale Salt Valley Road Class II Landfill, Lot 11 Chitty Road, Toodyay – Works Approval Application Supporting Documentation – IW Projects 21 December 2014;
    - IW projects letter to the DER dated 15 May 2015 – Response to the DER letter dated 26 March 2015;
    - IW projects letter to the DER dated 5 July 2015 – Response to the DER letter dated 19 June 2015;
    - *Insert any additional documentation relating to the Works Approval process*
- Works Approval (originally No. WA XYZ) – current version to be used; and,
- Facility operating Licence (originally No. L XYZ) – current version to be used.

Note: The Works Approval and facility operating Licence have finite validity periods and need to be periodically renewed/replaced. There is a need to always have a current Works Approval and Licence, and the current versions of these documents are the applicable reference documents.

1.4. Environmental Commitment

Opal Vale commits to develop, operate and close the Salt Valley Road Class II Landfill facility in accordance with all relevant approval conditions, industry best practise and to minimise environmental impact.

2. Facility & Operational Description

2.1. Facility Overview

The landfill facility has been developed on a small portion of Lot 11 Chitty Road. Lot 11 is 619 ha in size, while the landfill licensed area (Prescribed Boundary incorporating the landfill, surrounding operational area and internal buffer zones) is approximately 50 ha in size. The landfill is located in the southeast corner of the lot, with the Prescribed Boundary being approximately 100 m from the south-eastern lot boundary (landfill is approximately 200 m from the lot boundary).

Access to the site is via Salt Valley Road, using the existing BGC clay extraction entrance and a 3 km internal assess road.

The landfill will be developed in two stages with each stage consisting of a number of individual landfill cells to cater for 1 to 2 year's waste deliveries.

2.2. Staged Development

Stage 1 of the landfill development will occur in the southeast portion of the existing clay pit. This stage will consist of six individual landfill cells, with two separate leachate collection and extraction systems. Based on forecast input tonnage, Stage 1 is anticipated to last approximately 10 years.

Stage 2 will be developed to the northwest of Stage 1, in an area of future clay extraction. While Stage 1 is being developed and operated, Austral Bricks will continue with clay excavation and progressively create the landfill airspace for the development of the Stage 2 landfill.

Stage 2 is anticipated to be a similar size development to Stage 1; however, this Stage is only expected to last approximately 8 to 9 years, based on a constant waste throughput of 150,000 t/yr and no ramp-up of annual tonnage as experienced in Stage 1.

2.3. Available Landfill Airspace

Based on the proposed landfill design, the Stage 1 landfill available airspace is approximately 1.5 million m³. The future Stage 2 landfill is anticipated to have similar available landfill airspace; however, the ultimate volume will be dependent on the extent of continued clay excavation.

Available landfill airspace is a combination of the clay void and aboveground airspace; consequently, there is more available landfill airspace than there is clay extraction void.

2.4. Landfill Life Expectancy

At an annual landfill incoming waste tonnage of approximately 150,000 tonnes, with an anticipated landfill waste density of 0.85 t/m^3 (which includes a component of waste settlement over time), the waste will consume approximately 175,000 m³ of airspace annually. Based on the available landfill airspace in Stage 1, the landfill is anticipated to have a life expectancy of approximately 8.5 years. With the anticipated gradual increase in annual waste quantities up to the maximum anticipated 150,000 tonnes per year, it is likely that the Stage 1 landfill will have a life expectancy of approximately 10 to 12 years. The ultimate landfill duration will be dependent on the annual waste tonnage received and the actual waste density achieved.

The Stage 1 development has been broken down into six individual landfill cells that will be progressively developed. **Table 2.4.1 – Landfill Cell Capacity** provides information on the estimated size and anticipated life expectancy of each landfill cell.

Table 2.4.1 – Landfill Cell Capacity

Landfill Cell	Available Airspace	Annual Tonnage	Life Expectancy
Stage 1			
Cell 1	110,000 m^3	50,000 t	1.8 years
Cell 2	270,000 m^3	100,000 t	2.2 years
Cell 3	120,000 m^3	100,000 t	1.0 years
Cell 4	330,000 m^3	150,000 t	1.9 years
Cell 5	240,000 m^3	150,000 t	1.3 years
Cell 6	430,000 m^3	150,000 t	2.5 years
Stage 1 Total	1,500,000 m^3		10.7 years
Stage 2			
Cell 7	250,000 m^3	150,000 t	1.4 years
Cell 8	250,000 m^3	150,000 t	1.4 years
Cell 9	250,000 m^3	150,000 t	1.4 years
Cell 10	250,000 m^3	150,000 t	1.4 years
Cell 11	250,000 m^3	150,000 t	1.4 years
Cell 12	250,000 m^3	150,000 t	1.5 years
Stage 2 Total	1,500,000 m^3		8.5 years
Landfill Total	**3.000,000 m^3**		**19.2 years**

The above life expectancy is highly dependent on the annual tonnage received at the landfill facility.

As per the DER landfill development guidelines, the ideal is to have an individual landfill cell completed within two years of commencing waste placement.

Depending on the quantity of waste being received at the site, if the quantity is significantly different (lower or higher) than anticipated above, the size of the future individual landfill cells will be amended to achieve the target of a maximum two-year duration for each cell.

Over the life of the landfill it is anticipated that there will be a fluctuation in the quantity of waste delivered to site. This will be impacted by the availability of other Class II waste disposal options within the Perth metropolitan and surrounding areas as well as the rate of future recycling in the waste industry.

2.5. Facility Operational Overview

The primary operational activities on site will include the following:

- Landfill cell development.
- Waste receival.
- Waste placement.
- Cover material application.
- Surface water management.
- Groundwater management.
- Leachate management.
- Landfill gas management.
- Dust management.
- Litter management.
- Odour management.
- Noise management.
- Reporting of operational activities.
- Community communication.
- Complaints management.
- Progressive closure of completed cells.
- Final closure of the landfill.
- Monitoring and maintenance of the closed landfill areas.

2.6. Facility Operating Hours

The facility operating hours are as follows:

- Monday to Saturday – 7.00 to 18.00
- Sunday and Public Holidays – Closed

The landfill site will be permanently staffed during all hours of operation.

At the end of each day of operation, the site entry gate will be locked.

The site will not be left unattended while the entrance gate remains unlocked.

Appropriate signage will be maintained at the Salt Valley Road main entrance to the site providing details to customers and the general public of the facility operating hours.

The sign will also include contact information for after hour's incidents.

3. Interaction With Quarrying Operations

At the time of developing the landfill, clay extraction had created a void of approximately 1 million m^3, with a further 0.5 million m^3 of landfill airspace being created aboveground.

In an average year, there will be approximately 25,000 m^3 of clay removed. Including an additional 50% airspace being created aboveground; hence, there will be about 37,500 m^3 of landfill airspace created annually on site. Initially there is anticipated to be approximately 70,000 m^3 of landfill airspace being consumed annually. This could eventually increase to 175,000 m^3 within approximately five years (based on an annual waste intake of 150,000 tonnes). With approximately 1,500,000 m^3 of airspace available in Stage 1, within 10 to 12 years, the landfill activities will have consumed all available airspace; however, during the 10 to 12 years, the clay extraction would have progressed down the valley and generated a further 400,000 m^3 of void, which, allowing for aboveground landfilling equates to an additional 600,000 m^3 of landfill airspace. While this volume is being filled with landfill, the clay extraction progresses even further. Consequently, it is likely that the clay extraction will stay ahead of the landfill activities. The actual rate of progression of the clay extraction will be dependent on the Austral Brick clay product demand and hence, will be a variable quantity.

The Opal Vale has an agreement with Austral Bricks that, if the landfill catches up with the clay extraction activities, Opal Vale will assist in the excavation of the clay in advance of the waste placement to ensure that the landfill operation is not negatively impacted. The excavated material will be stockpiled in dedicated areas for future removal by Austral Bricks.

As part of the clay extraction activity, all the substandard clay material (from a brick and tile making point of view) will be used for cell construction, landfill daily cover and selected materials used as final landfill capping.

4. Facility Operating Licence

The landfill is to be operated in accordance with the DER issued facility operating Licence. The Licence sets out the conditions and constraints by which the facility is to be operated.

All staff members, including where applicable, all contractors' staff, are to be fully aware of the requirements of the Licence as applicable to their specific activities/responsibilities on site.

A copy of the Licence will always be readily available on site as a point of reference to guide facility operations.

The facility operating Licence will be periodically renewed/amended by the DER. The latest version of the Licence will be used to guide facility operations.

5. Occupational Health and Safety

All landfill activities will be carried out in a safe and structured manner to ensure that occupational health and safety is the primary consideration on site and the well-being of all users of the site including operators and customers be ensured.

The landfill activities are governed by WorkSafe and the *Occupational Safety and Health Act 1984* and associated Regulations, while the clay extraction activities (both Austral Bricks and BGC) are governed by the *Mines Safety and Inspection Act 1994* and associated Regulations.

These two sets of safety regulations have different requirements and liabilities for the responsible parties; consequently, wherever possible, the two activities are to be kept clearly separate.

6. Staffing and Staff Induction/Training

Table 6.1 – Staffing Structure and Responsibilities sets out the required on-site staffing levels to adequately operate the landfill facility.

Table 6.1 – Staffing Structure and Responsibilities

Designation	*No.	Responsibility
Landfill Supervisor	1	Overall management of the site including all compliance requirements
Weighbridge Operator	2	Waste receival and weighbridge operations. One staff in attendance at all times.
Landfill Operator	4	Waste inspection, placement, compaction and covering. Minimum two in attendance at all times. Occasional need for a third operator.
General Hand	1	General site activities.
Contract Labour	2	Litter collection, general assistance.
Landfill Gas Contractor	As determined by the contractor	Landfill gas extraction system installation, operation and monitoring

* Indicates the number of staff employed, not necessarily the number of staff in attendance at any one time. Includes rotation and back-up staff.

There will be some sharing of activities between staff to cover for lunch breaks, holiday leave, sick leave and unplanned absences.

In addition to the above site based staff, there will also be the Landfill Business Manager, Environmental Officer and administration support staff who will be assisting in the smooth operation of the facility; however, will not be permanently based on site.

All site based staff, contractors and visitors are to undergo a thorough site induction on first arriving on site. Only visitors that will be permanently supervised while on site will not be required to undertake the site induction.

Activity specific training will also be provided to the staff and contractors as required based on their on-site activities.

All staff and contractors are to undergo refresher training as a minimum every two years or as specified within individual activity management plans.

7. Site Infrastructure

7.1. Site Office, Crib Room and Ablutions

The site office, crib room and ablutions will be provided at the weighbridge, which is positioned at the entrance to the landfill site.

7.2. Vehicle Parking

Parking for private cars will be provided at the weighbridge.

Parking for landfill mobile plant will be provided at the works lay-down area.

The waste compactor and waste dozer will be parked on the landfill.

7.3. Fencing

7.3.1. Access Control

Site fencing will be established around the landfill operational area that will prevent stock wandering into the site and uncontrolled vehicle access. The site entrance gate(s) will be securely locked when the site is unmanned.

The fence will be positioned on the Prescribed Boundary (the official landfill boundary), or in a more suitable location based on operational requirements.

7.3.2. Litter Control

Immediately surrounding the active landfill area and the leachate ponds there will be a 2 m chain link mesh and barb wire fence to act as a litter collector and access prevention.

Depending on the prevailing wind direction and location of landfilling there will be a 4 m high temporary/mobile litter fence immediately adjacent to the landfill tipping area to improve litter management.

On a regular bases or at least weekly, the site operations staff will undertake regular fence line inspections to ensure the integrity and effectiveness of all site fencing as well as the removal of any accumulated litter that may have blown onto the fence.

8. Landfill Plant and Equipment

8.1. List of Plant and Equipment

The following is a list of plant and equipment to be utilised on site:

- 4 x 4 Ute.
- Landfill waste compactor.
- Waste dozer.
- Excavator.
- Dump truck/tipper.
- Water tanker/fire truck.
- Leachate extraction and recirculation pumps.
- Other associated minor equipment.

8.2. Plant and Equipment Operational Requirements

The 4 x 4 ute is used for general access around site.

The landfill waste compactor and waste dozer are required for the placement and compaction of waste on the active tipping area and the spreading of cover material at the end of each day.

The excavator and dump truck/tipper are required for the excavation, loading, hauling and tipping of cover material.

The water tanker/fire truck is used for dust suppression and fire fighting.

Leachate extraction pumps include the submersible pumps permanently positioned in the leachate collection sumps as well as leachate recirculation pumps for moving leachate from the leachate ponds back to the landfill surface.

8.3. Plant and Equipment Maintenance

All plant and equipment will be maintained in accordance with manufacturer's recommendations.

Records of all maintenance activities are to be kept on site.

8.4. Plant and Equipment Breakdown

With the exception of the 4 x 4 ute, all landfill equipment listed above will be seen as critical equipment for the efficient and effective operation of the landfill site and as such, there will be contingency planning to cover for the eventuality that there is an unscheduled breakdown of a piece of plant or equipment.

Due to the high cost of the vast majority of the plant and equipment, it is not feasible to have standby assets on site; consequently, there will be a contingency plan in place to be able to temporarily replace each asset within 24 hours of the unscheduled breakdown.

The vast majority of the plant and equipment will be “off the shelf” items and readily available for hire if needed, the exception being the waste compactor. In the event that a waste compactor is not available for immediate hire, this piece of plant will be temporarily replaced by a large dozer (minimum D9 or equivalent).

As part of contingency planning, the availability of the above hire plant and equipment will be regularly (at least annually) checked and contact details of the suppliers maintained on site for immediate action in the event of an unplanned breakdown.

9. Weather Station

Basic weather data will be collected on site to assist in the efficient management of the landfill activities.

Daily rainfall records will be maintained to assist in understanding the leachate generation and evaporation capacity of the landfill.

An ability to accurately observe the wind direction will be required to assist in dealing with dust and litter management as well as providing data if a complaint were received. Wind direction will be observed from a windsock positioned where it represents the general direction of the wind blowing across the landfill. Ideally this windsock will be easily observed from the active landfill area as well as the site office.

10. Site Security

The primary site security will be the perimeter fencing and locked gate (when the site is unattended). This will restrict uncontrolled access to site.

Due to the rural nature of the site, there will be the possibility that the site can be broken into. To limit temptation and to protect landfill assets, where possible, all assets of value (including fuel) will be kept securely under lock and key.

In the event of break-ins, remote cameras will be strategically placed in an attempt to identify the offenders.

11. Operational Activities

11.1. Landfill Cell Development

The landfill will be developed in a series of cells, with each cell being sized to accommodate approximately one to two years' landfill airspace requirements. However, the actual life expectancy of each landfill cell will be highly dependent on the quantity of waste being delivered to site.

Due to the existing shape of the clay pit and the fact that the future clay extraction will be occurring downhill of the landfill (in the direction in which the leachate will flow), the landfill will be developed in two stages. Stage 1 will be developed within the existing void, while Stage 2 will be developed in the future clay excavation void.

11.1.1. Approval Requirements

All landfill development on site will be covered by a valid Works Approval.

At least six months prior to the expiry of the current Works Approval or consumption of available approved landfill airspace, the relevant technical documentation will be prepared and submitted to the DER for the next Works Approval so that it can be issued prior to the expiry of the current Works Approval. It is essential to give the DER at least four months (ideally more) to review the application documentation and issue the new Works Approval.

11.1.2. Timing of Development

The planning for the construction of the next landfill cell will be programmed well ahead of the closure of the current active landfill cell. Site specific factors that will influence the timing of planning and construction include:

- Available useful airspace on the active cell. Planning should strive to have the next landfill cell constructed and ready for operation at least six months prior to the current landfill cell reaching maximum capacity;
- Annual waste disposal quantity;
- Time of the year. It will be extremely difficult to construct a landfill cell during the winter months. The ideal will be to complete all cell construction before the onset of winter and then leave the newly constructed cell to stand over winter, whereby any accumulated rainfall will be utilised as clean water (provided there is an ability to temporarily separate the new cell leachate drainage from the existing leachate drainage);
- Duration to obtain a new Works Approval (if required);
- Design and construction duration; and,
- Duration for the DER to review the construction completion documentation and amend the facility operating Licence to allow the new cell to be utilised.

11.1.3. Sizing of Landfill Cells

Each new landfill cell will be sized to accommodate between 1 and 2 year's waste disposal. Site specific factors that will influence the size of a landfill cell include:

- Annual waste disposal quantity;
- Waste density being achieved;
- Shape of the landfill base and how the new cell fits into the overall design;
- Landfill airspace achieved over previous cells and side batters; and,
- When the transition from the previous cell to the new cell is anticipated to occur.

11.1.4. Cell Construction

Design

The original landfill design has been developed to comply with the DER landfill development guidelines (*Victorian EPA Best Practice Environmental Management; Siting, Design, Operation and Rehabilitation of Landfills – October 2014*). All future landfill design will be in accordance with this guideline, or any subsequent DER guidelines.

It is noted that these guidelines were developed by the EPA in Victoria and hence, not all aspects of the guidelines are directly applicable or relevant to the Western Australian landfill industry.

Stability Assessment

As part of the DER landfill development guidelines, there will be a need to carry out a comprehensive landfill stability assessment for each Works Approval application. This has been done for the original Works Approval and has demonstrated that the design is stable and appropriate. The stability analysis has been based on theoretical material properties. As part of the construction process, once the actual construction materials are received on site, samples are to be provided to the stability assessment consultant (the consultant that undertook the stability assessment for the cell being constructed) so that the actual material properties can be tested to confirm that the theoretical assumptions were appropriate.

In the event that these construction materials are deemed of lower property to the theoretical assumptions, the stability assessment consultant will provide technical advice on how best to address the situation.

Construction

Cell construction will be carried out by suitably qualified construction contractors, including suitably qualified sub-contractors (specifically the lining installation and leak detection sub-contractors).

Construction will be programmed to occur in the dry summer months as undertaking earthworks in a clay pit during winter is particularly challenging. In addition, this would cause delays to the project timing and consequently project construction costs. The lining installation will also be hindered by wet weather, again with the subsequent negative impact on project timing and cost.

Construction Quality Assurance

As part of the landfill development guidelines, there will be an extensive Construction Quality Assurance process that will be followed during the landfill cell construction. All related earthworks will be undertaken with Level 1 geotechnical engineering supervision and testing. All lining and leachate system installation works will be undertaken with fulltime inspection by a suitably qualified individual.

On completion of the works, a Construction Quality Assurance Report covering both the earthworks and the liner installation will be prepared for submission to the DER as confirmation that the works have been completed in accordance with the CQA Plan.

Commissioning

The new landfill cell will only be able to commence receiving waste once the DER has amended the facility operating Licence to include the new landfill cell or provide written instruction that landfilling may commence. This can only occur after the CQA report and Compliance Documentation have been submitted to, reviewed and accepted by the DER.

It is to be noted that this process could take a few weeks or even a few months to be completed. It is advisable to liaise closely with the DER during this process to be aware of when the Licence will be issued.

Often, there will be a significant amount of operational pressure (lack of available airspace) to enter the new cell immediately on completion of construction. The timing of the issue of the Licence will be critical.

11.2. Waste Acceptance and Receival

11.2.1. Reference Documents

The facility operating Licence stipulates the class of landfill (Class II); hence, this determines what type of waste will be acceptable on site.

The acceptance of waste to the site will be governed by the DER *Landfill Waste Classification and Waste Definitions 1996 (As Amended)*. No waste will be landfilled that does not comply with the necessary waste acceptance criteria.

The applicable waste acceptance criteria will be strictly adhered to.

11.2.2. Material Types

Material types will consist of Class II material including the following:

- Class I waste
- C&I waste;
- C&D waste;
- Municipal waste; and,
- Contaminated soils up to Class II contamination thresholds.

The material will be originating from a wide range of construction, commercial, industrial and residential activities from within the Perth metropolitan area and potentially the surrounding shires; these include building & construction waste, light manufacturing, transport and freight services, mechanical workshops, offices, showrooms, shops, agriculture and residential properties.

The majority of the material delivered to the landfill site will be coming from the Resource Recovery Solutions waste sorting and transfer station in Bayswater. This facility is partly owned by the Director of Opal Vale Pty Ltd. The Bayswater facility sorts and recycles a significant percentage of the waste it receives, the Class II residue from this facility will be sent to the landfill.

The remainder of the incoming waste will be delivered by a range of other commercial waste collection companies or directly by the waste generators and will arrive at the landfill in a mixed form. Occasionally there will be dedicated loads of a single material type.

11.2.3. Landfill Operations Liability

The landfill supervisor will have the ultimate liability for the acceptance of waste into the landfill. It will be for the supervisor or his nominated representation to ensure that they have the necessary information, including, if applicable, laboratory analysis from the customer to adequately determine that the incoming waste stream is a Class II waste and hence will be acceptable on site.

Once the landfill supervisor accepts the waste, the customer will no longer be responsible for the waste, unless it can be conclusively demonstrated that the customer provided misleading information on the waste material.

11.2.4. Typical Conforming Waste Types

Typical conforming waste includes the following:

- Clean fill;
- Type 1 inert waste (C&D waste);
- Putrescible wastes (Class II waste);
- Contaminated solid waste meeting waste acceptance criteria specified for Class II landfills (possibly with specific Licence conditions);
- Type 2 Inert Wastes (with specific Licence conditions); and,
- Type 1 and Type 2 Special Wastes (for registered sites as approved under the Controlled Waste Regulations).

11.2.5. Asbestos Waste

The landfill site will accept asbestos containing material.

The control of materials containing asbestos products will be a critical management aspect within the facility.

It is deemed advantageous to the greater community to allow asbestos materials to be accepted on site. This ensures the appropriate handling and disposal of asbestos material.

Asbestos material will be accepted on site if it is appropriately wrapped and sealed in plastic; however, if substandard asbestos is received, it will be wrapped accordingly on site. The delivered material will be immediately taken to landfill where the asbestos will be appropriately buried within the landfill, in a specially allocated area within the landfill that will be appropriately coordinated and recorded.

An Asbestos Management Plan has been developed that addresses the receipt, handing and disposal of asbestos on site. The plan covers the following aspects:

Prevention/Inspection

- All customers will be advised that asbestos will only be accepted if it is handled in accordance with the asbestos handling procedure;
- Inspection of incoming loads by facility operations personnel; and,
- Confirmation that asbestos is appropriately wrapped.

Disposal (identified loads)

- Asbestos is laid on the landfill and not tipped from height;
- All asbestos will only be landfilled within a dedicated area of the landfill;
- Unloaded and covered; and,
- Disposal details recorded in the asbestos disposal register.

Handling of Asbestos (substandard loads)

- Wearing of appropriate PPE when handling asbestos;
- Separation of asbestos material from general loads;
- Wrapping asbestos in a manner to prevent asbestos fibres entering the atmosphere;
- Applicable labelling of wrapped materials;
- Methodology for unloading wrapped materials at the tipping face;
- Methodology for landfilling asbestos material; and,
- Maintenance of an asbestos disposal register.

All asbestos handled on site will be managed in accordance with the Asbestos Management Plan.

Appendix No. 1 – Asbestos Management Plan provides a copy of the Asbestos Management Plan.

11.2.6. Typical Non-Conforming Waste Types

Non-conforming waste could be the following:

- Liquid waste;
- Hazardous, intractable and problematic waste;
- High hazard flammable; and,
- Class III and Class IV waste.

Waste entering the site that is identified as non-conforming waste will not be allowed to be landfilled and will be immediately rejected. Depending on the type of non-conforming waste material, the material will be directed to another appropriate waste disposal location. Under no circumstances will the non-conforming waste be landfilled on site.

11.2.7. Customer Enquiries

When customers make enquiries for the disposal of waste material, the onus will be on the landfill supervisor to ensure that the customer provided adequate documentation to clearly substantiate what type the material is. This information will include, where necessary the following:

- Origin of the waste;
- The name of the waste generator;
- The type of waste;
- A description of the waste material;
- The process that generated the waste material;
- The quantity of material;
- Laboratory analysis (correct number of samples for the proposed quantity);
- Information on waste handling (consistency, odour, moisture content, special handling requirements); and,
- Any other information that may be relevant for the particular waste type.

11.2.8. Weighbridge

On arrival at the site, all waste delivery vehicles will register at the weighbridge.

The following activities will be undertaken in dealing with each waste load:

- Customers will be required to provide information on the source and type of waste material being delivered. Due to vehicles either being covered (transfer trailers and bins vehicles) or sealed (compactor vehicles), it will not be practical/possible to visually inspect the waste material at the weighbridge; however, an elevated camera will be mounted on the weighbridge gatehouse to enable the weighbridge operator to, where possible, monitor the contents of the incoming vehicles.
- The incoming load will be weighed over the weighbridge and as a minimum, the following information recorded:

- Date and time of entry;
- Customer name;
- Vehicle registration number;
- Type of waste delivered, including the identification of any asbestos;
- Waste load weight (either by deducting the vehicle's stored tare weight from the gross weight or reweigh of empty vehicle on exiting the facility);
- Origin of waste delivered (metropolitan or non-metropolitan for landfill levy purposes);
- Disposal location (asbestos waste only);
- Rate charged;
- Total charge for the load; and,
- Total GST charged for the load.

- Once the vehicle has been weighed in, the vehicle will progress to the active landfill tipping area.

11.2.9. Waste Inspection

On arrival at the site, the following inspection related activities will be carried out in dealing with each waste load:

- At the weighbridge the vehicle driver will confirm the waste type.
- As far as is practically reasonable, each load will be visually inspected prior to acceptance through the weighbridge.

  It is noted that this is not a comprehensive inspection of the bin/vehicle/contents, as the vast majority of the load will be obscured by the tarp, bin or vehicle.
- Enquiries will be carried out in order to identify:
  - Material type;
  - Material quantity;
  - Material origin; and,
  - Non-conforming material types.
- Material deemed conforming will be allowed to progress to the landfill tipping area.
- Material deemed non-conforming will not to be allowed to progress to the tipping area and shall be sent off site.
- For conforming loads that are instructed to progress to the landfill tipping area, these loads will be further inspected during the unloading process (improved inspection opportunity).

- On arrival at the tipping area, the vehicle will reverse into a specific area as directed by the site operations staff. While the vehicle/bin is being unloaded, one of the facility operators will inspect the material as it is being discharged to confirm that the material is acceptable and that there is no non-conforming material identifiable in the load.
- On completion of the tipping operation, the delivery vehicle departs the landfill.
- The landfill waste placement equipment will then push the waste to the final disposal location. During this pushing activity, there will be a further opportunity to identify any easily observable non-conforming waste material.

11.2.10. Waste Rejection

If during the waste acceptance or placement exercise non-conforming waste is identified and the customer has departed the site, the non-conforming waste will be separated and appropriately stored (typically stockpiled or placed in a waste bin located on the landfill area). If the customer can be identified, then the customer will be instructed to collect the waste and remove it from site. If the customer cannot be identified, then arrangements will be made for the removal of the non-conforming waste material from site. These arrangements will be made as soon as possible, but within 48 hours of the waste being discovered.

With regards to hazardous waste, it is highly unlikely that hazardous waste will be delivered to the landfill, but in the event that hazardous waste was discovered and the customer was unknown, then, if necessary, a specialist waste removal contractor will be immediately called in to remove the waste and any contaminated soil on which the hazardous waste was laid. If the hazardous waste has been spread out, it will still be scooped up by the landfill compactor and managed as described above.

Only waste that complies with the DER *Landfill Waste Classification and Waste Definitions 1996 (as amended)* as applicable to Class II landfill site will be accepted on site.

11.2.11. Record Keeping

A record of the weighbridge database will be maintained on site as well as, on a daily basis; a copy will be transmitted to the head office.

11.2.12. Tare Weight Recording

The weighbridge software will have the ability to store the tare weight of the waste delivery vehicles.

For vehicles that visit the site on a regular basis, the vehicle's tare weight will be stored on the weighbridge software. Thereafter, it will only be necessary for the vehicle to record its gross weight on entry into the landfill and a weighbridge docket produced.

In order to maintain an accurate tare weight, each vehicle will be required to re-tare every 30 days.

It will be important to ensure that the tare weight is representative of the weight of the empty vehicle. If the vehicle (eg. skip bin truck) is likely to have a different configuration of bin each time it arrives on site, then it will not be possible to record an accurate tare weight that will be representative of its tare weight over a 30 day period.

For vehicles that only visit the site occasionally, it will not be necessary to store a tare weight.

11.2.13. Customer Information

On delivery of the first load of waste by a certain customer, the customer details will be recorded into the weighbridge software. This information will include the following:

- Customer name;
- Customer address (physical and postal);
- Customer contact phone numbers;
- Customer email address;
- Vehicle type;
- Vehicle registration; and,
- Customer payment method.

Account customers will only be accepted by pre-arrangement through head office.

11.2.14. Transaction Docket

If the vehicle has a stored tare weight, then a transaction docket will be produced on entry to the site.

If no tare weight is stored, then the transaction docket will be produced on exiting the site.

The transaction docket will contain all the following necessary information:

- Date and time of entry;
- Customer name;
- Vehicle registration number;
- Type of waste delivered, including the identification of any asbestos;

- Waste load weight (either by deducting the vehicle's stored tare weight from the gross weight or reweigh of empty vehicle on exiting the facility);
- Origin of waste delivered (metropolitan or non-metropolitan for landfill levy purposes);
- Disposal location (asbestos waste only);
- Rate charged;
- Total charge for the load; and,
- Total GST charged for the load.

The driver will sign the docket and retain a copy for the customer's records. The original signed docket will be temporarily filed in the weighbridge office and as a minimum, on a weekly basis, sent to the head office.

11.2.15. Payment

Payment will either be via credit card or account.

All account customers will be pre-arranged and approved by head office prior to the acceptance of the first waste delivery.

No cash transactions will be accepted.

11.3. Waste Pre-treatment

There will be no pre-treatment of waste on site as the facility is fundamentally a landfill site.

The majority of the incoming waste will come from the Resource Recovery Solutions recycling and transfer station located in Bayswater (an affiliated company). The large portion of this waste will be residual waste from the facilities recycling operations.

11.4. Communication

The weighbridge and all landfill mobile equipment will have radio and mobile phone communication.

Pedestrians will have either radio or mobile phone communication.

The landfill will advertise which working channel will be utilised on site so that waste delivery vehicles, if they have the appropriate radios, will be able to communicate with the landfill operations and vice versa.

11.5. Waste Disposal and Placement

11.5.1. Vehicle Access

Vehicles will access the site from Salt Valley Road and follow the 3 km internal road up to the weighbridge. On exiting the weighbridge, the delivery vehicle will be instructed on how to get to the active tipping area and typically follow the appropriate site signage. On exiting the facility, the delivery vehicle will follow the reverse route.

The internal access road(s) from the weighbridge to the active tipping area will, from time to time be moved around to suit the location of the tipping area and to achieve the easiest assess possible for the waste delivery vehicles.

Where possible, the entrance road onto the active tipping area will be the easiest route, as the delivery vehicles are fully loaded on the way in. On the way out, when the vehicles are empty, the route may be marginally more difficult (highly dependent on the location and height of the active landfill area). Typically, where possible, the entrance route will be down hill and the exit uphill. This will only occur when the tipping area is below the entrance level to the landfill.

There will be adequate planning of the internal access roads to ensure that there will be year-round access to the active tipping areas. This planning will consider the following:

- Location of current and future tipping areas;
- How the individual waste cells will be filled;
- How to gain access over the waste mass;
- How to gain access to areas of future cell construction, which in some circumstances will have to be gained over the waste mass;
- The maximum gradient that vehicles can reasonably access (typically 1 V in 10 H);
- The road construction material to ensure that the roads are accessible during winter; and,
- Surface water drainage.

11.5.2. Active Tipping Area

The waste tipping location within the active landfill cell will be determined by the following:

- Progress of the landfill either horizontally or vertically.
- Final waste profile.
- Seasonal weather:
    - Wet weather – landfill on higher ground.
    - Dry weather - landfill anywhere.
- Wind direction (to reduce litter generation).

- Vehicle access;
    - Tipping area.
    - Turning circle.

On arrival at the active tipping area, as directed by the spotter, the waste delivery vehicle will stop on a hardstand area located close to the final waste disposal location and discharge its load. 4 m high mobile litter screens will be used in close proximity to the tipping area to improve litter collection and prevent excessive litter blowing away from the landfill site.

The deposited waste will be pushed into place by a dozer or waste compactor in layers not exceeding 0.5 m in depth. Once in the area of final disposal, the waste will be broken up and compacted by the waste compactor. This will be achieved by a minimum of three to five passed of the compaction vehicle. Subsequent loads of waste will be placed on top of this waste and similarly broken up and compacted.

The waste tipping area will be kept as small as possible, but to a maximum width of 30 m and a maximum height of 2 m.

This process will be continued until the area of waste placement has reached its desired height or waste deliveries have ceased for the day. Thereafter, the compacted waste will be covered with a 150 mm layer of daily cover material or an alternative daily cover solution utilised to cover all waste.

A 300 mm layer of intermediate cover will be placed over all waste that will not have subsequent waste placed over it within three months. This will provide an improved cover to the waste mass over an extended period.

The formation of the waste mass within each landfill cell will be in accordance with the individual landfill cell filling plans. The maximum slope of the internal waste batters will be 1 V in 2.5 H.

There may be the situation where a specific load of waste will be tipped in a different location and not in the area of the active tip face:

- Waste material deemed as suitable for cover material or road material will be stockpiled separately for subsequent use.
- Used car tyres will be spread out throughout the waste mass; hence a large load of tyres will need to be spread out on the tipping area and progressively covered by future waste placement so that the landfill will eventually pass over the top and cover them.
- Asbestos waste will be placed in dedicated areas within the landfill (in accordance with the site Asbestos Management Plan).

The placement of waste will take into account the physical and chemical properties of the waste. Where possible, sandy waste will be placed on top of coarse waste in order to fill voids around the course material. Acidic waste will not be placed with alkaline waste (and vice versa). Flammable waste (plastic and vehicle tyres) will be evenly distributed throughout the waste mass to reduce the chance of a large, uncontrolled fire within the landfill.

The landfill will undergo progressive closure; hence, all waste will be placed in specific areas to complete the final design profile as soon as possible in order to allow the capping and closure of portions of the landfill to occur as soon as possible.

11.5.3. Vehicle Tipping Location

The vehicle tipping area will be set up to ensure easy vehicle access to the predetermined area. To reduce the distance that the waste placement equipment needs to push the waste, the tipping location will be positioned as close as is possible to the final waste disposal location.

The tipping area will be wide enough to facilitate the simultaneous tipping of at least three waste vehicles side by side. In the event that there be a semi-tipper (or similar large vehicle) off-loading a load of waste, it will be tipped in an area where, if it falls over, it does not land on another vehicle or landfill machine.

11.6. Recycling

There will be no recycling on site. The facility is a landfill operation only and all recycling that was to occur, would happen prior to the waste being delivered to site.

11.7. Cover Material Application

11.7.1. Requirement

It is a requirement of the facility operating Licence that the waste be covered on a daily basis.

Cover will be applied to the landfill surface to achieve the following:

- Surface stability.
- Surface trafficability.
- Fire control.
- Litter control.
- Odour control.
- Vermin control.

The use of cover material will be optimised so that excessive cover material will not be used unnecessarily. The amount of cover material used will be highly dependent on the condition of the waste surface onto which it will be being applied. The landfill operators will ensure that the compacted waste surface will be relatively smooth and firm before applying cover material. An irregular waste surface with excessive void space will result in significant quantities of cover material being consumed in order to achieve an adequate coverage.

The use of excessive cover material results in the following:

- Wasted effort in sourcing, covering and removing cover material;
- Waste of cover material; and,
- Waste of landfill airspace.

The benefits of immediately covering the final waste profile include:

- Earlier completion of portions of the landfill;
- Improved visual amenity;
- Reduced litter generation;
- Improved odour and vermin control;
- Improved surface water management;
- Reduced leachate generation; and,
- Decreased possibility of a surface fire.

An adequate supply of cover material will be essential for the continuous operation of the landfills. The landfill operators will always maintain adequate stockpiles of available cover material in close proximity to the active tipping face.

11.7.2. Waste Cover Options

Daily cover to be used will be a combination of the following:

- On-site clayey material that is unsuitable for clay product manufacture;
- Soil that is received over the weighbridge (eg. from local earthworks projects);
- Soil material specifically imported onto site for use as cover material; and/or
- Alternative daily cover:
    - Tarpaulin covers;
    - Chemical emulsions; or,
    - Paper Mache.

The most likely cover material source will be on-site waste clay material that is unsuitable for clay product manufacture, thereafter, soil received over the weighbridge. The selection of the other materials will be dependent on the quantity of cover material required and the availability of the first two choices.

11.7.3. Material Quantity

The waste will be placed in benches of maximum 2 m high, with a 150 mm cover of soil applied daily. This is a conservative position as in most circumstances, in a single day, there will be at least two benches placed on top of each other and only the final surface of the waste covered at the end of the day; hence, only requiring half the cover material.

Based on 150 mm cover per 2 m bench, there will be approximately 105,000 m^3 of cover material required for the 1.5 M m^3 of landfill airspace in Stage 1.

The daily or weekly cover material requirements will be highly dependent on the waste tonnage throughput.

At 50,000 t/yr waste throughput = 175 t/day, at a compacted waste density of 0.8 t/m^3 for newly compacted waste, this equates to 218.5 m^3/day of landfill airspace consumption. Which, at 0.07 m^3 cover/m^3 of airspace = 15.3 m^3/day of cover material consumption, or 84 m^3/week.

11.7.4. Material Sources

The sources of daily cover material include:

- On-site cover – waste clay material from the clay extraction operation. This excludes overburden material from the top 2 m of the soil profile, as this will be used for landfill capping material. During clay excavation, there will be some material that is excavated from the pit that is not suitable for brick or tile manufacture, some of this waste material will be used for fill material during cell construction, but there will still be substantial quantities available for use as daily cover;
- Soil received over the weighbridge. This is an unknown quantity and material type, but is likely to be similar to the surrounding soil types in the region (gravel, clay); and,
- Soil material specifically imported onto site. The cover material will be sandy, rubble material from the Resource Recover Solutions Bayswater recycling process. There will be an ample (60,000 t/yr) supply of this material, well in excess of what will be required for daily cover.

11.7.5. Daily Cover

A soil daily cover material will be applied at the end of each day's landfill operations. The cover material will be placed to a depth of 150 mm over all exposed waste surfaces or alternative daily cover material will be utilised as a substitute to the traditional soil cover material.

11.7.6. Intermediate Cover

A soil intermediate waste cover will be placed on all landfill slopes that are not going to be landfilled within three months. The intermediate cover will be a minimum of 300 mm deep and suitable spread and track rolled to cover all exposed waste and to enable surface water that lands on the intermediate cover surface to be shed away from the active landfill area.

Depending on the duration that the intermediate cover will be left in place, over time, erosion may reduce the cover layer thickness and it may be necessary to occasionally reinstate the intermediate cover material.

The naturally occurring clayey soils on site are an ideal intermediate cover material as it is more resistant to erosion (water and wind) than a typical sandy material.

12. Environmental Protection Activities

12.1. Concept

The operations of the landfill facility will be carried out so as to minimise the potential negative impact on the local environment.

12.2. Contingency Planning

In the event that normal operational conditions do not adequately manage the environmental impact of an activity, there will be a need to implement contingency measures to further improve environmental management on site. These contingency measures will be dealt with against each potential environmental impact below.

12.3. Surface Water Management

12.3.1. Concept

Surface water management will be an essential operational consideration to prevent surface water from entering the active landfill area and to prevent contaminated surface water from exiting the landfill.

Uncontaminated Surface Water

The site is located on the crest of a hill and does not intersect any drainage lines and receives no upstream run-off water; consequently, there will be no major work associated with the diversion of surface water away from the landfill development.

The design of the landfill facility includes a 1 m high perimeter bund all the way around the active landfill area this will ensure that there is no surface water flow into the landfill. Outside the landfill perimeter bund is an access road and beyond that is a 1 m deep stormwater drain to divert any surface water flow away from the landfill footprint and into adjacent natural watercourses. This “nominal” stormwater diversion infrastructure will be adequate to ensure that there will be no surface water entering the landfill footprint.

During facility operations, regular monitoring of the condition of these drains will be undertaken to ensure that the efficiency of the drains will be maintained. This will be checking that the drains do not fill up with sediment and hence overflow or that there is no excessive erosion in the invert of the drains.

Within the clay excavation, but outside of the landfill area, all surface water collected will be retained within the pit, in storage pond(s) excavated within the clay pit. The availability of surface water will remain a critical aspect on site. Historically, the clay extraction and farming activities have consumed all available surface water collected within the pit and peripheral diversion drains. With the inclusion of the landfill activities, conservation of surface water will become even more critical; hence, the need to conserve surface water.

Any surface water runoff from around the landfill site that enters the external water storage dam will be monitored for turbidity and contamination, but not salinity (as the landfill has no impact of salinity).

Should the water quality in the dam be determined as substandard, depending on the water quality, it will be retained in the dam, used as dust suppression water or treated as leachate.

Contaminated Surface Water

With regards to the potential for surface water contamination, there are a number of site-specific features/safeguards that will be implemented to minimise the potential for any contamination of the watercourse. These include the following:

- No upstream water catchment (no potential for flooding into the landfill);
- Minimum 1 m high perimeter bund surrounding the landfill to separate it from any surface water;
- Perimeter stormwater drains to divert any localised runoff away from the landfill area;
- Lined landfill to contain leachate;
- Naturally occurring clayey soil to further improve the leachate containment;
- Large portion of the landfill is below ground; hence, improved control of surface water runoff;
- Active leachate collection system on top of the landfill liner;
- Leachate evaporation ponds to receive and evaporate leachate;
- Minimum 500 mm freeboard to all leachate evaporation ponds;
- Water storage dam immediately downstream of the landfill to collect any possible contaminated surface water runoff and allow an opportunity to monitor the quality of the surface water; and,
- In excess of 2.5 km of watercourse downstream of the landfill before the watercourse exits the site (significant opportunity to remediate any surface water contamination if it should occur).

Based on the above, there will be substantial surface water management mechanisms in place to prevent surface water contamination; however, within the landfill footprint, there will be a need to adequately manage surface water runoff so as to clearly separate contaminated surface water on the exposed landfill areas from the uncontaminated surface water on the temporarily capped or permanently capped surfaces.

The profile of the waste mass will be the most critical aspect when controlling surface water runoff. All exposed waste surfaces (uncovered or daily covered areas) will slope into the active landfill, while all covered (intermediate or final cover) areas will slope away from the active landfill.

During the formation of the individual waste lifts (2 m high), care will be taken to ensure that the surface will be finished off with a definite fall into the active landfill area. All subsequent lifts will follow this same shape. In the event of heavy rain, the surface water will then naturally flow down into the centre of the landfill and percolates into the waste mass.

The temporary waste batters shaped to flow out of the landfill will be immediately covered with intermediate cover material (min. 300 mm thick) so that any surface water runoff does not come into contact with the waste material. This intermediate cover material will be regularly inspected to ensure that erosion does not expose any waste and hence result in surface water contamination.

At the interface between the active landfill area (flowing into the landfill) and the intermediate capped area (flowing out of the landfill), there will be a minimum of a 500 mm earthen bund installed along the edge. This will prevent any accidental surface water runoff from the active landfill area flowing down the intermediate capped area and off the landfill.

All capped landfill areas have been designed to fall away from the landfill; hence, there will be no surface water contamination issues in this portion of the landfill.

12.3.2. Water Quality Limits

The maximum standards to be applied to the quality of the surface water within the external surface water dam will be as follows:

- Turbidity Limits:
    - Dry Weather – Max. 50 NTU, Medium 25 NTU;
    - Stormwater Flow – Max. 100 NTU, Medium 50 NTU.
- *DER Stock Watering Guidelines 2010* (based on the accepted beneficial downstream water use).

Salinity monitoring is not included as the landfill activity will have no impact on salinity and that this is seen as a natural occurring circumstance on site.

Should sampling and testing indicate that the surface water in the storage dam is above the maximum defined limits, then this water will be used for dust suppression on the landfill surface or in the extreme case, classified as leachate and treated accordingly.

In the event that only elevated turbidity is encountered, the stored water will either be left to stand in the dam until the subsequent programmed testing event, or will be used for dust suppression on the internal site access roads (not on the landfill footprint).

No surface water will be discharged from within the clay excavation; hence, no sampling and analysis will be undertaken at this location, unless this is a condition of the facility operating licence.

12.3.3. Monitoring

The surface water storage dam outside the clay void will be sampled and analysed at least every six months to ascertain the effectiveness of the surface water management system.

Regular monitoring of the surface water drainage systems and capped surfaces will be required to ensure the effectiveness and efficiency of these aspects of the surface water control mechanism. As a minimum a comprehensive inspection will occur before the onset of winter rains and also after any extreme rain events.

12.3.4. Risk Assessment

A risk assessment of all identified potential environmental risks associated with the management of surface water has been undertaken. The primary consideration being the potential impact on the adjacent creek lines surrounding the landfill site and the surface water storage within the clay void.

The emissions and discharge risk assessment framework has been taken from the *DER Corporate Policy Statement No. 07 – Operational Risk Management*.

Emissions Risk Matrix utilised in the risk assessment is based on the following:

Likelihood	Consequence				
	Insignificant	**Minor**	**Moderate**	**Major**	**Severe**
Almost Certain	Moderate	High	High	Extreme	Extreme
Likely	Moderate	Moderate	High	High	Extreme
Possible	Low	Moderate	Moderate	High	Extreme
Unlikely	Low	Moderate	Moderate	Moderate	High
Rare	Low	Low	Moderate	Moderate	High

The outcome of the risk assessment is that there is a low risk of surface water impact to the creek line to the north of the landfill site and a low to moderate risk of contamination of the surface water storage within the clay void as a result of the proposed activities.

Table 12.3.4.1 – Surface Water Risk Assessment provides the detail of the risk assessment.

Table 12.3.4.1 – Surface Water Risk Assessment

Emission Source Description	Environmental Impact Risk	Management Tools and Mitigation Options/Factors	Activation Trigger and Corrective Action	Monitoring of Corrective Action Efficiency	Contingency Action if Corrective Action is Ineffective	Likelihood & Consequence	Risk Level
Upstream run-off water	Inundation of surface water drainage system around the landfill.	The site is located on the crest of a hill and does not intersect any drainage lines and receives no upstream run-off water. A function of the physical nature of the site; hence, no management intervention required.	A function of the physical shape of the site. No corrective action required.	A function of the physical shape of the site. No monitoring required.	A function of the physical shape of the site. No contingency action required.	Rare & Minor	Low
	Uncontaminated surface water flowing into the landfill and adding to the quantity of leachate on site.	The design of the landfill facility includes a 1 m high perimeter bund all the way around the active landfill area this will ensure that there is no surface water flow into the landfill. 1 m deep stormwater drain to divert any surface water flow away from the landfill footprint and into adjacent natural watercourses. Regular inspection of drains will be undertaken to ensure that the efficiency of the drains is maintained.	Activation Trigger: • Additional inspection of surface water drainage system prior to the onset of winter rains. • Additional inspection of surface water drainage system following heavy rainfall events. Corrective Action: • System repair and maintenance as required.	On completion of any repair or maintenance works, further monitoring of the surface water system following heavy rains.	Improved engineering solutions for the repair or maintenance of the surface water drainage system.	Rare & Minor	Low
Surface water within clay excavation	Uncontaminated surface water flowing into the landfill and adding to the quantity of leachate on site.	All surface water collected will be retained within the pit, in storage pond(s) excavated within the clay pit. Landfill cells are surrounded by minimum 2 m high perimeter bunds to ensure surface water does not come into contact with the waste and is directed to the storage pond(s). The farming, clay and landfill operations are net consumers of water; hence, the stored water is a valuable commodity and is consumed during summer month.	A function of facility design, not operation. No corrective actions.	A function of facility design, not operation. No monitoring required.	A function of facility design, not operation. No contingency action required.	Rare & Minor	Low

Emission Source Description	Environmental Impact Risk	Management Tools and Mitigation Options/Factors	Activation Trigger and Corrective Action	Monitoring of Corrective Action Efficiency	Contingency Action if Corrective Action is Ineffective	Likelihood & Consequence	Risk Level
		There will be no net accumulation of water within the pit; hence, no possibility that the pit will become inundated and flood the landfill. Ongoing adjacent clay extraction activity occurring downhill from landfill activity; hence, any possible flooding will occur in the clay extraction area and not the landfill area.					
Contaminated surface water on the landfill	Leachate escapes beyond the lined landfill area and contaminates clean surface water.	Lined landfill to contain leachate. Naturally occurring clayey soil below the landfill liner to further improve the leachate containment. Active leachate collection and extraction system on top of the landfill liner. Adequate leachate pond storage capacity. Landfill cells are surrounded by minimum 2 m high perimeter bunds within the clay void to ensure leachate is contained within the lined landfill area. Progressive waste lifts formed to ensure surface water flows into the landfill and not to the external slopes. Minimum 500 mm earth bund at the interface between the waste lift working surface and external waste batter to prevent any contaminated surface water flowing down the outside, external landfill batters. Application of daily cover to absorb most rainfall events and reduce surface water flow on the waste surface.	Activation Trigger: • Prior to onset of winter rains. • During and after heavy rainfall events. • Surface water monitoring detects elevated contamination levels. Corrective Action: • Inspection of covered and capped landfill areas. • Inspection of active landfill areas. • Investigate possible causes for the contamination and implement the appropriate response plan - These could include replacing eroded cover material, modifying the fall on the active landfill area to ensure surface water flows into the landfill, replacing earth bund on the interface between the active landfill and the external batter and more regular application of cover material.	Monitoring will be dependent on the corrective action undertaken, but may include: • Measuring the thickness of the daily and intermediate cover material. • Monitoring how regularly cover material is applied. • Inspecting the integrity of the earth bund on the interface between the active landfill. • Checking the fall on the active landfill area. • Observing the performance of the corrective actions during a heavy rainfall event.	Increasing the thickness of the daily or intermediate cover material layer. Installing a more comprehensive earth bund on the interface between the active landfill. Amendment to the landfill waste placement program to increase the fall on the active tipping area to ensure contaminated surface water remains on the active landfill surface.	Possible & Minor	Moderate

Emission Source Description	Environmental Impact Risk	Management Tools and Mitigation Options/Factors	Activation Trigger and Corrective Action	Monitoring of Corrective Action Efficiency	Contingency Action if Corrective Action is Ineffective	Likelihood & Consequence	Risk Level
		External waste batters immediately covered with a minimum 300 mm intermediate cover material or permanently capped and rehabilitated. Regular inspection of formed waste profile to ensure adequate drainage control of surface water. Regular inspection or intermediate cover and permanent capped areas to ensure adequate cover material is in place to prevent surface water contact with waste material. Immediate cleanup of any identified leachate spills beyond the landfill perimeter. Sampling and analysis of surface water to monitor water quality.					
Leachate management system failure	Leachate escapes beyond the lined leachate ponds and contaminates clean surface water.	Leachate modelling undertaken based on extremely conservative model input assumptions. Leachate evaporation ponds designed to cater for anticipated worst-case scenario leachate generation and rainfall events throughout the life of the landfill. Minimum 500 mm freeboard to all leachate evaporation ponds to ensure no over-topping of the pond perimeter bund. Regular inspection of leachate ponds and recording leachate depth to ensure that the minimum freeboard is maintained. Leachate pumping only to occur while the site is occupied. This activity will be governed by automatic pump controls restricting	Activation Trigger: • Less that 500 mm freeboard in any leachate pond. Corrective Action: • Balance leachate quantity in all/some ponds to ensure minimum freeboard is maintained. • Increase effort of leachate management to reduce leachate quantity on site.	Monitor the level of the leachate ponds to ensure minimum freeboard is maintained.	Tanker leachate off site.	Rare & Minor	Low

Emission Source Description	Environmental Impact Risk	Management Tools and Mitigation Options/Factors	Activation Trigger and Corrective Action	Monitoring of Corrective Action Efficiency	Contingency Action if Corrective Action is Ineffective	Likelihood & Consequence	Risk Level
		pump operations to predetermined operating hours. Sampling and analysis of surface water to monitor water quality.					
	Leaking or burst leachate pipe and contaminates clean surface water.	Leachate pumping only to occur while the site is occupied. Aboveground leachate pipes enabling easy identification and repair of any leaks. Regular inspection of leachate pipes. Sampling and analysis of surface water to monitor water quality.	Activation Trigger: • Inspection identifies leaking or damaged pipe. • Leachate flow ceases during pumping. Corrective Action: • Pipe to be immediately repaired. • Stop pumping and inspect leachate pipeline. Pipe to be immediately repaired. • Clean up spill and remove all contaminated soil.	Inspect repaired pipe once pumping resumes.	Redo repair if initial effort was insufficient.	Rare & Minor	Low

12.3.5. Surface Water Response Plan

In the event that the six-monthly monitoring, or other monitoring of the surface water bodies identifies contamination above the discharge thresholds, a response plan will be implemented. This response plan will incorporate the following:

- Identification of the elements that have exceeded the discharge limits. This will potentially indicate the type of surface water management mechanism that has failed and resulted in the contamination;
- Consider the impact of the discharge limit exceedance:
    - If the impact will be inconsequential (eg elevated turbidity in the external surface water storage dam), ignore the event from a Response Plan point of view and either use the stored water for dust suppression or retain the water in the dam until the subsequent programmed monitoring event;
    - If the impact will be significant (eg. evidence of leachate in the external surface water storage dam), action the response plan;
- Undertake a full inspection of the area upstream of the detected contamination to identify any system failures;
- Rectification of the system failure but implementing a temporary solution as a quick fix until the area dries out sufficiently or if possible, implement a permanent solution in the first place;
- Undertake further inspections further-afield to identify if the same problem is occurring elsewhere; and,
- Consider amending the standard operating procedures if the current procedures are ineffective (eg. thicker intermediate cover in certain areas to improve erosion resistance).

It is not possible to develop a response plan that covers each likely eventuality and proposed feasible solutions to those possible problems. In the event that a problem is identified, the appropriate specialist will be engaged to develop an incident specific remedial solution. Depending on the degree of the incident, the DER may need to be involved in the process.

12.4. Groundwater Management

12.4.1. Concept

Groundwater contamination was and continues to be an essential consideration when developing the landfill facility. Significant effort was undertaken to identify the depth to groundwater and the background quality thereof. The landfill design has and will continue to be substantially developed around protecting the groundwater from contamination.

Unlike surface water, groundwater contamination is a slow process of gradual percolation of leachate into the ground and once occurring, is impractical to rectify the cause within a short timeframe; consequently, the impact thereof will be potentially a long-term issue.

Depending on the source of contamination, remedial actions will be available; however, are generally very slow and extremely expensive to undertake. Consequently, there has and will continue to be significant effort put in during design and construction to ensure that the best quality infrastructure be installed.

In addition, ongoing groundwater monitoring will be undertaken by a specialist contractor to monitor the condition of the groundwater to identify any possible contamination.

The groundwater will be protected from potential landfill impact by the following site-specific attributes and actions:

- Natural environment (low permeability soils);
- The substantial landfill lining system;
- Selective waste receival (only Class II material);
- Ongoing leachate management;
- Progressive landfill closure;
- Comprehensive capping system;
- Cap rehabilitation; and,
- Post closure repair and monitoring.

With all of these protection mechanisms in place, it is still an industry-wide accepted fact that all landfill liners leak (generally through construction defects). However, based on the protection measures, the leakage would be minimal and of no environmental consequence.

12.4.2. Groundwater Contamination Limits

There are no defined contamination limits for groundwater, but typically the *DEC (2010) Fresh Water Guidelines* will be used as a benchmark to determine if there is some impact on the groundwater occurring. The quality of the background groundwater will also be a considering factor.

12.4.3. Monitoring

The groundwater was monitored prior to the development of the landfill and this information has provided the background data on the site.

Ongoing groundwater monitoring will be undertaken by a specialist contractor to monitor the condition of the groundwater to identify any contamination. The frequency of monitoring and the range of parameters to be analysed will be as stipulated in the facility operating Licence.

12.4.4. Risk Assessment

A risk assessment of all identified potential environmental risks associated with the management of groundwater has been undertaken. The primary consideration being the potential contamination of groundwater by leachate.

The emissions and discharge risk assessment framework has been taken from the *DER Corporate Policy Statement No. 07 – Operational Risk Management*.

Emissions Risk Matrix utilised in the risk assessment is based on the following:

Likelihood	Consequence				
	Insignificant	**Minor**	**Moderate**	**Major**	**Severe**
Almost Certain	Moderate	High	High	Extreme	Extreme
Likely	Moderate	Moderate	High	High	Extreme
Possible	Low	Moderate	Moderate	High	Extreme
Unlikely	Low	Moderate	Moderate	Moderate	High
Rare	Low	Low	Moderate	Moderate	High

The outcome of the risk assessment is that there is a low risk of groundwater impact as a result of the proposed activities, the exception being a moderate risk of groundwater contamination via leakage through the landfill liner.

Table 12.4.4.1 – Groundwater Risk Assessment provides the detail of the risk assessment.

Table 12.4.4.1 – Groundwater Risk Assessment

Emission Source Description	Environmental Impact Risk	Management Tools and Mitigation Options/Factors	Activation Trigger and Corrective Action	Monitoring of Corrective Action Efficiency	Contingency Action if Corrective Action is Ineffective	Likelihood & Consequence	Risk Level
Leachate within the landfill	Leakage of leachate through the liner and into the groundwater.	Compliance with the DER landfill development guidelines ensures the appropriate design and construction of the landfill liner. Modelling of the liner design has indicated that it complies with the DER landfill development guidelines from leakage and stability point of view and that it is fit for purpose.	Activation Trigger: • Inability to obtain a Works Approval (due to substandard infrastructure design). Corrective Action: • Amend design to comply with the appropriate guidelines.	Able to obtain a Works Approval.	Further amendments to the design to comply with the appropriate guidelines.	Rare & Minor	Low
		Appropriate construction quality control to ensure that the construction works are carried out to the required standards. Leak detection inspection of the constructed liner to identify any material or construction defects and subsequent repair of any defects identified.	Activation Trigger: • Substandard construction works identified. Corrective Action: • Increase site presence during construction activities.	Confirm construction works carried out according to specifications.	Rigorous enforcement of contract conditions. Withhold payment for works. Dispute resolution process.	Likely & Minor	Moderate
		Appropriate operation of the landfill to minimise leakage through the landfill liner: • Not compacting the first 2 m of waste placed on the new liner to prevent damage to the synthetic surface. • Maintaining a maximum of 300 mm of leachate over the landfill liner to reduce the hydraulic head on the liner and subsequently reduce leakage through any holes in the liner. • Progressive capping and rehabilitation of the landfill. Capping to occur as soon as practical on completion of	Activation Trigger: • Operator performance is identified as being substandard. • Groundwater bore monitoring detects contamination in the groundwater. Corrective Action: • Improve staff training and monitoring of performance in order to achieve the necessary standard of performance on site. • Additional focus on minimising the hydraulic head on the lining system. • Capping the completed	Confirm landfill operator performance is operated to best practise standards.	Replace operations staff.	Rare & Minor	Low

Emission Source Description	Environmental Impact Risk	Management Tools and Mitigation Options/Factors	Activation Trigger and Corrective Action	Monitoring of Corrective Action Efficiency	Contingency Action if Corrective Action is Ineffective	Likelihood & Consequence	Risk Level
		the final waste profile.	landfill areas as soon as possible.				
Contaminated surface water on the landfill	Leachate escapes beyond the lined landfill area and infiltrates into the groundwater.	Lined landfill to contain leachate. Naturally occurring clayey soil below the landfill liner to further improve the leachate containment. Active leachate collection and extraction system on top of the landfill liner. Adequate leachate pond storage capacity. Landfill cells are surrounded by minimum 2 m high perimeter bunds within the clay void to ensure leachate is contained within the lined landfill area. Progressive waste lifts formed to ensure surface water flows into the landfill and not to the external sloped. Minimum 500 mm earth bund at the interface between the waste lift working surface and external waste batter to prevent any contaminated surface water flowing down the outside, external landfill batters. Application of daily cover to absorb most rainfall events and reduce surface water flow on the waste surface. External waste batters immediately covered with a minimum 300 mm intermediate cover material or permanently capped and rehabilitated. Regular inspection of formed waste profile to ensure adequate drainage	Activation Trigger: • Prior to onset of winter rains. • During and after heavy rainfall events. • Groundwater monitoring detects elevated contamination levels. Corrective Action: • Inspection of covered and capped landfill areas. • Inspection of active landfill areas. • Investigate possible causes for the contamination and implement the appropriate response plan - These could include replacing eroded cover material, modifying the fall on the active landfill area to ensure surface water flows into the landfill, replacing earth bund on the interface between the active landfill and the external batter and more regular application of cover material.	Monitoring will be dependent on the corrective action undertaken, but may include: • Measuring the thickness of the daily and intermediate cover material. • Monitoring how regularly cover material is applied. • Inspecting the integrity of the earth bund on the interface between the active landfill. • Checking the fall on the active landfill area. • Observing the performance of the corrective actions during a heavy rainfall event.	Increasing the thickness of the daily or intermediate cover material layer. Installing a more comprehensive earth bund on the interface between the active landfill. Amendment to the landfill waste placement program to increase the fall on the active tipping area to ensure contaminated surface water remains on the active landfill surface.	Possible & Insignificant	Low

Emission Source Description	Environmental Impact Risk	Management Tools and Mitigation Options/Factors	Activation Trigger and Corrective Action	Monitoring of Corrective Action Efficiency	Contingency Action if Corrective Action is Ineffective	Likelihood & Consequence	Risk Level
		control of surface water. Regular inspection or intermediate cover and permanent capped areas to ensure adequate cover material is in place to prevent surface water contact with waste material. Immediate cleanup of any identified leachate spills beyond the landfill perimeter, including the excavation of all contaminated soil. Sampling and analysis of groundwater to monitor groundwater quality.					
Leachate management system failure	Leachate escapes beyond the lined leachate ponds and contaminates groundwater.	Leachate modelling undertaken based on extremely conservative model input assumptions. Leachate evaporation ponds designed to cater for anticipated worst-case scenario leachate generation and rainfall events throughout the life of the landfill. Minimum 500 mm freeboard to all leachate evaporation ponds to ensure no over-topping of the pond perimeter bund. Regular inspection of leachate ponds and recording leachate depth to ensure that the minimum freeboard is maintained. Leachate pumping only to occur while the site is occupied. This activity will be governed by automatic pump controls restricting pump operations to predetermined operating hours. Naturally occurring low permeability soil on site, which slows down any infiltration of leachate into the soil	Activation Trigger: • Less that 500 mm freeboard in any leachate pond. Corrective Action: • Balance leachate quantity in all/some ponds to ensure minimum freeboard is maintained. • Increase effort of leachate management to reduce leachate quantity on site. • Immediately clean up any leachate spill areas.	Monitor the level of the leachate ponds to ensure minimum freeboard is maintained.	Tanker leachate off site.	Rare & Minor	Low

Emission Source Description	Environmental Impact Risk	Management Tools and Mitigation Options/Factors	Activation Trigger and Corrective Action	Monitoring of Corrective Action Efficiency	Contingency Action if Corrective Action is Ineffective	Likelihood & Consequence	Risk Level
		and affords ample opportunity to clean up and remediate the spill area to prevent/limit groundwater contamination. Immediate cleanup of any identified leachate spills beyond the leachate pond perimeter, including the excavation of all contaminated soil. Sampling and analysis of groundwater to monitor water quality.					
		Leachate pumping only to occur while the site is occupied. Aboveground leachate pipes enabling easy identification and repair of any leaks. Regular inspection of leachate pipes. Naturally occurring low permeability soil on site, which slows down any infiltration of leachate into the soil and affords ample opportunity to clean up and remediate the spill area to prevent/limit groundwater contamination. Immediate cleanup of any identified leachate spills beyond the landfill perimeter, including the excavation of all contaminated soil. Sampling and analysis of groundwater to monitor water quality.	Activation Trigger: • Inspection identifies leaking or damaged pipe. • Leachate flow ceases during pumping. Corrective Action: • Pipe to be immediately repaired. • Stop pumping and inspect leachate pipeline. Pipe to be immediately repaired. • Immediately clean up spill and remove all contaminated soil.	Inspect repaired pipe once pumping resumes.	Redo repair if initial effort was insufficient.	Rare & Minor	Low

12.4.5. Groundwater Response Plan

Due to the difficulty in determining the cause, impact and remedial action required for any detected groundwater contamination, it will not be feasible to define the actions to be undertaken to rectify any identified issues.

In the event that there be landfill related contamination identified in the groundwater, this matter will be reported to the DER and if deemed necessary, a response plan developed in agreement with the DER and other suitable experts.

12.5. Leachate Management

12.5.1. Concept

Leachate management revolves primarily around the minimising of the amount of leachate being generated. This will be achieved by ensuring that there be adequate surface water diversion away from the waste mass, that the appropriate final waste profile be attained and the waste suitably capped as soon as is reasonably possible in order to shed surface water flow away from the waste mass.

Leachate generated will be managed as efficiently as possible via a range of treatment options to reduce the volume within the landfill and prevent the annual accumulation of leachate on site.

12.5.2. Leachate Generation

The quantity of leachate generated during the operating life of the landfill will be highly dependent on a range of site specific factors including:

- Timing of when new landfill cells will be commissioned (summer or winter);
- Size of the landfill and area of exposed landfill liner;
- Quantity of landfill waste within the landfill;
- Shape of the waste mass (slope angle);
- Operation of the landfill;
- Type of waste; and,
- Type of cover material.

All of the above variables will have a significant influence on the quantity of leachate being generated on-site.

Modelling of the anticipated volume of leachate generated during the development and operation of the Stage 1 landfill has indicated that two evaporation ponds will be adequate for the management of anticipated leachate volumes for the first four years of operation, in the fifth year a third leachate pond will be required and in the eighth year a fourth pond will be required. This assessment is based on 20% of the generated leachate being recirculated onto or within the landfill waste mass up until the seventh year and then 40% of the generated leachate recirculated. This modelling has been undertaken utilising significantly conservative assumption and hence, this level of leachate recirculation should easily be able to be achieved in order to adequately manage the quantity of leachate being generated on site.

12.5.3. Leachate Management Options

Leachate management will be a critical activity on site. There will however be numerous leachate management options available for the on-site handling of leachate. In summer time, when there will be only occasional rainfall, this will be when the landfill operators will have to significantly reduce the volume of leachate stored on site, ideally getting to a stage where the leachate ponds will be empty by the end of summer. During winter, when the site receives the majority of its rainfall, this will be when most of the leachate generated on site will be accumulated within the leachate ponds. Fortunately, with the site being located in a relatively low rainfall zone (mean annual rainfall of 427.6 mm), there will still be a significant portion of the winter period where leachate management solutions other than simple storage in the leachate ponds will be viable.

Leachate management options to be utilised on site, in the order of priority, include the following:

- Accumulation in the leachate ponds (typically over winter);
- Evaporation from the surface of the leachate ponds – ongoing without any operator effort;
- Use of a water tanker to spray leachate onto the internal landfill roads (only over the lined landfill area);
- Leachate recirculation onto the waste surface using drip irrigation and/or low pressure sprays (large nozzle diameters to prevent them blocking up) – active landfill areas and intermediate covered areas draining into the landfill footprint;
- Leachate recirculation into the waste mass – via injection wells and drains installed into the waste mass. And, in conjunction with the landfill gas contractor, the landfill gas wells will also be used for this purpose;
- Micro-sprays or water cannon over the leachate pond surface or on the landfill surface (nozzle blockage will be a concern with this method) – wind direction will also be important, as the spray drift needs to remain on the lined surface and also be well away from the active landfill areas;
- If needed, volumes of leachate will be pumped directly onto the incoming waste as it is placed and compacted in the landfill. The dry incoming waste (even in winter) will absorb a significant volume of leachate and the waste placement activities will mix the moisture evenly through the waste mass.
- In the case of an emergency, leachate will be trucked off site to the Water Corporation or to a composting facility.

The evaporation and recirculation activities will be far more efficient during summer; however, during winter, with a concerted effort during favourable weather conditions, reasonable leachate volumes will be “consumed” by these methods.

The intent of recirculating leachate onto the waste surface is to maximise leachate evaporation and not to saturate the waste mass. Recirculation is to be controlled to avoid waste saturation.

12.5.4. Leachate Ponds

A space allocation has been made for up to six leachate ponds to cater for possible future leachate quantities, including Stage 2 landfill development. Initially only two leachate ponds will be constructed, with leachate generation modelling indicating that a third pond will be required in year five and a fourth in year eight. The remaining two ponds being constructed as and when required. In reality, if deemed necessary, there will be no restriction on the development of more than six ponds (subject to the appropriate Works Approval), as there will be ample space available on site; however, this need is seen as unlikely.

Each leachate pond has a maximum evaporation area of 2,304 m² (48 m x 48 m) and retains a volume of 5,024 m³ whilst still maintaining a 500 mm freeboard.

The leachate ponds will be designed with a maximum average operating depth of 2.5 m and an additional 500 mm freeboard, resulting in a total maximum average depth of 3.0 m (excluding the 0.5 m sump).

12.5.5. Leachate Evaporation

Based on the size of the leachate ponds, the effective annual evaporation from a single pond will be calculated as follows:

- Pond maximum evaporation area = 2,304 m^2;
- Median annual evaporation = 2,054.8 mm;
- Median annual rainfall = 427.6 mm;

Evaporation Volume = Area (0.8 * Evaporation – Rainfall) = 2,802 m^3/year/pond.

12.5.6. Leachate Extraction from Landfill

The landfill design incorporates an automated pumping system from the leachate sump, which will be operated by a set of float switches that control when the leachate pump is switched on and off. This automated system will only be functional during facility operating hours, while staff are on site to monitor its performance. After hours, the system will be automatically isolated to prevent it pumping leachate.

The automated pumping system will be designed to maintain the head on the landfill liner to less that the prescribed maximum of 300 mm. The leachate pump (144 mm diameter, submersible Davey SS60/03 or similar) will switch on when the leachate level is 800 mm above the base of the leachate sump (300 mm above the landfill liner) and then switch off once the leachate level drops to 300 mm above the base of the leachate sump (200 mm below the level of the liner). The pumped volume will be approximately 60 m^3 and will take approximately one hour to pump. The actual performance of the pump will be determined on site by the delivery head, the volume of leachate within the 500 mm float switch zone and the rate of leachate generation within the landfill.

The submersible pump will be installed within the main 355 mm diameter leachate extraction pipe. There are however two spare leachate extraction pipes of which, either could be used for leachate extraction in the event that the main extraction pipe be damaged.

The leachate extraction pump and associated pipework will deliver leachate directly to the leachate ponds via aboveground delivery pipework, where by adjusting valves, the leachate will be pumped into any pond. The leachate extraction point has a blanked-off flange isolation valve that will be used to connect an additional pipe for recirculation of leachate directly from the sump onto the landfill. A separate, mobile delivery pump will be used to pump leachate from the leachate ponds back to the landfill, again via the aboveground delivery pipework.

12.5.7. Accumulation Limits

The DER landfill development guidelines limit the maximum depth of leachate over the liner to 300 mm; hence, the float valve setting on the leachate extraction pump. Increasing the depth of leachate on the liner simply increases the hydraulic head (water pressure) on any leaks in the liner and consequently increases the leakage rate through the liner.

There will also be a minimum 500 mm freeboard to be maintained in each leachate pond. This will cater for extreme rainfall events and possible wind action, to prevent any leachate flowing out of the ponds.

12.5.8. Leachate Pond Management

Ideally at the end of summer, all of the evaporation ponds will be empty and the leachate sump(s) have less that 300 mm of leachate above the liner. This reflects the situation of least accumulated leachate on site. Any leachate being generated within the landfill is being recirculated directly onto the waste mass via a number of management options mentioned above.

As the winter rains commence and the weather cools down, the leachate evaporation potential from the landfill surface will decrease. At some point, the rate of leachate generation will be greater than the rate of evaporation from the waste surface. This will be the seasonal turning point at which leachate will start being pumped into the leachate ponds. Throughout winter, there will be a net generation of leachate and the ponds will gradually start accumulating leachate until the summer seasonal tipping point be reached where the evaporation from the waste surface will once again be greater than the rate of generation within the landfill. Around this point in time, there will also be a net evaporation of leachate from the leachate pond surface.

Throughout summer, leachate will be gradually pumped out of the landfill and recirculated over the landfill until a stage is reached where the ponds will once again be empty in preparation for the following winter period. Ideally, all of the ponds will be empty by at least the end of March each year. This provides a buffer of approximately six weeks between the ponds being empty and the traditional onset of winter rains in mid-May.

If the leachate ponds are emptied well before the end of March, then this will be an indication that the pond utilisation and leachate management techniques are working well and that there be adequate capacity in the leachate ponds. However, if the ponds are not able to be emptied by the end of March, then this will be an indication that the leachate generation is greater than the ideal pond capacity and that extra leachate management effort is required during summer or the next pond should be constructed.

Modelling of the anticipated leachate generation quantities and the available storage capacity in the leachate ponds has conservatively determined that the leachate ponds will be able to store and evaporate all leachate on site. In addition, there will be a component (20% to 40%) of leachate recirculation and evaporation onto the landfill surface that will further reduce the quantity of leachate on site.

12.5.9. Monitoring

The leachate volume modelling that was undertaken as part of the original facility development was a conservative, hypothetical assessment of the possible leachate quantities that would be generated within the landfill and have been used for the purposes of facility design. It will be however, the actual leachate volumes that are important to monitor to gain an understanding of the quantity of leachate being generated on site as well as the quantity being treated.

To adequately gauge the leachate performance across the site, the following monitoring will be undertaken:

- Depth of leachate in the leachate sump(s) – initially measured weekly, at the beginning and end of the day of measurement. This will be pushed out to monthly measurement if the monitoring indicates that the pump float valve system is adequately able to maintain the head of leachate at less than the maximum 300 mm above the landfill liner;
- Volume of leachate pumped out of the leachate sump(s) – measured continuously via a flow meter, but recorded weekly;
- Depth of leachate in the evaporation ponds – measured monthly;
- Minimum pond freeboard calculated based on the monthly depth readings;
- Volume of leachate pumped into the leachate ponds – measured continuously via a flow meter, but recorded weekly;
- Volume of leachate pumped out of the leachate ponds – measured continuously via a flow meter, but recorded weekly; and,
- Quality of leachate in the sump – sampled as stipulated in the facility operating Licence.

This data will provide sufficient information to gain an understanding of how the leachate generation will be compared with the leachate disposal activities and hence guide further leachate management activities if need be.

The efficiency of the automated leachate extraction system to maintain the head of leachate on the liner to a maximum of 300 mm will easily be monitored by measuring the depth of leachate in the leachate sump. Measuring will be achieved utilising an electronic measuring device inserted through one of the two spare leachate extraction pipes. Ideally this measurement will be taken at the beginning of the day, before the automated system is switched on and then again at the end of the day.

These measurements will indicate how much leachate has been generated over night and then to what levels the pump maintains the leachate at during the day whilst operating on automatic.

Due to the extremely high permeability of the leachate drainage aggregate, it will be unlikely that there will be a drawdown curve around the pump while operating; however, that will easily be confirmed by measuring the leachate depth while the pump is operating and then switch the pump off and remeasure a short time thereafter. If there is an impact of a drawdown curve, then leachate measurements will only occur while the pump is not operating.

After a short time of facility operations (provided that there is leachate to be pumped and measured), it will be likely that the pump cycling capacity and the impact on the depth of leachate in the sump will become known and hence there will be no need to regularly monitor the leachate depth in the leachate sump. In these circumstances, the sump will only be measured and recorded on a monthly basis.

The leachate sump headworks also include a flow meter, which will be used to monitor the quantity of leachate being pumped from the sump. This gives the facility operators data on the annual leachate quantity being generated within the landfill and also, by taking the readings on a weekly basis, confirms that the leachate pump is working.

The leachate ponds are of known size and holding capacity. The design drawings include pond volumes at 1 m deep, at maximum operating depth (with a 500 mm freeboard) and at the absolute maximum holding capacity of the pond (overflow volume). By measuring the depth of leachate in each pond the facility operators will obtain an accurate volume of stored leachate.

12.5.10. Risk Assessment

A risk assessment of all identified potential environmental risks associated with the management of leachate has been undertaken. The primary consideration being the potential contamination of surface and groundwater by leachate.

The emissions and discharge risk assessment framework has been taken from the *DER Corporate Policy Statement No. 07 – Operational Risk Management*.

Emissions Risk Matrix utilised in the risk assessment is based on the following:

Likelihood	Consequence				
	Insignificant	**Minor**	**Moderate**	**Major**	**Severe**
Almost Certain	Moderate	High	High	Extreme	Extreme
Likely	Moderate	Moderate	High	High	Extreme
Possible	Low	Moderate	Moderate	High	Extreme
Unlikely	Low	Moderate	Moderate	Moderate	High
Rare	Low	Low	Moderate	Moderate	High

The outcome of the risk assessment is that there is a low to moderate risk of leachate impact on surface and groundwater as a result of the proposed activities.

Table 12.5.10.1 – Leachate Management Risk Assessment provides the detail of the risk assessment.

Table 12.5.10.1 – Leachate Management Risk Assessment

Emission Source Description	Environmental Impact Risk	Management Tools and Mitigation Options/Factors	Activation Trigger and Corrective Action	Monitoring of Corrective Action Efficiency	Contingency Action if Corrective Action is Ineffective	Likelihood & Consequence	Risk Level
Failure of the leachate collection and delivery system.	Blockage of leachate collection system above the landfill liner resulting in greater than 300 mm of leachate over the landfill liner and hence, increased leakage through the liner.	Compliance with the DER landfill development guidelines ensures the appropriate design and construction of the landfill liner. Utilisation of premium quality leachate drainage aggregate, geofabric and pipework. Pipework sized to allow internal inspection via camera and subsequent remedial action to unblock pipework. Coarse leachate drainage aggregate to enable leachate to flow around any localised blockage in the leachate collection pipework. Multiple leachate extraction points from a single leachate sump to provide additional leachate extraction location(s) in the vent that the primary extraction point was damaged or blocked. Recording of pumped leachate volumes and leachate depth in sump to determine if there is a problem with leachate extraction.	Activation Trigger: • Inability to obtain a Works Approval (due to substandard infrastructure design). • Low flow or inability to pump leachate out of leachate sump. Corrective Action: • Amend design to comply with the appropriate guidelines. • Withdraw leachate pump and undertake inspection of the leachate collection and extraction pipework. Where possible, clean out and rectify blockage. There is limited ability to unblock clogged leachate aggregate, as it is inaccessible.	Able to obtain a Works Approval. Check that the leachate pump operates at normal pumping rate.	Further amendments to the design to comply with the appropriate guidelines. Utilise spare leachate extraction point.	Rare & Moderate	Moderate
	Failure or reduced capacity of the leachate extraction pump resulting in greater than 300 mm of leachate over the landfill liner and hence, increased leakage through the liner.	Recording of pumped leachate volumes and leachate depth in sump to determine if there is a problem with leachate extraction.	Activation Trigger: • Leachate pump delivery slows down or ceases. Corrective Action: • Inspect leachate delivery pipe for blockages or damage, if not found, remove and replace pump. • If feasible, get pump repaired and retain as a back-up spare.	Check that the leachate pump operates at normal pumping rate.	Replace pump and check if is faulty.	Possible & Insignificant	Low

Emission Source Description	Environmental Impact Risk	Management Tools and Mitigation Options/Factors	Activation Trigger and Corrective Action	Monitoring of Corrective Action Efficiency	Contingency Action if Corrective Action is Ineffective	Likelihood & Consequence	Risk Level
	Crushing of the leachate extraction pipe and either stopping leachate pumping or preventing the pump from being removed from the sump for maintenance or replacement resulting in greater than 300 mm of leachate over the landfill liner and hence, increased leakage through the liner.	Recording of pumped leachate volumes and leachate depth in sump to determine if there is a problem with leachate extraction. Removal of the leachate pump as part of regular maintenance may indicate a narrowing of the extraction pipework. In this case, insert a steel pipe to prevent that extraction pipe from crushing any further. This may entail an internal inspection of the leachate extraction pipe. Steel pipe to be sufficiently large to enable the leachate pump to be inserted within. Utilise smaller diameter bore pump to fit into the reduced aperture of the pipe.	Activation Trigger: • Inability to remove the pump from the leachate sump. Corrective Action: • Undertake an internal inspection of the extraction pipe to identify the problem. Utilise down-hole technology to pry open the pipe bore and remove pump. Insert steel sleeve to support pipe. • Possibly utlise a smaller diameter and/or length bore pump.	Check that the leachate pump is able to be inserted and removed from the leachate extraction pipework as necessary. Check that the leachate pump operates at normal pumping rate.	Utilise spare extraction pipe.	Unlikely & Moderate	Moderate
	Rupture of the aboveground leachate delivery pipework and consequent discharge of leachate groundwater.	Leachate pumping only to occur while the site is occupied. This activity will be governed by automatic pump controls restricting pump operations to predetermined operating hours. Regular inspection of leachate delivery pipework. Pipework above ground to facilitate easy identification of pipe damage and any leaks. Repair and maintenance of aboveground pipework.	Activation Trigger: • Inspection identifies leaking or damaged pipe. • Leachate delivery ceases while pumping continues. Corrective Action: • Pipe to be immediately repaired. • Stop pumping and inspect leachate pipeline. Pipe to be immediately repaired. • Clean up spill and remove all contaminated soil.	Inspect repaired pipe once pumping resumes.	Redo repair if initial effort was insufficient.	Possible & Insignificant	Low
Leachate ponds above maximum capacity (not able to achieve the	Excess leachate generation on site and the possibility that the evaporation	Leachate modelling undertaken based on extremely conservative model input assumptions. Leachate evaporation ponds	Activation Trigger: • Less that 500 mm freeboard in any leachate pond.	Monitor the level of the leachate ponds to ensure minimum freeboard is maintained.	Tanker leachate off site.	Rare & Minor	Low

Emission Source Description	Environmental Impact Risk	Management Tools and Mitigation Options/Factors	Activation Trigger and Corrective Action	Monitoring of Corrective Action Efficiency	Contingency Action if Corrective Action is Ineffective	Likelihood & Consequence	Risk Level
minimum 500 mm freeboard).	ponds may overflow and consequent discharge of leachate to surface and groundwater.	designed to cater for anticipated worst-case scenario leachate generation and rainfall events throughout the life of the landfill. Minimum 500 mm freeboard to all leachate evaporation ponds to ensure no over-topping of the pond perimeter bund. Regular inspection of leachate ponds and recording leachate depth to ensure that the minimum freeboard is maintained.	Corrective Action: • Balance leachate quantity in all/some ponds to ensure minimum freeboard is maintained. • Increase effort of leachate management to reduce leachate quantity on site.	Monitor the level of the leachate ponds to ensure minimum freeboard is maintained.	Tanker leachate off site.	Rare & Minor	Low
	Ineffective leachate volume reduction management on site and the possibility that the evaporation ponds may overflow and consequent discharge of leachate to surface and groundwater	Numerous leachate management options available for site operations staff (refer above). Monitor site operations staff performance to ensure adequate effort in being put in to manage leachate. Optimise periods of net evaporation to recirculate leachate onto the landfill surface. Cap or temporarily close portions of the landfill as soon as is practical.	Activation Trigger: • Less that 500 mm freeboard in any leachate pond Corrective Action: • Balance leachate quantity in all/some ponds to ensure minimum freeboard is maintained. • Increase effort of leachate management to reduce leachate quantity on site.	Monitor the level of the leachate ponds to ensure minimum freeboard is maintained.	Tanker leachate off site.	Rare & Minor	Low

12.5.11. Leachate Management Response Plan

The regular monitoring of the leachate system will provide insight into the system operations and should there be any unusual changes in monitoring data, this could indicate that there is a potential problem with an element of the system. The following is a list of potential indicators:

- If there is a noticable decrease in the quantity of leachate being pumped out of the leachate sump, this could indicate the following:
    - That there be a blockage in the leachate aggregate or leachate collection pipe work. The longer the pump cycle, the further away from the sump the blockage will occur. Very short pump cycles will indicate a blockage around the leachate sump;
    - That the pump be losing efficiency and the need for replacement. This will typically be associated with a longer than usual pump cycle; or,
    - That the leachate extraction pipe has collapsed and there will be reduced access down the pipe. This will easily be confirmed by the removal of the leachate pump. If the pipe has collapsed, the pump will be stuck.
- If there be increased depth of leachate over the liner, this would indicate the following:
    - Problems with the pump float valves; or,
    - Decreased pump efficiency.
- If there be a noticeable drop in the level in one leachate pond in comparison to another (so long as this is not associated with pumping differences), this would indicate a leak in the one pond. The larger the leak, the greater the comparative drop in leachate level.

In the event that the regular leachate monitoring identifies potential problems with the leachate management system, a response plan will be implemented. This response plan will incorporate the following:

- Assess the monitoring data to try and identify the possible cause(s);
- Assess how best to confirm the suspected possible cause(s);
- Consider the impact of the problem(s):
- If possible, rectify the problem (eg. replace a pump);
- If not possible to rectify the problem (eg. blocked leachate drainage aggregate), assess the likely impact on future landfill operations and whether there are any contingency measures that could be implemented to minimise the impact;
- Consider amending the standard operating procedures if the current procedures are ineffective (eg. damage to the leachate pond lining system).

Should the ongoing monitoring of leachate quantities on site indicate that there be a gradual net accumulation of leachate over time, the following contingency actions will be implemented:

- Employ an additional staff member to concentrate solely on leachate management activities (increased treatment effort);
- Apply thicker intermediate cover over temporary closed areas to increase the retention of rainwater within the soil and hence, reduce leachate generation;
- Bring forward the timing of subsequent leachate pond construction;
- As a last resort, tanker excess leachate off-site.

From a day-to-day operational consideration, spare pumps (or readily available hire pumps), pipe lines and fittings will be kept on site so that in the event of a system breakdown, there will be readily available items of equipment to ensure continuity of leachate management.

It is not possible to develop a response plan that covers each likely eventuality and proposed feasible solutions to those possible problems. In the event that a problem be identified, the appropriate specialist will be engaged to develop an incident specific remedial solution. Depending on the degree of the incident, the DER may need to be involved in the process.

12.6. Landfill Gas Management

12.6.1. Concept

Landfill gas management revolves primarily around minimising the amount of landfill gas emissions through the landfill waste mass and utilising the collected gas to prevent methane entering the environment. This will be achieved by ensuring that there be an efficient gas extraction system installed within the waste and the appropriate consumption/combustion of the collected landfill gas.

Landfill gas will be managed by a specialist landfill gas contractor. This contractor will be responsible for the progressive installation of landfill gas infrastructure as the waste mass develops, including installing a flare or other mechanism(s) for the treatment of the extracted gas.

The landfill gas contractor will also be responsible for the monitoring of fugitive emissions from the landfill, and if elevated emissions are recorded, determining and implementing remedial solutions for the improvement of landfill gas capture to ensure fugitive emissions are below allowable levels.

12.6.2. Landfill Gas Quantity and Treatment

The quantity of landfill gas generation for Stage 1 landfill has been calculated using the *Intergovernmental Panel on Climate Change 2006 IPCC Guidelines for National Greenhouse Gas Inventories* model. This model has been selected as it is used by some companies within the landfill gas industry to determine the potential quantities of landfill gas likely to be generated from the proposed landfill facility. In addition, the Federal Government uses this model to determine landfill emissions as part of its recent multi-billion dollar emissions trading scheme. Hence, the model can be considered as highly reliable. It is acknowledged that only the gas generation forecast portion of the IPCC model has been used for the Opal Vale project and not the landfill emissions portion of the model.

The inputs into the model include:

- Landfill capacity – 1.5 M m^3;
- Annual waste input quantity – 150,000 tonnes. It is noted that the model is not able to manage a "ramp up" of annual waste quantity; hence, the worst case scenario has been adopted;
- Landfill closure year – 2025;
- Gas capture percentage – 75%. This is the maximum value that is allowed to be claimed in NGERS (in reality, the gas capture percentage is likely to be significantly higher, in the order of 90%). This input is required for the model to work; however, is only used by the model when calculating emissions from the landfill and as stated above, this portion of the model was not used for the Opal Vale project. Hence, although a necessary input parameter, it is irrelevant to the landfill gas generation quantity output;
- Methane oxidation factor through the landfill cap – 0.025. Based on 10% oxidation of the 25% landfill gas that is not extracted by the active extraction system (refer to the 75% gas capture percentage above). Again, this input is required for the model to work; however, is only used by the model when calculating emissions from the landfill and as stated above, this portion of the model was not used for the Opal Vale project. Hence, although a necessary input parameter, it is irrelevant to the landfill gas generation quantity output; and,
- Waste composition – MSW= 30%, C&I = 60% and C&D = 10%.

Table 12.6.2.1 – Landfill Gas Quantities provide the IPCC model outputs based on the above inputs. The quantities of gas generated is for methane (CH_4).

Table 12.6.2.1 – Landfill Gas Quantities

Year	CH4 Tonnes	CH_4 Volume (m^3)	m^3/hr	Generation Potential (MW)
Landfill commences operation in late 2015				
2015				
2016				
2017				
2018	458	681691	77.8	
2019	895	1331263	152.0	
2020	1311	1950267	222.6	
2021	1707	2540173	290.0	
2022	2085	3102383	354.2	1
2023	2445	3638228	415.3	1
2024	2788	4148978	473.6	1
2025	3115	4635835	529.2	1
Landfill ceases operation sometime in 2025				
2026	3427	5099948	582.2	1
2027	3724	5542408	**632.7**	1
2028	3550	5282561	603.0	1
2029	3384	5035203	574.8	1
2030	3225	4799725	547.9	1
2031	3075	4575548	522.3	1
2032	2931	4362121	498.0	1
2033	2795	4158922	474.8	1
2034	2665	3965453	452.7	1
2035	2541	3781239	431.6	1
2036	2423	3605833	411.6	1
2037	2311	3438805	392.6	1
2038	2204	3279749	374.4	1
2039	2102	3128277	357.1	1
2040	2005	2984023	340.6	1
2041	1913	2846637	325.0	1
2042	1825	2715784	310.0	
2043	1741	2591150	295.8	
2044	1661	2472433	282.2	
2045	1585	2359348	269.3	
2046	1513	2251621	257.0	
2047	1444	2148994	245.3	
2048	1378	2051221	234.2	
2049	1316	1958068	223.5	
2050	1256	1869311	213.4	
2051	1199	1784739	203.7	
2052	1145	1704151	194.5	
2053	1094	1627355	185.8	
2054	1044	1554168	177.4	
2055	998	1484417	169.5	
2056	953	1417937	161.9	
2057	910	1354570	154.6	
2058	870	1294168	147.7	
2059	831	1236589	141.2	
2060	794	1181697	134.9	

As can be seen from the above table, predicted methane gas generation will peak at 632.7 m^3/hr 12 years after commencement, which will be two years after Stage 1 operations will have ceased. Maximum potential power generation will be 1 MW, for approximately 20 years (2022 to 2041).

Based on landfill gas generation rates of between 250 m^3/hr and 1,000 m^3/hr (all gas, not just methane), the following gas treatment options will be available:

- Power generation;
- Intermittent use and off-time flaring;
- High-temperature flaring; and,
- Low-calorific flaring.

Above 1,000 m^3/hr, the additional treatment options will include:

- Substitute fuel; and,
- Combined heat and power generation.

As an indication, 630 m^3/hr of methane would equate to approximately 1,250 m^3/hr of landfill gas (based on 50% methane content).

With the site being located in a relatively remote rural setting (distance to power distribution networks) and there only being the potential for a 1 MW of power generation, it will be unlikely that this would be a viable option. The most likely option would be a high-temperature flare; however, the landfill gas contractor will assess the options available as the gas volume increases.

12.6.3. Landfill Gas Extraction

The intention of the landfill gas extraction system will be to maximise the extraction of landfill gas, while minimising the quantity of oxygen being sucked into the waste mass. There will need to be a carefully measured balance between applying too much or too little suction to the waste mass.

The landfill gas installation will incorporate the following:

- Lateral and vertical wells will be progressively installed in the waste mass as the height increases. These will start being installed in Cell 2 once the waste height has reached a minimum of 10 m above the base liner. These wells will continue to be installed at minimum 10 m height intervals. There will be insufficient gas generation in Cell 1 to justify the installation of an extraction system at this early stage of the facility development.
- The leachate drainage layer installation will stop at 5 m from the top of the landfill. This will be to prevent a preferred flow path for gas to escape the landfill. A landfill gas extraction pipe will be installed on the top of this drainage layer, in direct contact with the aggregate/sand to collect the gas from this layer.
- As the final waste profile is progressively achieved, deep vertical wells (20 m) will be installed on the surface. These wells will be installed at a maximum spacing of 50 m to ensure that there is a comprehensive coverage of the waste mass. In some areas this spacing will likely be reduced to improve extraction ability. The gas extraction wells will be piped to the gas management system (likely a flare) in the allocated landfill gas infrastructure location. There will be a condensate return pipe from the gas management infrastructure back into the landfill and connected into the leachate collection

aggregate layer and/or adjacent waste mass. The gas extraction wells, connecting pipes and condensate return pipes will all be installed before the lined capping layer has been constructed so that there will be minimal penetrations through the capping layer. Where required, penetrations will all be located as close to the edge of the landfill as is reasonably possible.

- There will be a landfill gas collection layer installed on top of the waste mass, just under the lined capping layer. This sand collection layer has a dual purpose. It provides a "corridor" for the gas extraction pipes to run under the lined cap surface without having to dig up the waste cover material and also to enable the collection of gas that accumulates under the lined cap surface.
- A perimeter landfill gas manifold will be installed around the edge of the landfill to act as the main collector of gas running to the flare. All of the extraction wells will be connected to this manifold.
- To reduce the possibility of oxygen intake, there will be no gas extraction (drilled pipes) within 5 m of the sides of the waste mass or final waste profile. There will also be no gas well drilling closer than 5 m from the base and side slopes.

12.6.4. Emissions Limits

The landfill gas action levels, beyond which the landfill gas contractor or the landfill operator will be required to undertake remedial action include:

- Landfill surface final cap = Methane ≥100 ppm;
- Within 50 mm of penetrations through the final cap = Methane ≥100 ppm;
- Landfill surface intermediate cover areas (no waste within next three months) = Methane ≥ 200 ppm;
- Within 50 mm of penetrations through the intermediate cover = Methane ≥ 1,000 ppm; or,
- Landfill gas flares = Methane and volatile organic compounds ≥ 98% destruction efficiency.

12.6.5. Monitoring

The landfill gas contractor will undertake regular monitoring of the performance of the gas extraction and destruction system. The extent of monitoring will depend on the type of systems that the contractor installs. As a minimum, the following monitoring will be anticipated:

- Flare operation;
- Gas flow rate;
- Oxygen content;
- Methane content;
- Moisture content; and,
- Temperature.

The monitoring locations and frequency will be determined by the landfill gas contractor.

As determined by a landfill gas risk assessment of the site, there will be no external gas monitoring wells installed.

All monitoring of landfill gas emissions will occur on the landfill areas. The following minimum locations will be monitored for fugitive emissions:

- Landfill surface final cap – random monitoring around the capped surface;
- Around penetrations through the capped surface;
- Landfill surface intermediate cover area – random monitoring around the covered surface;
- Around penetrations through the covered surface;
- At the landfill gas flare.

The monitoring frequency will be as stipulated in the facility operating Licence.

12.6.6. Risk Assessment

A risk assessment of all identified potential environmental risks associated with the management of landfill gas on site has been undertaken. The primary consideration being the potential impact to the neighbouring residential property.

The emissions and discharge risk assessment framework has been taken from the *DER Corporate Policy Statement No. 07 – Operational Risk Management*.

Emissions Risk Matrix utilised in the risk assessment is based on the following:

Likelihood	Consequence				
	Insignificant	**Minor**	**Moderate**	**Major**	**Severe**
Almost Certain	Moderate	High	High	Extreme	Extreme
Likely	Moderate	Moderate	High	High	Extreme
Possible	Low	Moderate	Moderate	High	Extreme
Unlikely	Low	Moderate	Moderate	Moderate	High
Rare	Low	Low	Moderate	Moderate	High

The outcome of the risk assessment is that there is a low risk of landfill gas impact on any receptors, including the nearest residential property as a result of the proposed activities.

Table 12.6.6.1 – Landfill Gas Management Risk Assessment provides the detail of the risk assessment.

Table 12.6.6.1 – Landfill Gas Management Risk Assessment

Emission Source Description	Environmental Impact Risk	Management Tools and Mitigation Options/Factors	Activation Trigger and Corrective Action	Monitoring of Corrective Action Efficiency	Contingency Action if Corrective Action is Ineffective	Likelihood & Consequence	Risk Level
Subterranean landfill gas migration.	Subterranean landfill gas migration impacting on adjacent landfill infrastructure.	Best practise landfill lining system, landfill operations and gas extraction will ensure absolute minimum landfill gas emissions through the liner and into the surrounding soil. Naturally occurring low permeability soil highly resistant to gas migration. Soil does have minor quartz veins running through the strata; however the veins have been impregnated with clay fines and are also highly resistant to gas migration. No belowground services except landfill gas pipes; hence, no preferential gas flow pathway. Weighbridge raised above ground on stilts to be accessible to drivers stopped on the weighbridge; hence, no opportunity for gas build-up below the structure. Weighbridge raised above ground to enable ready access to load cells; hence, no opportunity for gas build-up below the structure. No landfill gas monitoring bores are proposed due to the total absence of preferential flow paths for any gas migration and the fact that the above mitigating factors make it highly unlikely that there would be any negative impact from landfill gas.	Activation Trigger: • Landfill gas odour detected. • Landfill gas monitoring indicates the presence of landfill gas. Corrective Action: • Identify the location of where the gas is emitting. • Identify the gas flow pathway. • Cut off the flow pathway. • Allow the accumulated gas to dissipate.	Undertake landfill gas monitoring of the area immediately around the original emission point to confirm that the gas flow has ceased. Repeat monitoring a week later to again confirm that the gas flow has ceased.	Further investigation and remedial action to detect and cut off the gas flow.	Rare & Minor	Low
	Subterranean landfill gas migration impacting	Best practise landfill lining system, landfill operations and gas extraction will ensure absolute	Activation Trigger: • Landfill gas odour detected. • Landfill gas monitoring	Undertake landfill gas monitoring of the area immediately around the original emission point to confirm	Further investigation and remedial action to detect and cut off the gas flow.	Rare &	Low

Emission Source Description	Environmental Impact Risk	Management Tools and Mitigation Options/Factors	Activation Trigger and Corrective Action	Monitoring of Corrective Action Efficiency	Contingency Action if Corrective Action is Ineffective	Likelihood & Consequence	Risk Level
	on the farmhouse 400 m from the landfill. Note: Although this farmhouse is excluded as a receptor (as agreed by the landowner), from a safety point of view, subterranean landfill gas migration has been considered.	minimum landfill gas emissions through the liner and into the surrounding soil. 400 m buffer distance and variable topography (ridge line) between gas emission source and farmhouse provides significant opportunity for any gas emissions to dissipate. Naturally occurring low permeability soil is highly resistant to gas migration. Soil does have minor quartz veins running through the strata; however the veins have been impregnated with clay fines and are also highly resistant to gas migration. No belowground services to the farmhouse except septic tank on the opposite (downhill) side of the house to the landfill; hence, no preferential gas flow pathway. Farmhouse raised above ground on stilts; hence, no opportunity for gas build-up below the structure. No landfill gas monitoring bores are proposed due to the total absence of preferential flow paths for any gas migration and the fact that the above mitigating factors make it highly unlikely that there would be any negative impact from landfill gas. In addition, the DER landfill development guidelines reference gas monitoring bores for no development within 250 m of the landfill as having a bore spacing of 50 m to 150 m. With only one farmhouse and it being 400 m from the landfill it is not deemed	indicates the presence of landfill gas. Corrective Action: • Identify the location of where the gas is emitting. • Identify the gas flow pathway. • Cut off the flow pathway. • Allow the accumulated gas to dissipate.	that the gas flow has ceased. Repeat monitoring a week later to again confirm that the gas flow has ceased.		Minor	

Emission Source Description	Environmental Impact Risk	Management Tools and Mitigation Options/Factors	Activation Trigger and Corrective Action	Monitoring of Corrective Action Efficiency	Contingency Action if Corrective Action is Ineffective	Likelihood & Consequence	Risk Level
		necessary to install a monitoring bore.					
	Subterranean landfill gas migration impacting on the nearest residential property 1.35 km from the landfill.	Buffer distance (1.35 km), topography (15 m deep valley and 70 m hill on opposite side) and vegetation between gas emission source and nearest residential receptor provide significant opportunity for any gas emissions to dissipate. Best practise landfill lining system, landfill operations and gas extraction will ensure absolute minimum landfill gas emissions through the liner and into the surrounding soil. Naturally occurring low permeability soil highly resistant to gas migration. Soil does have minor quartz veins running through the strata; however the veins have been impregnated with clay fines and are also highly resistant to gas migration. No landfill gas monitoring bores are proposed due to the total absence of preferential flow paths for any gas migration and the fact that the above mitigating factors make it highly unlikely that there would be any negative impact from landfill gas.	No perceived impact; hence, no further action.	No perceived impact; hence, no further action.	No perceived impact; hence, no further action.	Unlikely & Insignificant	Low
Fugitive landfill gas emissions.	Consistent odour emissions (amenity impact), gas concentrations (explosive risk) and toxins (health	Buffer distance and topography between odour source and nearest residential receptor provides significant opportunity for any odour emissions, gas concentrations and toxins to dissipate.	Physical nature of the site. Nil corrective actions possible.	Physical nature of the site. Nil corrective actions possible.	Physical nature of the site. Nil contingency actions possible.	Rare & Minor	Low

Emission Source Description	Environmental Impact Risk	Management Tools and Mitigation Options/Factors	Activation Trigger and Corrective Action	Monitoring of Corrective Action Efficiency	Contingency Action if Corrective Action is Ineffective	Likelihood & Consequence	Risk Level
	impact) beyond the site boundary and impacting on the nearest neighbouring residential property. Note: The farmhouse 400 m from the landfill is excluded as a receptor (as agreed by the landowner); hence, has not been considered in this aspect of the risk assessment.	Compliance with the DER landfill development guidelines ensures the appropriate design and construction of the landfill infrastructure. In particular the landfill liner, landfill gas extraction system and landfill capping to be able to adequately manager the level of fugitive gas emissions from the landfill.	Activation Trigger: • Inability to obtain a Works Approval (due to substandard infrastructure design). Corrective Action: • Amend design to comply with the appropriate guidelines.	Able to obtain a Works Approval.	Further amendments to the design to comply with the appropriate guidelines.	Rare & Minor	Low
		Appropriate construction quality control to ensure that the construction works are carried out to the required standards.	Activation Trigger: • Substandard construction works identified. Corrective Action: • Increase site presence during construction activities.	Confirm construction works carried out according to specifications.	Rigorous enforcement of contract conditions. Withhold payment for works. Dispute resolution process.	Rare & Minor	Low
		Appropriate training and monitoring of landfill operator performance to ensure that the landfill is operated to best practise standards.	Activation Trigger: • Operator performance is identified as being substandard. • On-site odour monitoring identifies unreasonable levels of odour. • An odour complaint is received. Corrective Action: • Improve staff training and monitoring of performance in order to achieve the necessary standard of performance on site.	Confirm landfill operator performance is operated to best practise standards. Consult with complainant to see if the odour concerns have been solved.	Replace operations staff.	Rare & Minor	Low
		Utilisation of specialist landfill gas contractor to design, install and manage the gas extraction infrastructure. This ensures best	Activation Trigger: • Contractor performance is identified as being substandard.	More regular odour monitoring of contractor performance. Consult with complainant to see if the odour concerns have been	Amend contract to capture operational shortcomings. In an extreme case, replace contractor.	Rare & Minor	Low

Emission Source Description	Environmental Impact Risk	Management Tools and Mitigation Options/Factors	Activation Trigger and Corrective Action	Monitoring of Corrective Action Efficiency	Contingency Action if Corrective Action is Ineffective	Likelihood & Consequence	Risk Level
		practise landfill gas management and hence, optimisation of gas capture and destruction, resulting in minimal fugitive gas emissions from site. Contract conditions to transfer the appropriate level of control to the contractor to ensure that the landfill gas system is installed, operated and monitored in accordance with licence conditions and best practise. Progressive installation of landfill gas extraction system to maximise landfill gas extraction. Progressive installation of landfill capping system to minimise landfill gas fugitive emissions. Monitoring and maintenance of gas extraction system to ensure optimum operation of the system.	• On-site odour monitoring identifies unreasonable levels of odour. • An odour complaint is received. Corrective Action: • Rigorous enforcement of contractual conditions.	solved.			
		Regular monitoring of the performance of the gas extraction network and making adjustment and or repairs as required. The DER landfill development guidelines set rigorous fugitive gas emission limits and action levels. Compliance with these maximum emission levels will substantially reduce fugitive gas emissions from site.	Activation Trigger: • On-site odour monitoring identifies unreasonable levels of odour. • An odour complaint is received. Corrective Action: • Rigorous enforcement of contractual conditions.	More regular odour monitoring of contractor performance. Consult with complainant to see if the odour concerns have been solved.	Amend contract to capture operational shortcomings. In an extreme case, replace contractor.	Rare & Minor	Low

12.6.7. Landfill Gas Response Plan

The regular monitoring of the landfill gas system will provide insight into the system operations and analysis of the monitoring data would indicate that there be a potential problem with an element of the system. The following will be a list of potential indicators:

- Lower combustion efficiency of the flare could indicate that there be a problem with the temperature of the flare burners;
- Reduced gas flow rate would indicate a blocked gas pipe;
- Elevated oxygen content would indicate problems with penetration seals or excessive vacuum in an area of the waste mass;
- Decreased methane content would indicate decreased moisture content in the waste or it is stabilising;
- Elevated temperature would indicate a subterranean landfill fire;
- Elevated fugitive gas emissions would indicate problems with cap penetrations, ruptures in the cap lining system or insufficient gas extraction below the landfill cap.

In the event that the regular landfill gas monitoring identifies potential problems with the landfill gas management system, a response plan will be implemented. This response plan will incorporate the following:

- Assess the monitoring data to try and identify the possible cause(s);
- Assess how best to confirm the suspected possible cause(s);
- Consider the impact of the problem(s):
- If possible, rectify the problem (eg. increase gas vacuum pressure);
- If not possible to rectify the problem (eg. blocked gas extraction pipe), assess the likely impact on future landfill operations and whether there are any contingency measures that could be implemented to minimise the impact (eg. install additional extraction well);
- Consider amending the standard operating procedures if the current procedures are ineffective (eg. change specification of the gas pipe).

It is not possible to develop a response plan that covers each likely eventuality and proposed feasible solutions to those possible problems. In the event that a problem be identified, the appropriate specialist will be engaged to develop an incident specific remedial solution. Depending on the degree of the incident, the DER may need to be involved in the process.

12.7. Dust Management

12.7.1. Concept

The objective of dust management will be to minimise significant impacts on amenity and environmental impacts as a result of dust emissions, with the primary focus of eliminating dust emissions beyond the Lot 11 property boundary.

Due to the importance of dust management on site and the detail required to cover this aspect of landfill management, a separate Dust Management Plan has been developed.

Appendix No. 2 – Dust Management Plan provides a copy of the Dust Management Plan.

12.7.2. Sources

Potential sources of dust emissions include:

- Construction activities;
- Vehicle movements along access roads;
- Landfill active tipping area activities;
- Loading and unloading of cover material;
- Vehicle wheels spreading dirt around the site; and,
- Adjacent clay extraction operations (existing operation).

All identified sources are deemed relatively minor and easily manageable within the confines of the Prescribed Boundary and the larger Lot 11.

12.7.3. Treatment Options

There will be a number of dust mitigation strategies that will be employed in order to reduce dust emissions on-site. The mitigation strategy will be a function of the source of dust generation.

Construction activities

As part of the construction activity, the construction contractor will be required to control dust. During construction, the primary source of dust generation will be vehicle movements along access roads. This dust will be controlled by using a water tanker to wet down the roads.

There will only be minimal dust generated during earthworks as the insitu clayey material will be moist when excavated and moisture conditioned (moisture added) prior to fill compaction. Even the use of stockpiled material will not generate excessive dust, as has been observed during the clay extraction operation, where only access road dust suppression has been required. This will be primarily due to the schistose nature of the clayey material where it is not a true clay material as it lacks the finer clay particles, which are the particles that generate the most dust.

Vehicle movements along access roads

The type of construction materials used on the road surface will significantly influence the generation of dust. All internal roads (excluding those on the landfill) consist of a gravel surface layer (wearing course). This road construction material will result in dust being generated by vehicle movements along internal access roads; consequently, dust management strategies will be required to be implemented.

Speed is the primary cause of dust generation from vehicles moving along access roads. The reduction of vehicle speed will be the primary method for reducing the generation of dust. A maximum site speed limit of 40 km per hour will be enforced. Appropriate signage will be utilised to indicate the maximum speed limit. Should dust generation continue to be a problem at 40 km per hour, the speed limit will either be reduced or alternative dust control strategies employed to reduce dust emissions.

The primary means of dust suppression along all internal roads will consist of watering via water tanker. The site water tanker will be used on an as needed basis to spread appropriate quantities of water to prevent excessive dust generation as a result of vehicle movements along internal access roads. The "appropriate quantities of water" will be dependent on the ambient weather conditions (heat and wind speed), number of traffic movements and the performance of the road construction material (gravel surface); hence, it will not be appropriate to determine a prescribed application rate. The application rate will be varied dependent on site conditions. The determining factor influencing the water application rate will be the quantity of dust being generated.

Adequate dust suppression will also be achieved by the use of dust suppression agents (Dustex or similar). These dust suppression agents will be spread using the water tanker and in accordance with the manufacturer's recommendations (application rates). Again dust suppression agents will be used in conjunction with the water tanker to provide additional dust suppression capabilities. Dust suppression agents are ideal for the main internal access roads to reduce water tanker activity and water consumption.

Landfill active tipping area activities

The water tanker will be used within the landfill area to suppress dust along the access roads. The unloading, placement and compaction of waste material will be unlikely to generate excessive dust (minor dust contributor). If a particular dusty load of waste material were received during periods of adverse weather conditions, the material will be unloaded as close to the landfill tipping face as possible, wet down by the water tanker and left until weather conditions improve. Once weather conditions have improved, only then will the dusty load be pushed and compacted into the landfill.

Loading and unloading of cover material

Due to the nature of this activity it will be difficult to adequately control dust emissions during adverse weather conditions; however, this activity will not be seen as a potential major contributor towards dust loading on site. The primary method for controlling dust emissions would be, where possible, to delay these activities until weather conditions improve. Where this were not possible, due care would be taken to place the material in vehicles and not drop it from a height. There will be little option for change of methodology with regards to unloading of vehicles during adverse weather conditions. There may; however, be opportunities to load and unload vehicles further away from the site boundary to reduce the risk of dust emissions blowing beyond the boundary.

Vehicle wheels spreading dirt around the site

The site is an active clay pit and landfill facility with non-sealed access roads; consequently, there will be some spreading of dirt in and around active areas on site. The quantity and consequence of the spreading of dirt will be minimal such that it could be managed by the use of a water tanker as part of the usual dust suppression activities on the site assess roads.

Adjacent clay extraction operations (existing operation)

Austral Bricks has been excavating and removing clay material from site for many years without causing dust generation issues. The use of a water tanker to wet down the internal access roads is all that has been necessary to manage dust from this operation. As mentioned above, the schistose nature of the material being excavated results in low dust generation and hence, can be easily managed.

12.7.4. Water Source

The primary source of dust suppression water will be from the water storage ponds within the clay void (existing source) and from the new surface water storage dam external to the clay pit. In addition, leachate will be used for dust suppression on the internal access roads within the lined landfill area.

As a fallback position, there will also be water available from the adjacent BGC clay void if required.

12.7.5. Emissions Limits

There is a target of no dust emissions beyond the Lot 11 property boundary and nil community complaints.

12.7.6. Monitoring

Dust emissions will be visually monitored on a continuous basis by site operations staff. The facility will also maintain a comprehensive complaints register, which will be used as a gauge of success with regards to dust emissions management. In the event that there be a dust emissions issue identified, formal dust monitoring will be undertaken by an independent third party to determine the extent of the problem and propose appropriate improved dust management solutions.

12.7.7. Risk Assessment

A risk assessment of all identified potential environmental risks associated with the management of dust has been undertaken. The primary consideration being the prevention of dust emissions beyond the Lot 11 site boundary. The secondary consideration being the prevention of dust emissions beyond the Prescribed Boundary.

As a minimum, the Prescribed Boundary is 50 m from the edge of the lined landfill area (along the southern edge of the landfill); however, the remainder of the boundary is at least 100 m from the edge of the landfill.

Table 12.7.7.1 – Lot 11 Buffer Distances provides detail of the extent of the buffer distances from the landfill to the various boundaries for Lot 11.

Table 12.7.7.1 – Lot 11 Buffer Distances

Direction	Buffer Distance to Stage 1 Landfill
North West towards Salt Valley Road.	3 km, of part cleared land, part native bush, the immediately adjacent Austral Bricks clay extraction and half way to the road, the BGC clay extraction operation. Stage 2 landfill will have a buffer of 2.2 km.
North North East, to nearest residential receptor.	650 m to the Lot 11 boundary and the residence a further 700 m away, total distance from landfill to receptor is 1.35 km. Part cleared land, majority native bush.
North East to property boundary.	350 m, part cleared land, part native bush.
South East to property boundary.	200 m to boundary. Dirt haul road to neighbouring clay pit immediately beyond boundary. Neighbouring clay pit, 200 m beyond boundary within a large area of native bush.
South to property boundary.	340 m of cleared land, with a residential property 1.1 km beyond the boundary, including 700 m of native bush.
South West to property boundary.	1.3 km of cleared land.

The emissions and discharge risk assessment framework has been taken from the *DER Corporate Policy Statement No. 07 – Operational Risk Management*.

Emissions Risk Matrix utilised in the risk assessment is based on the following:

Likelihood	Consequence				
	Insignificant	**Minor**	**Moderate**	**Major**	**Severe**
Almost Certain	Moderate	High	High	Extreme	Extreme
Likely	Moderate	Moderate	High	High	Extreme
Possible	Low	Moderate	Moderate	High	Extreme
Unlikely	Low	Moderate	Moderate	Moderate	High
Rare	Low	Low	Moderate	Moderate	High

The outcome of the risk assessment is that there is a low risk of dust emissions beyond the Lot 11 site boundary and hence, a low impact on any neighbouring receptors as a result of the proposed activities.

Table 12.7.7.2 – Dust Management Risk Assessment provides the detail of the risk assessment.

Table 12.7.7.2 – Dust Management Risk Assessment

Emission Source Description	Environmental Impact Risk	Management Tools and Mitigation Options/Factors	Activation Trigger and Corrective Action	Monitoring of Corrective Action Efficiency	Contingency Action if Corrective Action is Ineffective	Likelihood & Consequence	Risk Level
Construction activities – vehicle movements.	Vehicle movements around site resulting in dust emissions beyond the Prescribed Boundary and potentially beyond the Lot 11 site boundary.	Minimum 100 m buffer distance to the Prescribed boundary and 200 m buffer distance between dust source and Lot 11 property boundary provides significant opportunity for any dust emissions to settle. North westerly wind direction towards the shortest boundary is not common. Contractor responsible for dust suppression (enforceable action). Water tanker used to wet down roads. Only short haul distances and majority being within the existing clay void. Slow vehicle speeds due to short haul distances and tight confines of the access within the clay void. Natural material on site is more a schist than clay; hence, lower clay component and less dust generation potential.	Activation Trigger: • Excessive dust observed around the construction activities. • Dust observed blowing over the Prescribed Boundary. • Dust observed blowing over the site boundary. • A dust complaint is received. Corrective Action: • Instruct contractor to increase watering of access roads. • Instruct contractor to slow vehicles down. • Contractor instructed to change operations to undertake less dusty activities. • If dust emissions become a persistent issue, then dust monitors will be installed on the affected site boundary.	Undertake dust observation monitoring of the construction area immediately following the implementation of corrective actions by the contractor to determine the effectiveness of the actions. If installed, check dust monitors for evidence of dust blowing over the site boundary.	Cease all construction activities if dust cannot be prevented from blowing over the Lot 11 property boundary.	Unlikely & Insignificant	Low
Construction activities – earthworks.	Earthworks activities resulting in dust emissions beyond the Prescribed Boundary and potentially beyond the Lot 11 site boundary.	Minimum 100 m buffer distance to the Prescribed boundary and 200 m buffer distance between dust source and Lot 11 property boundary provides significant opportunity for any dust emissions to settle. North westerly wind direction towards the shortest boundary is	Activation Trigger: • Excessive dust observed around the construction activities. • Dust observed blowing over the Prescribed Boundary. • Dust observed blowing over the site boundary. • A dust complaint is	Undertake dust observation monitoring of the construction area immediately following the implementation of corrective actions by the contractor to determine the effectiveness of the actions. If installed, check dust monitors for evidence of dust blowing over the	Cease all construction activities if dust cannot be prevented from blowing over the Lot 11 property boundary.	Unlikely & Insignificant	Low

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Emission Source Description	Environmental Impact Risk	Management Tools and Mitigation Options/Factors	Activation Trigger and Corrective Action	Monitoring of Corrective Action Efficiency	Contingency Action if Corrective Action is Ineffective	Likelihood & Consequence	Risk Level
		not common. Contractor responsible for dust suppression (enforceable action). Water tanker used to wet down working area. The insitu material on site is more of a schist than a clay; hence, lower clay component and less dust generation potential. Majority of the earthworks will involve excavation, handling and compaction of the insitu material. The excavated material will be relatively moist as it retains moisture due to the schistose nature of the material. When being used as fill, the material will need to be moisture conditioned to achieve optimum compaction; hence, further reducing dust generation potential. The schistose material does not generate dust when in stockpile as has been observed during the clay extraction operation where large volumes of material are pushed up into stockpile.	received. Corrective Action: • Instruct contractor to increase watering of the construction area. • Instruct contractor to be more careful when handling (loading/unloading) material. • Contractor instructed to change operations to undertake less dusty activities. • If dust emissions become a persistent issue, then dust monitors will be installed on the affected site boundary.	site boundary.			
Vehicle movements along access roads.	Vehicle movements on access road resulting in dust emissions beyond the Lot 11 site boundary. The majority of the access roads are outside the Prescribed Boundary; hence,	Minimum 200 m buffer distance between dust source and Lot 11 property boundary provides significant opportunity for any dust emissions to settle. North westerly wind direction towards the shortest boundary is not common. The internal site access road runs up the centre of the site, well away from any site boundaries, until it	Activation Trigger: • Excessive dust observed on the access roads. • Dust observed blowing over the site boundary. • A dust complaint is received. Corrective Action: • More regular wetting down of access roads.	Undertake dust observation monitoring of the access roads immediately following the implementation of corrective actions to determine the effectiveness of the actions. If installed, check dust monitors for evidence of dust blowing over the site boundary.	Only essential vehicle movements along access roads where problematic dust emissions occur (these being primarily waste vehicles and water tanker).	Unlikely & Insignificant	Low

Emission Source Description	Environmental Impact Risk	Management Tools and Mitigation Options/Factors	Activation Trigger and Corrective Action	Monitoring of Corrective Action Efficiency	Contingency Action if Corrective Action is Ineffective	Likelihood & Consequence	Risk Level
	this boundary is not an impact consideration.	arrives at the landfill site, where the minimum buffer distances are present. Restricting vehicle speed to 40 km/hr. Installation of speed humps if necessary. Water tanker used to wet down internal access roads as the primary dust suppression methodology. The use of dust suppression agents (Dustex or similar) will be used, as a secondary methodology if using only water proves ineffective.	• More rigorous enforcement of site speed limit. • Installation of speed humps to further slow down vehicles. • Reduce site speed limit even further. • Utilisation of more dust suppression agents.				
Landfill active tipping area activities.	Waste placement activities resulting in dust emissions beyond the Prescribed Boundary and potentially beyond the Lot 11 site boundary.	Minimum 100 m buffer distance to the Prescribed boundary and 200 m buffer distance between dust source and Lot 11 property boundary provides significant opportunity for any dust emissions to settle. North westerly wind direction towards the shortest boundary is not common. Incoming waste generally not dusty. Vehicles tipping as close to the disposal location as possible. If a dusty load is receive during adverse weather conditions it will be wet down with the water tanker and left until weather conditions improve before being pushed up and compacted. Water tanker used to wet down tipping area as the primary dust suppression methodology.	Activation Trigger: • Excessive dust observed around the active tipping area. • Dust observed blowing over the Prescribed Boundary. • Dust observed blowing over the site boundary. • A dust complaint is received. Corrective Action: • More regular wetting down of active tipping area. • If possible, move tipping area to be further from the affected site boundary.	Undertake dust observation monitoring of the active tipping area immediately following the implementation of corrective actions to determine the effectiveness of the actions. If installed, check dust monitors for evidence of dust blowing over the site boundary.	Only essential vehicle movements on the active tipping area (these being primarily waste vehicles, waste placement vehicles and water tanker).	Unlikely & Insignificant	Low

Emission Source Description	Environmental Impact Risk	Management Tools and Mitigation Options/Factors	Activation Trigger and Corrective Action	Monitoring of Corrective Action Efficiency	Contingency Action if Corrective Action is Ineffective	Likelihood & Consequence	Risk Level
		Schistose or sandy daily cover material is not overly dusty material to handle.					
Loading and unloading of cover material.	Loading and unloading of cover material resulting in dust emissions beyond the Prescribed Boundary and potentially beyond the Lot 11 site boundary.	Minimum 100 m buffer distance to the Prescribed boundary and 200 m buffer distance between dust source and Lot 11 property boundary provides significant opportunity for any dust emissions to settle. North westerly wind direction towards the shortest boundary is not common. Schistose or sandy daily cover material is not overly dusty material to handle. The primary dust suppression methodology is to delay these activities until weather conditions improve. Water tanker used to wet down the cover material stockpile area. Due care taken to place the material in vehicles and not drop it from a height. If possible, load and unload vehicles further away from the site boundary. Maintain sufficient material stockpile close to the tipping area so the activity can be stopped for at least a day without negatively impacting the application of daily cover material.	Activation Trigger: • Excessive dust observed around the cover material handling areas. • Dust observed blowing over the Prescribed Boundary. • Dust observed blowing over the site boundary. • A dust complaint is received. Corrective Action: • Delay activities until weather improves. • More regular wetting down of cover material areas. • If possible, load and unload vehicles further away from the site boundary.	Undertake dust observation monitoring of the active tipping area immediately following the implementation of corrective actions to determine the effectiveness of the actions. If installed, check dust monitors for evidence of dust blowing over the site boundary.	Cease activity if dust cannot be prevented from blowing over the Lot 11 property boundary.	Unlikely & Insignificant	Low
Vehicle wheels spreading dirt around the site.	Vehicle wheels spreading dirt around the site	Minimum 100 m buffer distance to the Prescribed boundary and 200 m buffer distance between dust	Activation Trigger: • Excessive dust observed on the access roads.	Undertake dust observation monitoring of the access roads immediately following the	Only essential vehicle movements along access roads where problematic dust emissions occur	Unlikely &	Low

Emission Source Description	Environmental Impact Risk	Management Tools and Mitigation Options/Factors	Activation Trigger and Corrective Action	Monitoring of Corrective Action Efficiency	Contingency Action if Corrective Action is Ineffective	Likelihood & Consequence	Risk Level
	resulting in dust emissions beyond the Prescribed Boundary and potentially beyond the Lot 11 site boundary.	source and Lot 11 property boundary provides significant opportunity for any dust emissions to settle. North westerly wind direction towards the shortest boundary is not common. Schistose or sandy daily cover material is not overly dusty material to handle. Spread dirt ends up on access roads, which is managed as described above.	• Dust observed blowing over the site boundary. • A dust complaint is received. Corrective Action: • More regular wetting down of access roads. • More rigorous enforcement of site speed limit. • Installation of speed humps to further slow down vehicles. • Reduce site speed limit even further. • Utilisation of more dust suppression agents.	implementation of corrective actions to determine the effectiveness of the actions. If installed, check dust monitors for evidence of dust blowing over the site boundary.	(these being primarily waste vehicles and water tanker).	Insignificant	
Adjacent clay extraction operations (existing operation).	Adjacent clay extraction operations resulting in dust emissions beyond the Prescribed Boundary and potentially beyond the Lot 11 site boundary.	This is a separate operation with its own dust control requirements. Austral Bricks has been excavating and removing clay material from site for many years without causing dust generation issues. Clay extraction occurs to the north west of the landfill area and is a minimum of 500 m from the nearest site property boundary.	Activation Trigger: • Nil from a landfill management point of view. • Excessive dust seen on site. Corrective Action: • Advise Austral Bricks of the excessive dust observed on site.	Nil from a landfill management point of view.	Nil from a landfill management point of view.	Unlikely & Insignificant	Low

12.7.8. Dust Management Response Plan

In the event that the regular dust monitoring identifies potential problems with the dust management activities, a response plan will be implemented. This response plan will incorporate the following:

- Assess the location that has been identified as a problem and consider the possible cause(s);
- Consider the impact of the problem(s):
- If possible, rectify the problem (eg. increased use of the water tanker);
- If not possible to rectify the problem (eg. dust from cover material handling), assess the likely impact on neighbouring properties and whether there be any contingency measures that could be implemented to minimise the impact (eg. stop the activity or move further away from the site boundary);
- Consider amending the standard operating procedures if the current procedures are ineffective (eg. increase stockpiled material at the active tipping area during low wind periods to allow for suspension of this activity during high wind periods).

It will not be possible to develop a response plan that covers each likely eventuality and proposed feasible solutions to those possible problems. In the event that a problem be identified, the appropriate specialist will be engaged to develop an incident specific remedial solution. Depending on the degree of the incident, the DER may need to be involved in the process.

12.8. Litter Management

12.8.1. Concept

The objective of litter management will be to minimise the generation of litter and ensure that litter that has been blown from the active landfill area be collected as soon as is practical with a special focus on preventing litter emissions beyond the Lot 11 property boundary.

12.8.2. Sources

Potential sources of litter emissions include:

- Blown from waste delivery vehicles;
- Blown from active tipping area during tipping of waste loads;
- Blown from active tipping area during pushing and compaction of the waste; and,
- Blown from waste delivery vehicles departing the site.

12.8.3. Treatment Options

There will be a number of litter mitigation strategies that will be employed in order to reduce litter emissions on-site. The mitigation strategy will be a function of the source of litter generation.

Blown from waste delivery vehicles

It is a road regulation that all waste delivery vehicles must be adequately tarpped or covered while driving on public roads; consequently, all vehicles delivering waste to the site would be either sealed or tarpped vehicles. This will adequately control litter such that there would be no litter emissions from these vehicles entering the site.

In the event that vehicles arriving on site are inadequately covered; the weighbridge operator will advise the vehicle driver to improve the covering of the vehicle. This comment will be recorded on the weighbridge docket. In the event of a second warning to the driver, again the weighbridge docket will be marked up with the warning, but in this case, the company will also be advised (presuming that the driver is not the company owner). If the driver delivers a third unsuitably covered load, then the head office will contact the company to resolve the issue. Typical resolution being:

- Bar the driver from site;
- Bar the vehicle from site;
- The waste delivery company makes the appropriate changes to the vehicle to improve covering; or,
- Other solutions that may be negotiated between head office and the waste delivery company.

Blown from active tipping area during tipping of waste loads

This will be the activity that will be most likely to result in significant litter in certain circumstances, as the waste will be typically tipped from a height onto the landfill surface. The degree of litter generation will be a function of the following factors:

- Tipping height;
- Waste type;
- Waste vehicle type (compactor trucks cause less litter than loosely packed vehicles);
- Wind speed and direction;
- Season of the year (summer is worse than winter); and,
- Location of the active tipping face.

Treatment options include:

- Selecting waste tipping areas to best suit the ambient weather conditions;
- Utilisation of litter screens in close proximity to the tipping vehicles;
- Litter fencing around the active landfill area;
- Removing litter from the litter screens and fences as soon as possible, but as a minimum at least every two days;
- Collecting litter blown beyond the active landfill as soon as possible, but as a minimum on a weekly basis; and,
- Collecting litter blown beyond the Lot 11 boundary as a minimum on a weekly basis.

Blown from active tipping area during pushing and compaction of the waste

This activity will also be likely to result in significant litter in certain circumstances as the waste is pushed around the landfill surface. The degree of litter generation will be a function of the following factors:

- The distance that the waste needs to be pushed;
- Waste type;
- The time it takes to compact the waste;
- Wind speed and direction;
- Season of the year (summer is worse than winter); and,
- Location of the active tipping face.

Treatment options include:

- Selecting waste tipping areas to best suit the ambient weather conditions;
- Minimising the distance from where the waste vehicle tipped to the position of final waste placement;
- Litter fencing around the active landfill area;
- Removing litter from the litter screens and fences as soon as possible, but as a minimum at least every two days;
- Collecting litter blown beyond the active landfill as soon as possible, but as a minimum on a weekly basis; and,
- Collecting litter blown beyond the Lot 11 boundary as a minimum on a weekly basis.

Blown from waste delivery vehicles departing the site

Once the vehicles have tipped the waste at the landfill, some of the vehicles do not completely empty all of the waste from the back of the vehicle (typically walking floor trailers) and in some circumstances there will be litter blown around the inside of the vehicle as it departs the site. If the vehicle covering system is not well fitted, this loose waste material could blow out of the vehicle. The degree of litter generation will be a function of the following factors:

- The type of vehicle;
- The efficiency of the vehicle tipping operation;
- Waste type;
- The functionality/efficiency of the vehicle cover system; and,
- The speed of the vehicle.

Treatment options include:

- Being aware of the vehicles that have the potential to cause litter from this source (walking floors, not tippers);
- Where possible, the inspection of the vehicles prior to departing the tipping area to ensure that the vehicle is empty;
- Advising customers which vehicles are causing the problem and working with the customers to try and reduce/eliminate the problem;
- Collecting litter blown down the internal access roads and also on Salt Valley Road, within the first kilometre of the site entrance; and,
- Collecting litter blown beyond the Lot 11 boundary as a minimum on a weekly basis.

Litter generation and the appropriate management thereof will be an ongoing aspect of landfill operations. There is no reasonable way to completely prevent the generation of litter; hence, an active litter management system will be required on site at all times. The more effort that would be undertaken to reduce litter generation, the less effort that will be required to collect litter that has been blown around the site.

Ultimately, litter collection around the landfill and beyond the site boundary will be the only effective way to clean up the site and maintain it in a reasonable state.

12.8.4. Emissions Limits

Minimising litter blown beyond the active landfill and also beyond the Lot 11 property boundary.

Not having litter beyond the Lot 11 property boundary for more that a week (litter collection as a minimum on a weekly basis).

12.8.5. Monitoring

Daily inspection of the active landfill tipping area.

Weekly inspection of the greater landfill site (within the Prescribed Boundary), Lot 11 and beyond the site boundaries, including Salt Valley Road in the vicinity of the landfill entrance.

12.8.6. Litter Management Response Plan

In the event that the regular litter monitoring identifies excessive litter blowing beyond the active landfill area or litter blown beyond the Lot 11 boundary remains beyond the boundary for more than a week, a response plan will be implemented. This response plan will incorporate the following:

- Assess the current litter management mechanisms and consider the possible cause(s);
- Consider the impact of the problem(s):
- If possible, rectify the problem (eg. increased use of litter screens/increased use of litter collection personnel);
- If not possible to rectify the problem (eg. extreme weather conditions), assess the likely impact on neighbouring properties and whether there be any contingency measures that could be implemented to minimise the impact (eg. additional litter collections);
- Consider amending the standard operating procedures if the current procedures be ineffective (eg. use of additional litter screens/installation of more perimeter litter fencing).

It will not be possible to develop a response plan that covers each likely eventuality and proposed feasible solutions to those possible problems. In the event that a problem be identified, the appropriate specialist will be engaged to develop an incident specific remedial solution. Depending on the degree of the incident, the DER may need to be involved in the process.

12.9. Odour Management

12.9.1. Concept

The objective of odour management will be to minimise the generation of odour from the landfill and leachate management system.

12.9.2. Sources

The sources of potential odour emissions from the proposed landfill activities include the following:

- Putrescible waste being delivered and unloaded at the active tipping area;
- Fugitive landfill gas emissions;
- Leachate ponds; and,
- Leachate recirculation onto the surface of the landfill.

12.9.3. Treatment Options

There will be a number of odour mitigation strategies that will be employed in order to reduce odour emissions on-site. The mitigation strategy will be a function of the source and intensity of odour generation.

Putrescible waste being delivered and unloaded at the active tipping area

Most putrescible waste arriving on site will not be overly odourous as in the vast majority of circumstances; the waste would yet to putrefy, as it is relatively fresh waste.

The degree of odour generation and the impact on receptors as a result of putrescible waste being delivered to site will be a function of the following factors:

- Waste type;
- Waste age;
- Wind speed and direction;
- Buffer distance to receptors;
- Distance the waste would be pushed prior to being compacted and covered;
- Duration the waste be left uncovered; and,
- Efficiency of the waste covering operation.

Treatment options to manage and reduce the potential impact of odours on site will include:

- Efficient active tipping area to reduce the time between the waste being tipped and it being compacted in place;
- Minimising the distance that the waste be pushed around the active tipping area; and,
- Application of adequate cover material.

Excessively odourous loads will be an extremely rare occurrence on site and typically relate to a dedicated waste collection emanating from a single source (eg. crayfish factory). These loads will be received directly from the waste generator and will not be received in bulk transfer trailers from transfer stations (as they cause odour issues at the transfer stations, which are typically closer to sensitive receptors than the landfill).

The waste collection company will be required to make enquiries to the landfill supervisor or head office as to whether the waste will be able to be accepted at the landfill. In this case, the landfill supervisor would investigate the waste source and type to assess if it be acceptable. If deemed acceptable, then special landfilling conditions will be imposed upon the delivery of the odourous material such as;

- Minimum notification period prior to waste delivery;
- Delivery only in certain wind conditions (speed and direction); and,
- Maximum quantities of waste to be delivered in a single load or day.

These conditions will be set to ensure that the landfill will be able to adequately manage the waste material. On the day of delivery, a void will be prepared in the landfill where the odourous waste will be tipped and immediately covered over.

If waste acceptance be agreed to, then a trial will be carried out to assess the effectiveness of the proposed landfill methodology and the odourous nature of the waste. If the trial were successful, then the waste would be accepted. As a result of the trial, or ongoing receival of the waste, from time to time, it may be necessary to amend the acceptance conditions or landfill methodology to improve odour management.

In the event of an excessively odourous waste load arriving at the landfill without prior arrangement, the method of detection of the odourous load will be that the weighbridge operator notices the excessive odour or the plant operators detect the odour on the tipping face.

In the event that the load is still in the vehicle when the odour is detected, the landfill supervisor will instruct the vehicle driver not to tip the load and park up the vehicle while investigations are quickly carried out. The driver will be asked about the waste type in the vehicle and its origin. There would be a need to obtain additional information from the waste collection company and/or the waste generator. Once all available information has been collected, the landfill supervisor will determine if the load will be accepted or rejected. Rejected loads will be immediately removed from site and the appropriate rejection information recorded on the vehicle transaction docket via the weighbridge software.

When considering the acceptability of the odourous load, the landfill supervisor will consider the following influencing factors:

- The customer's past performance with odourous loads;
- The size of the load;
- The degree of odour emanating from the load (assessed by a walk around the vehicle and sensing the degree of excessive odour);
- The information provided by the vehicle driver, collection company and waste generator (if obtained);
- The wind speed and direction to likely receptors;
- The track record of odour complaints on site; and,
- The ability to quickly form a void in the landfill to receive the load and cover it immediately.

If the load is acceptable, it will be received and immediately covered over.

The customer will be advised of the prearrangement requirements for any future odourous loads.

Fugitive landfill gas emissions

Fugitive landfill gas emissions from the landfill will have the potential to be the greatest cause of odour on site. Consequently, the management of landfill gas will be a critical aspect of the overall facility management.

The odourous component of the landfill gas will be the hydrogen sulphide content, which will be typically less than 1% of the gas volume. This will have a density slightly greater than air; hence, tends to stay at ground level and not dissipate vertically as does methane and the vast majority of the other components of the landfill gas.

The degree of odour generation on site and the impact on receptors will be a function of the following factors:

- The type of landfill liner material used;
- The quality of liner installation;
- The permeability of the natural soils;
- Waste type;
- Waste moisture content;
- Wind speed and direction;
- Buffer distance to receptors;
- Age of the waste;
- Volume of waste in the landfill;
- Density of the waste;
- Timing of when the gas extraction infrastructure will be installed;
- The efficiency of the landfill gas infrastructure;
- The type of cover material used;
- The quality of the cover material placement;
- The type of final capping utilised;
- The quality of the workmanship when sealing around penetrations through the landfill cap; and,
- The degree of settlement around penetrations through the landfill cap.

As can be seen, there will be many influencing factors that need to be adequately managed to ensure the appropriate control of landfill gas on site. There will also be many landfill activities that are carried out by different parties on site that need to be well coordinated to ensure that the best possible control of landfill gas is achieved.

The related parties include:

- Landfill designer (liner and capping);
- Landfill construction contractors (liner and capping);
- Construction Quality Assurance consultants (liner and capping);
- Landfill operators; and,
- Landfill gas specialist contractor.

Control and treatment options include:

- Compliance with the DER landfill development guidelines ensures the appropriate design and construction of the landfill infrastructure to best contain and extract landfill gas;
- Appropriate training and monitoring of landfill operator performance;
- Utilisation of specialist landfill gas contractor to design, install and manage the gas extraction infrastructure; and,
- Regular monitoring of the performance of the gas extraction network and making adjustment and/or repairs as required.

Leachate ponds

Odour emissions from the leachate ponds are anticipated to be extremely low and hence, will not cause odour concerns. Odour from the leachate ponds will emanate from the following sources:

- When the fresh leachate is pumped from the landfill into the pond (this only occurs during pumping);
- Directly from the leachate pond surface; and,
- During forced evaporation via spray irrigation.

The degree of odour generation and the impact on receptors will be a function of the following factors:

- The concentration/quality of the leachate;
- The quantity of leachate pumped into the ponds at any one time;
- The rate of pumping into the ponds;
- How the leachate flows into the pond (projected into the air or flows down the side of the pond liner);
- The quantity of leachate irrigation during forced evaporation;
- Depth of the leachate in the pond (to prevent it going anaerobic);
- Wind speed and direction; and,
- Buffer distance to receptors.

On site control and treatment options include:

- Regular pumping of small quantities of leachate into the ponds as opposed to pumping significant quantities in a short time period;
- Allowing the fresh leachate to flow down the side of the pond liner as opposed to projecting it into the air;
- The leachate pond's maximum depth does not allow the leachate to become anaerobic;
- Large pond surface area to encourage aerobic digestion within the ponds to reduce the odourous component within the liquid; and,

- Lime (or other chemicals) dosing of the leachate pond to change the pH and hence the odour emissions.

Leachate recirculation onto the surface of the landfill

This operation includes the distribution of leachate onto the landfill surface via sprinklers and/or water tanker.

Due to the relatively low volumes of leachate being recirculated at any one time, this will be a minor source of odour emissions.

The degree of odour generation on site and the impact on receptors will be a function of the following factors:

- The concentration/quality of the leachate;
- The quantity of leachate sprayed onto the landfill surface at any one time (leachate recirculated into the landfill does not generated odour emissions);
- The rate of spraying onto the landfill;
- Wind speed and direction; and,
- Buffer distance to receptors.

On site control and treatment options include:

- Only recirculating leachate when conditions are appropriate:
    - The waste surface is dry;
    - The daily recirculation quantity be able to be evaporated from the surface and not accumulate on the surface; and,
    - There is adequate space on the waste surface to enable recirculation without negatively impacting on the landfill operations.
- Regular spraying of small quantities of leachate onto the landfill as opposed to significant quantities in a short time period; and,
- Low volume spray irrigation in preference to large volume sprinklers.

12.9.4. Emissions Limits

Odour limits are subjective to individual tolerances and sensitivities and it is difficult to set a definitive odour value that can be readily measured on site. Hence, the emissions limits adopted for on-site monitoring by landfill staff will be founded around “nil” odour, “noticeable” odour and “unreasonable” odour.

Noticeable odour will be a level of odour when it is first identified by the person undertaking the odour monitoring.

Unreasonable odour will be a level of odour that is deemed by the person undertaking the monitoring as being unreasonable. The level of what is deemed unreasonable, will be agreed by the site monitoring personnel based on the location of monitoring, location of the nearest receptor and the likely impact on the receptor.

The DER sets a target of 500 odour units emitted from a single source and this will be used as the benchmark for third-party olfactory monitoring should it be undertaken.

The acceptability of the site emissions limits will be based on the number of complaints received from site operations staff, neighbours and customers. A target of zero complaints will be adopted.

If, based on the adopted "noticeable" and "unreasonable" odour limits, there are still complaints received, then the limits will be reassessed and lowered to ensure no complaints are received.

12.9.5. Monitoring

As part of normal operations, site staff will be aware of typical odour levels associated with day-to-day activities around the landfill site. Should any unusual odour levels be experienced, the site staff will immediately report the incident to the site supervisor, who will investigate the cause and take the appropriate action to manage the odour. It is acknowledged that site staff do become desensitised to odour after being exposed to the same odour for an extended period. The facility will also maintain a comprehensive complaints register, which will be used as a gauge of success with regards to odour emissions management.

Formal, on-site odour monitoring by site staff will consist of regular monitoring of the odour levels (nil, noticeable or unreasonable) at predetermined locations around the site and recording the monitoring event data, which as a minimum will include the following:

- Location;
- Date;
- Time;
- Odour level (nil, noticeable or unreasonable);
- Odour type (unrelated to landfill activity, landfill gas, fresh waste, leachate);
- Weather conditions:
    - Wind direction;
    - Wind speed (nil, low, mild, strong);
    - Temperature (cold, cool, warm, hot); and,
- Name of person undertaking the monitoring.

As a minimum, odour monitoring locations will include:

- In the valley line (low point) along Salt Valley Road;
- Accessible points along the Lot 11 property boundary;
- Nearest accessible point to the neighbouring residential properties, while remaining on Lot 11;
- 500 m from the landfill and leachate ponds;
- At the Prescribed Boundary to the landfill site; and,
- Immediately adjacent to all sources of odour:
    - Leachate ponds;

- Leachate extraction points;
- Landfill gas flare infrastructure;
- Penetrations through the landfill cap;
- Active landfill tipping area;
- Areas of leachate recirculation; and,
- Daily and temporary covered areas.

The precise location of each monitoring point will be determined by the following:

- Predominant wind directions;
- Site topography (including valley lines);
- Neighbouring residential properties; and,
- Accessibility.

A minimum of three staff members will be trained to monitor odour around the site; however, only one staff member will undertake the site monitoring at any one time. This training will include:

- Recognition of the different types of odour (unrelated to landfill activity, landfill gas, fresh waste, leachate);
- Recognition of the different emission limits of odour (nil, noticeable or unreasonable);
- Identification of the monitoring locations;
- Factors influencing when and where monitoring is to occur;
- Actions to be taken in the event of unreasonable odour being detected;
- Data recording and record keeping.

Odour monitoring will occur on a weekly basis at the relevant down-wind monitoring points. Should this regular monitoring not identify any changes in odour levels at each location, then the monitoring frequency will be extended; however, as a minimum, odour monitoring will occur on a monthly basis.

The timing of when the monitoring will occur on a particular day or at a particular location is to be determined to ensure that the worst-case odour scenario is monitored. This will include:

- Salt Valley Road valley line in the early morning, especially when there is a temperature inversion in winter;
- Leachate ponds when leachate is being pumped into the ponds;
- Areas of leachate recirculation when leachate is being recirculated; and,
- When the winds speed is low.

To reduce the possibility that the person undertaking the monitoring gets desensitised, monitoring will occur from the furthest/least odourous locations first and then progress towards the nearer/more odourous locations.

All records of odour monitoring will be retained as a database of odour performance on site.

In the event that there be ongoing odour emission issues identified on site, independent third-party odour monitoring will be undertaken to determine the extent of the problem and to propose appropriate improved odour management solutions.

12.9.6. Risk Assessment

A risk assessment of all identified potential environmental risks associated with the management of odour has been undertaken. The primary consideration being the potential impact on the nearest residential receptor.

The emissions and discharge risk assessment framework has been taken from the *DER Corporate Policy Statement No. 07 – Operational Risk Management*.

Emissions Risk Matrix utilised in the risk assessment is based on the following:

Likelihood	Consequence				
	Insignificant	**Minor**	**Moderate**	**Major**	**Severe**
Almost Certain	Moderate	High	High	Extreme	Extreme
Likely	Moderate	Moderate	High	High	Extreme
Possible	Low	Moderate	Moderate	High	Extreme
Unlikely	Low	Moderate	Moderate	Moderate	High
Rare	Low	Low	Moderate	Moderate	High

The outcome of the risk assessment is that there is a low risk of odour impact to the nearest residential receptor as a result of the landfill activities.

The primary reason being the extensive buffer distance (1.35 km) between the odour source and the receptor and the fact that this receptor is located on the other side of a heavily wooded valley line and is at a higher elevation in comparison to the landfill facility (valley 15 m below the level of the landfill and the receptor is 70 m above the level of the landfill).

Table 12.9.6.1 – Odour Risk Assessment provides the detail of the risk assessment.

Table 12.9.6.1 – Odour Risk Assessment

Emission Source Description	Environmental Impact Risk	Management Tools and Mitigation Options/Factors	Activation Trigger and Corrective Action	Monitoring of Corrective Action Efficiency	Contingency Action if Corrective Action is Ineffective	Likelihood & Consequence	Risk Level
Putrescible waste being delivered and unloaded at the active tipping area.	Short-term odour spike until waste is compacted and covered.	Buffer distance and topography between odour source and nearest residential receptor provides significant opportunity for any odour emissions to dissipate. Efficient, active tipping area to reduce the time between the waste being tipped and it being compacted in place. Minimising the distance that the waste is pushed around the active tipping area. Application of adequate cover material (150 mm). Special handling of excessively odourous waste by: • Prearranged delivery; • Minimum notification period prior to waste delivery; • Delivery only in certain wind conditions (speed and direction); • Maximum quantities of waste to be delivered in a single load or day; • Advanced preparation of the landfill tipping area; • Tipping the waste directly in the position of final placement (no pushing the waste around the tipping area); and, • Immediately covering the odourous waste.	Activation Trigger: • On-site odour monitoring identifies unreasonable levels of odour at the active landfill area. • An odour complaint is received. Corrective Action: • Get vehicles to tip waste closer to the final disposal location. • Compact waste immediately. • Application of more regular cover material (not wait until the end of the day). • Additional effort in burying odourous waste.	Undertake odour monitoring of the active tipping area immediately following the implementation of corrective actions to determine the effectiveness of the actions. Check cover material application thickness (150 mm). Check tipping area layout optimises efficient waste disposal operations. Consult with complainant to see if the odour concerns have been solved.	Apply additional thickness of cover material (300 mm). Rejection of excessively odourous waste materials until site conditions improve to enable adequate control of odour emissions.	Unlikely & Insignificant	Low
Fugitive landfill gas emissions.	Consistent odour emissions beyond the site boundary.	Buffer distance and topography between odour source and nearest residential receptor provides	Physical nature of the site. Nil corrective actions possible.	Physical nature of the site. Nil corrective actions possible.	Physical nature of the site. Nil contingency actions possible.	Rare &	Low

Emission Source Description	Environmental Impact Risk	Management Tools and Mitigation Options/Factors	Activation Trigger and Corrective Action	Monitoring of Corrective Action Efficiency	Contingency Action if Corrective Action is Ineffective	Likelihood & Consequence	Risk Level
		significant opportunity for any odour emissions to dissipate.				Minor	
		Compliance with the DER landfill development guidelines ensures the appropriate design and construction of the landfill infrastructure. In particular the landfill liner, landfill gas extraction system and landfill capping to be able to adequately manager the level of fugitive gas emissions from the landfill.	Activation Trigger: • Inability to obtain a Works Approval (due to substandard infrastructure design). Corrective Action: • Amend design to comply with the appropriate guidelines.	Able to obtain a Works Approval.	Further amendments to the design to comply with the appropriate guidelines.	Rare & Minor	Low
		Appropriate construction quality control to ensure that the construction works are carried out to the required standards.	Activation Trigger: • Substandard construction works identified. Corrective Action: • Increase site presence during construction activities.	Confirm construction works carried out according to specifications.	Rigorous enforcement of contract conditions. Withhold payment for works. Dispute resolution process.	Rare & Minor	Low
		Appropriate training and monitoring of landfill operator performance to ensure that the landfill is operated to best practise standards.	Activation Trigger: • Operator performance is identified as being substandard. • On-site odour monitoring identifies unreasonable levels of odour. • An odour complaint is received. Corrective Action: • Improve staff training and monitoring of performance in order to achieve the necessary standard of performance on site.	Confirm landfill operator performance is operated to best practise standards. Consult with complainant to see if the odour concerns have been solved.	Replace operations staff.	Rare & Minor	Low
		Utilisation of specialist landfill gas contractor to design, install and	Activation Trigger: • Contractor performance is	More regular odour monitoring of contractor performance.	Amend contract to capture operational shortcomings.	Rare	Low

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Emission Source Description	Environmental Impact Risk	Management Tools and Mitigation Options/Factors	Activation Trigger and Corrective Action	Monitoring of Corrective Action Efficiency	Contingency Action if Corrective Action is Ineffective	Likelihood & Consequence	Risk Level
		manage the gas extraction infrastructure. This ensures best practise landfill gas management and hence, optimisation of gas capture and destruction, resulting in minimal fugitive gas emissions from site. Contract conditions to transfer the appropriate level of control to the contractor to ensure that the landfill gas system is installed, operated and monitored in accordance with licence conditions and best practise. Progressive installation of landfill gas extraction system to maximise landfill gas extraction. Progressive installation of landfill capping system to minimise landfill gas fugitive emissions. Monitoring and maintenance of gas extraction system to ensure optimum operation of the system.	identified as being substandard. • On-site odour monitoring identifies unreasonable levels of odour. • An odour complaint is received. Corrective Action: • Rigorous enforcement of contractual conditions.	Consult with complainant to see if the odour concerns have been solved.	In an extreme case, replace contractor.	& Minor	
		Regular monitoring of the performance of the gas extraction network and making adjustment and or repairs as required. The DER landfill development guidelines set rigorous fugitive gas emission limits and action levels. Compliance with these maximum emission levels will substantially reduce fugitive gas emissions from site.	Activation Trigger: • On-site odour monitoring identifies unreasonable levels of odour. • An odour complaint is received. Corrective Action: • Rigorous enforcement of contractual conditions.	More regular odour monitoring of contractor performance. Consult with complainant to see if the odour concerns have been solved.	Amend contract to capture operational shortcomings. In an extreme case, replace contractor.	Rare & Minor	Low
Leachate ponds.	Odour spike generated when the fresh leachate is pumped from the	Buffer distance and topography between odour source and nearest residential receptor provides significant opportunity for any odour	Activation Trigger: • On-site odour monitoring identifies unreasonable levels of odour.	Check leachate pumping rate is lower than normal or has been stopped for a few hours. Undertake odour monitoring of the	Stop pumping leachate for the remainder of the day. However, this will result in an accumulation of leachate in the sump and hence a	Rare & Minor	Low

Emission Source Description	Environmental Impact Risk	Management Tools and Mitigation Options/Factors	Activation Trigger and Corrective Action	Monitoring of Corrective Action Efficiency	Contingency Action if Corrective Action is Ineffective	Likelihood & Consequence	Risk Level
	landfill into the ponds.	emissions to dissipate. Regular pumping of small quantities of leachate into the ponds as opposed to pumping significant quantities in a short time period will reduce odour spikes. Allowing the fresh leachate to flow down the side of the pond liner as opposed to projecting it into the air, or have the discharge pipe positioned as close to the liquid surface as possible.	• An odour complaint is received. Corrective Action: • Reduce the leachate pumping rate or stop pumping for a short period (max. few hours).	leachate ponds immediately following the implementation of corrective actions to determine the effectiveness of the actions. Consult with complainant to see if the odour concerns have been solved.	requirement to pump more leachate the following day and potentially exacerbate the odour concerns.		
	Consistent odour generated directly from the leachate pond surface.	Buffer distance and topography between odour source and nearest residential receptor provides significant opportunity for any odour emissions to dissipate. The leachate pond's maximum depth does not allow the leachate to become anaerobic and hence generate excessive odour. Large pond surface area to encourage aerobic digestion within the ponds to reduce the odourous component within the liquid. Lime (or other chemicals) dosing of the leachate pond to change the pH and hence reduce the odour emissions.	Activation Trigger: • On-site odour monitoring identifies unreasonable levels of odour. • An odour complaint is received. Corrective Action: • Seek specialist advice on how to reduce odour emissions. This will likely entail sampling and analysis of leachate to identify the cause of the odour emissions, then chemical treatment (normally pH adjustment).	Follow up to ensure specialist advice and subsequent actions are activated ASAP. Undertake odour monitoring of the leachate ponds following the implementation of corrective actions to determine the effectiveness of the actions. Consult with complainant to see if the odour concerns have been solved.	Revert back to the specialist for addition advice. In an extreme case, replace specialist.	Rare & Minor	Low
	Odour spike generated during forced evaporation via spray irrigation.	Buffer distance and topography between odour source and nearest residential receptor provides significant opportunity for any odour emissions to dissipate. Ensuring that the leachate in the ponds is not overly odourous (refer	Activation Trigger: • On-site odour monitoring identifies unreasonable levels of odour. • An odour complaint is received. Corrective Action:	Undertake odour monitoring of the leachate ponds following the implementation of corrective actions to determine the effectiveness of the actions. Consult with complainant to see if the odour concerns have been	Cease activity until conditions improve (leachate quality or weather).	Rare & Minor	Low

Emission Source Description	Environmental Impact Risk	Management Tools and Mitigation Options/Factors	Activation Trigger and Corrective Action	Monitoring of Corrective Action Efficiency	Contingency Action if Corrective Action is Ineffective	Likelihood & Consequence	Risk Level
		above). Only spray-irrigate when wind direction and net evaporation capacity is favourable. Spray equipment settings to maximise evaporation in proportion to volume of leachate pumped (ie. minimise pumped volume for the volume of evaporation achieved so as not to saturate the waste mass).	• Reduce irrigation spray rate until conditions improve (leachate quality or weather).	solved.			
Leachate recirculation via water tanker and/or sprinklers onto the surface of the landfill.	Odour spike generated during leachate recirculation.	Buffer distance and topography between odour source and nearest residential receptor provides significant opportunity for any odour emissions to dissipate. Only recirculating leachate when conditions are appropriate: • The waste surface is dry. • The daily recirculation quantity is able to be evaporated from the surface and not accumulate on the surface. • Wind direction is appropriate. Regular spraying of small quantities of leachate onto the landfill as opposed to significant quantities in a short time period. Low volume spray irrigation in preference to large volume sprinklers.	Activation Trigger: • On-site odour monitoring identifies unreasonable levels of odour. • An odour complaint is received. Corrective Action: • Reduce irrigation spray rate until site conditions improve (leachate quality, landfill surface dries out or weather).	Undertake odour monitoring of the landfill area following the implementation of corrective actions to determine the effectiveness of the actions. Consult with complainant to see if the odour concerns have been solved.	Cease recirculation until site conditions improve (leachate quality, landfill surface dries out or weather).	Rare & Minor	Low
Leachate recirculation via direct pumping onto the incoming waste	Odour spike generated during leachate recirculation.	Buffer distance and topography between odour source and nearest residential receptor provides significant opportunity for any odour	Activation Trigger: • On-site odour monitoring identifies unreasonable levels of odour.	Undertake odour monitoring of the landfill active tipping area following the implementation of corrective action to determine the	Having ceased leachate pumping, which only occurs as a last resort when trying to reduce the volume of leachate in the leachate ponds,	Rare & Minor	Low

Emission Source Description	Environmental Impact Risk	Management Tools and Mitigation Options/Factors	Activation Trigger and Corrective Action	Monitoring of Corrective Action Efficiency	Contingency Action if Corrective Action is Ineffective	Likelihood & Consequence	Risk Level
while being pushed and compacted into the landfill.		emissions to dissipate. Only recirculating leachate into the waste mass as a last resort when trying to reduce the volume of leachate in the leachate ponds, as the tipping face operators do not like this option as it makes a mess of their working area. Minimal odour generation as only a small area of the landfill is impacted and the vast majority of the leachate gets covered immediately.	• An odour complaint is received. Corrective Action: • Cease activity and let the landfill surface dry out.	effectiveness of the action. Consult with complainant to see if the odour concerns have been solved.	there may be a need to continue to reduce the volume of leachate in the ponds. In this event, leachate is to be tankered off site.		

12.9.7. Odour Management Response Plan

In the event that the odour monitoring or complaints identify excessive odour emissions from site, a response plan will be implemented. This response plan will incorporate the following:

- Assess the odour source identified as a problem and consider the possible cause(s);
- Consider the impact of the problem(s):
- If possible, rectify the problem (eg. change leachate pumping rates);
- If not possible to rectify the problem (eg. pumping rate is required to maintain the maximum 300 mm leachate level on the landfill liner), assess the likely impact on neighbouring properties and whether there are any contingency measures that could be implemented to minimise the impact (eg. lower the leachate discharge pipe to below the level of the leachate to prevent aeration during pumping);
- Consider amending the standard operating procedures if the current procedures are ineffective (eg. change leachate pumping schedule).

It will not be possible to develop a response plan that covers each likely eventuality and proposed feasible solutions to those possible problems. In the event that a problem is identified, the appropriate specialist will be engaged to develop an incident specific remedial solution. Depending on the degree of the incident, the DER may need to be involved in the process.

12.10. Noise Management

12.10.1. Concept

The objective of noise management will be to minimise the generation of noise from the onsite activities and in all circumstances, maintain noise emissions below the noise levels set in the *Environmental Protection (Noise) Regulations 1997*.

12.10.2. Sources

Potential sources of noise emissions include:

- Vehicles and mobile plant moving around the site;
- Reversing beacons on vehicles;
- Adjacent clay extraction operation.

12.10.3. Treatment Options

There will be a number of noise mitigation strategies that will be employed in order to reduce odour emissions on-site. The mitigation strategy will be a function of the source of noise generation.

Vehicles and mobile plant moving around the site

This will be typically a function of speed. With the site speed limit being a maximum of 40 km/hr, this should be sufficient to minimise the noise emissions from this source. The internal road configuration will be relatively tight, with minimal straight sections of road along which vehicles would have the opportunity to gain excessive speed.

An additional contributing factor to noise from vehicles and mobile plant will be the noise power levels from the individual vehicles or mobile plant. This issue will be primarily related to the larger pieces of equipment such as the waste compactor and dozer and some of the clay extraction equipment used by Austral Bricks.

The degree of noise generation and the impact on receptors will be a function of the following factors:

- The number of vehicles and plant operating simultaneously;
- The speed of the vehicles;
- The noise power levels of each moving item;
- Wind speed and direction; and,
- Buffer distance to receptors;

Treatment options include:

- Controlling the vehicle speed on internal roads:
    - Via changed site speed limits; and
    - Via speed humps if speeding remains a problem.

Reversing beacons on vehicles

Should this noise source be identified as a problematic source of emissions, the reversing beacons would be modified to reduce the noise volume or replaced with low frequency beepers/croakers that emit lower noise levels, but still comply with the necessary safety regulations.

Adjacent clay extraction operation

The degree of noise generation and the impact on receptors will be a function of the following factors:

- The number of vehicles and plant operating simultaneously;
- The speed of the clay removal vehicles;
- The noise power levels of each moving item;
- The noise from reversing beacons;
- Wind speed and direction; and,
- Buffer distance to receptors;

Treatment options include:

- Controlling the vehicle speed on internal roads;

- Changing plant reversing beacons to low frequency beepers/croakers; and,
- Coordinating the use of landfill and clay extraction plant to minimise the number of noisy plant being used at one time.

12.10.4. Emissions Limits

The *Environmental Protection (Noise) Regulations 1997*, require that sensitive premises including dwellings in non-industrial areas are not subjected to noise levels exceeding 45 dBA for more than 10% of the time, 55 dBA for more than 1% of the time and never exceeding 65 dBA during normal working hours. There are penalties for tonality of 5 dB, modulation 5 dB and 10 dB for impulsiveness.

12.10.5. Monitoring

The site will be monitored on a daily basis by the onsite attendant. The facility will also maintain a comprehensive complaints register, which will be used as a gauge of success with regards to noise emissions management.

In the event that there be a noise emission issue identified, formal acoustics monitoring will be undertaken by an independent third party to determine the extent of the problem and to propose appropriate improved noise management solutions.

12.10.6. Risk Assessment

A risk assessment of all identified potential environmental risks associated with the management of noise has been undertaken. The primary consideration being the potential impact on the nearest residential receptor.

The emissions and discharge risk assessment framework has been taken from the *DER Corporate Policy Statement No. 07 – Operational Risk Management*.

Emissions Risk Matrix utilised in the risk assessment is based on the following:

Likelihood	Consequence				
	Insignificant	Minor	Moderate	Major	Severe
Almost Certain	Moderate	High	High	Extreme	Extreme
Likely	Moderate	Moderate	High	High	Extreme
Possible	Low	Moderate	Moderate	High	Extreme
Unlikely	Low	Moderate	Moderate	Moderate	High
Rare	Low	Low	Moderate	Moderate	High

The outcome of the risk assessment is that there is a low risk of noise impact to the nearest residential receptor as a result of the landfill activities.

The primary reason being the extensive buffer distance (1.35 km) between the noise source and the receptor.

Table 12.10.6.1 – Noise Risk Assessment provides the detail of the risk assessment.

Table 12.10.6.1 – Noise Risk Assessment

Emission Source Description	Environmental Impact Risk	Management Tools and Mitigation Options/Factors	Activation Trigger and Corrective Action	Monitoring of Corrective Action Efficiency	Contingency Action if Corrective Action is Ineffective	Likelihood & Consequence	Risk Level
Vehicles and mobile plant moving around the site.	Noise from vehicles and mobile plant moving around the site negatively impacting on the nearest residential receptor.	Buffer distance and topography between odour source and nearest residential receptor provides significant opportunity for noise emissions to dissipate. Specialist noise consultant (Herring Storer) undertook a noise assessment and determined that the landfill operations could be operated within the regulated noise limits. Control of vehicle speed (40 km/hr). Heavy machinery noise power levels to limit emissions.	Activation Trigger: • A noise complaint is received. Corrective Action: • Improved control of vehicle speed, include installing speed humps if needed. • Third-party noise monitoring of vehicle noise power levels and other related site activities to identify the activities that emit the greatest noise. • Install additional noise suppressors on heavy equipment or implement other actions as determined by the noise monitoring.	Consult with complainant to see if the noise levels concerns have been solved. Possible third-party noise monitoring following the implementation of noise reduction strategies.	Replace noisy equipment with lower noise power level equipment or confirmation that the noise levels are within allowable regulated levels.	Unlikely & Insignificant	Low
Reversing beacons on vehicles.	Noise from reversing beacons on vehicles negatively impacting on the nearest residential receptor.	Buffer distance and topography between odour source and nearest residential receptor provides significant opportunity for noise emissions to dissipate. Specialist noise consultant (Herring Storer) undertook a noise assessment and determined that the landfill operations could be operated within the regulated noise limits.	Activation Trigger: • A noise complaint is received. Corrective Action: • Modify reversing beacons to reduce the noise volume or replaced with low frequency beepers/croakers that emit lower noise levels.	Consult with complainant to see if the modified beepers have solved the problem. Possible third-party noise monitoring of vehicle noise emissions.	Further changes to beepers or confirmation that the noise levels are within allowable regulated levels.	Unlikely & Insignificant	Low
Adjacent clay extraction operation.	Combined noise impact of the landfill and adjacent clay extraction operation negatively impacting on the	Buffer distance and topography between odour source and nearest residential receptor provides significant opportunity for noise emissions to dissipate. Specialist noise consultant (Herring	Activation Trigger: • A noise complaint is received. Corrective Action: • Third-party noise monitoring	Consult with complainant to see if the noise levels concerns have been solved. Possible third-party noise monitoring of vehicle noise	Further changes to noise emission sources or confirmation that the noise levels are within allowable regulated levels.	Unlikely & Insignificant	Low

Emission Source Description	Environmental Impact Risk	Management Tools and Mitigation Options/Factors	Activation Trigger and Corrective Action	Monitoring of Corrective Action Efficiency	Contingency Action if Corrective Action is Ineffective	Likelihood & Consequence	Risk Level
	nearest residential receptor.	Storer) undertook a noise assessment of the combined noise levels and determined that the landfill operations could be operated within the regulated noise limits.	of vehicle noise power levels and other related site activities to identify the activities that emit the greatest noise. • If elevated noise levels are identified, implement possible solutions as recommended by the third-party specialist.	emissions.			

12.10.7. Noise Management Response Plan

In the event that the noise monitoring or complaints identify excessive noise emissions from site, a response plan will be implemented. This response plan will incorporate the following:

- Assess the noise source identified as a problem and consider the possible cause(s);
- Consider the impact of the problem(s):
- If possible, rectify the problem (eg. only move cover material when the site is not busy – only minimal vehicles moving around site);
- If not possible to rectify the problem (eg. site too busy and cover material needs to be moved), assess the likely impact on neighbouring properties and whether there be any contingency measures that could be implemented to minimise the impact (eg. install sound suppressors on the dump truck and excavator);
- Consider amending the standard operating procedures if the current procedures are ineffective (eg. move cover material early in the morning as opposed to towards the end of the day).

It will not be possible to develop a response plan that covers each likely eventuality and proposed feasible solutions to those possible problems. In the event that a problem be identified, the appropriate specialist will be engaged to develop an incident specific remedial solution. Depending on the degree of the incident, the DER may need to be involved in the process.

12.11. Fire Management

Under no circumstances will waste be burnt on site. Burning of waste does not form part of the site waste management activities.

Fire management will be a critical activity on the landfill site. A significant portion of Class II waste will be combustible and due to the wide variety of waste received, it will be possible that there could be spontaneous combustion within the waste mass. Consequently there will be a risk of fire within the landfills.

The risk of landfill fires will be managed in the following ways:

- Appropriate compaction and covering of waste;
- Collection of litter from up against the litter fences;
- Not placing significant quantities of flammable material in a single area within the landfill (piles of tyres);
- Appropriate site security to reduce the likelihood of vandals entering the site;
- Appropriate fire fighting equipment on site:
    - The water tanker will be the primary fire fighting piece of equipment on site;

- Sufficient stockpiles of cover material will be maintained close to the active tipping area to facilitate rapid covering of the waste in the event of a fire;
- Minimum 50 kL of water will be stored on site (in storage dam); and,
- The water tanker will always be left full to be able to react immediately to a fire.

- Adequate training for site operating staff.

Due to the importance of fire management on site and the detail required to cover this aspect of landfill management, a separate Fire Management Plan has been developed.

Appendix No. 3 – Fire Management Plan provides a copy of the Fire Management Plan.

12.12. Chemical and Fuel Management

All chemicals and fuels will be stored in accordance with the *Code of Practise for the Storage and Handling of Dangerous Goods*.

Initially fuel will not be kept on site. Normally machinery and plant accessing the site will be fuelled from mobile refueling, with fuel being placed directly into each machine/plant.

At some time in the future, should fuel be required to be stored on site, it will be stored in purpose built, self-bunded fuel dispensing containers. These units come with their own fuel pump, bowser, fill point and spill kit.

There will also be limited quantities of oils and greases stored on site for regular maintenance of mobile equipment. These hydrocarbons are typically contained in small quantities of up to 5 litres, but occasionally in 25 litre drums. All of these hydrocarbons are stored undercover (in shipping containers).

Minor spills fuel (< 5 litres) will be cleaned up and placed in the landfill. Bacteria breakdown will dissipate small quantities of fuel or lubricants in the same manner as any other organic waste stream.

Any spillages of greater than 5 litres will be reported to the DER as soon as practicable, but within 24 hours. The spillage clean up methodology will be dependent on the size of the spill and in accordance with the DER requirements.

12.13. Mosquito Management

Mosquitoes breed in standing water in natural and man-made wetlands, as well as a range of water-holding containers in the human environments. They can breed in fresh, brackish and saline water conditions and different mosquito species have different habitat requirements.

There will be the potential for mosquito breeding on site. The control of mosquitoes will primarily be a function of limiting the breeding opportunities by limiting the extent of water bodies around the landfill site as well as limiting the vegetation growth within the water bodies.

There will be an operational need to store water on site; hence, it will not be possible to eliminate all water bodies; however, it will be possible to eliminate vegetation within the storage ponds and dams.

Based on historical site activities associated with the clay extraction, where there were extensive water storage ponds within the clay excavation, there was no pond vegetation and also no mosquito breeding activity. Consequently, so long as the perimeter vegetation around the water storage ponds and dams is eliminated, there should be no future problem with mosquito breeding.

Due to the chemical composition of leachate and the non-existence of vegetation within the leachate ponds, the ponds will not be a source of mosquito breeding.

In the rare event that mosquitoes are identified as a problem on site, there are a number of management techniques that will be used to reduce the breeding of mosquitoes and hence reduce exposure of people to mosquito bites. Approaches include the physical, biological, chemical and cultural mosquito control.

12.14. Bird Management

Birds are attracted to landfill sites in search of food and water. Once a colony of birds has established on site, it will be extremely difficult to eliminate them from site. The best that can be achieved will be to control the bird numbers and the impact that they cause. It is unlikely that once birds have established on site that there could ever be completely removed.

Mechanisms to prevent/limit the colonisation of birds on site include the following:

- Elimination water bodies (not possible on this site);
- Immediate application of a good layer of cover material over the fresh waste;
- Scare devices;
- Traps; and,
- Selected culling (with the appropriate permission).

Birds are attached to the food source within the freshly delivered waste. This is typically associated with the landfilling of large quantities of municipal waste. This is not anticipated to be a significant waste stream and hence, birds are no anticipated to be a significant problem on site.

When birds are first noticed on site, there will be a need to immediately implement bird control mechanisms to try and discourage the colonisation of the site by the birds.

12.15. Vermin Management

Potential sources of vermin include:

- Arriving in material being delivered to the facility; and/or
- Living in and around the facility.

The following preventative or corrective measures are available:

- Regular pushing up and compaction of the waste;
- Application of adequate cover material;
- Progressive closure of completed landfill areas;
- Monthly inspections of the site will be undertaken specifically to identify if there are any vermin present on and around the landfill. The monthly inspection will be carried out by site operational staff;
- During normal site operations, staff will be mindful of the potential presence of vermin, especially in the incoming material deliveries;
- Should vermin be identified on site, the appropriate eradication procedures will be undertaken (dependent on the vermin type). This will be to involve professional pest controllers being utilised to manage the situation. Typically vermin could include:
    - Rats and mice;
    - Cats; and,
    - Birds.
- On occasion it may be appropriate to use both mouse and rat traps around the site even if vermin have not been seen. This will assist in identifying the presence of any rats or mice.

12.16. Noxious Weed Management

The potential sources of weed infestation include:

- In material being delivered to the site; and,
- Blow-in from surrounding areas (minor source).

Management measures include:

- No green waste processing site;
- Application of adequate cover material;
- Regular site inspections; and,
- Weed eradication as required – small areas controlled by landfill operations staff, larger areas controlled by professional weed control company or with the assistance of the local farmer.

With the site being located within a rural area, and a large, predominantly agricultural property that is well away from public roads, there are currently very few weeds observed on site. The local farmer has been very successful in the control of weed. This situation will be expected to continue during the operation of the landfill as all waste received on site will immediately be delivered to the landfill, placed, compacted and covered daily. Any weeds within the waste will be well contained and covered over within the landfill.

The local farmer will be using the landfill buffers around the landfill for stock grazing and cropping; hence, the current level of weed control will be maintained around the landfill site.

The landfill operations and the local farmer will work closely together to ensure that there will be adequate management of weed on site.

13. Contingency Planning

All site staff will be fully trained in the operation of the landfill in accordance with the facility operating Licence, management plans and procedures and industry best practise.

To further reduce the risk of operational or environment incidents, contingency measures will be implemented to ensure on-site activities are carried out as programmed and in accordance with standard operating procedures. The site supervisor will be responsible to ensure that all landfill related activities are undertaken at the appropriate time and to the required standard.

Contingency planning will form part of the environmental and operational management of the site and will include the following:

- The ongoing monitoring and reporting of potential contamination of surface or groundwater;
- The ongoing monitoring and reporting of landfill gas emission levels to detect if there is a shortcoming within the landfill gas management system such as extraction well failure, pipe blockages, flare failure or damage to the landfill capping system;
- The ongoing monitoring and reporting of leachate generation, accumulation and treatment volumes to detect if there is a shortcoming within the leachate management system such as blockage of leachate collection pipes, ineffective treatment systems or excessive leachate accumulation;
- Maintenance of records of landfill fires, including potential ignition sources, actions taken and lessons learnt;
- The ongoing monitoring and reporting of unauthorised waste disposal, including identification of how the vehicle entered the landfill;
- The ongoing monitoring and reporting of odours and dust beyond the Prescribed Boundary and Lot 11 boundary;
- The ongoing monitoring and reporting of litter washed or blown beyond the Prescribed Boundary and Lot 11 boundary; and,
- Mobile equipment breakdown and back-up options.

The site supervisor will be responsible to ensure that the appropriate contingency planning be in place to monitor the performance and outcomes of the above activities and if any shortfalls are identified in the facility operating systems, that the appropriate actions will be taken to identify, implement and record system improvements.

14. Reporting Obligations

14.1. Quarterly Landfill Levy Returns

It will be a requirement within the *Waste Avoidance and Resource Recovery Levy Regulations 2008*, that all landfills receiving waste from the Perth metropolitan area pay the landfill levy on those tonnes.

On a quarterly bases, the landfill levy submission and payment will be made to the DER. This in an accounting function that will be carried out by the head office. The site supervisor will ensure that the appropriate weighbridge data be transferred to head office to facilitate the submission of the landfill levy return.

14.2. Annual Reporting

The facility operating Licence stipulates the extent of annual environmental reporting required.

The following are the reports that will be required:

- *To be completed once the operating Licence has been issued.*

14.3. Incident reporting

The facility operating Licence stipulates the need for incident reporting to the DER.

The following are the reports that will be required:

- *To be completed once the operating Licence has been issued.*

15. Community Communication

There was significant community resistance to the development of the landfill facility. After substantial effort on behalf of Opal Vale, the facility was eventually approved and constructed.

It is important to appreciate that the community are not supportive of the landfill development; hence, every effort will be made to communicate thoroughly with the immediate community on relevant aspects of the landfill operations. In particular, providing advanced warning of any landfill activity that may be of interest or impact on the neighbouring properties.

A list of the property owners' names and contact details will be maintained on site and the immediate, local community will be provided with the contact details of the weighbridge operator and the site supervisor.

In addition, the site entrance signage will clearly indicate the after hours contact details of the site supervisor.

16. Complaints Management

There will be a Complaints Register maintained relating to all site activities. The register will either be a bound book or electronic file.

All complaints relating to the landfill operation will be entered into the Complaints Register. The Register will record, as a minimum, the following information:

- Date and time the complaint was received.
- How the complaint was received (by phone, email, in person, via the DER etc.)
- The details of the complainant (if available).
- Details of the complaint:
    - What is the complaint about?
    - When did the incident occur?
    - How often did the incident occur?
    - Was anyone else impacted by the incident?
- Local weather conditions at the time of receiving the complaint that may be relevant to identify the cause of the complaint.
- Name of the person receiving the complaint.
- Action taken to investigate the complaint.
- Follow-up dealings with the complainant.
- Outcome of the complaint investigation.

The Complaints register will be maintained at the weighbridge office. The register will be maintained up to date, with all complaints being entered into the register before the end of the day on which the complaint was received.

17. Landfill Closure and Rehabilitation

Landfill closure will be a critical activity on the landfill site. The appropriate and comprehensive closure of the landfill will have a significant impact on reducing the environmental emissions from the site and greatly assist in the timely stabilisation of the waste mass.

Due to the importance of closure of the landfill a separate Rehabilitation Management Plan has been developed.

Appendix No. 4 – Rehabilitation Management Plan provides a copy of the Rehabilitation Management Plan.

18. Financial Assurance

The SAT order 27 – Cash Bond, states:

"*Prior to the commencement of operation of the facility, the applicant shall provide a cash bond of $120,000 to the Shire of Toodyay as a performance guarantee against the satisfactory completion of the rehabilitation of the site, such funds to be held in an interest bearing account, with the interest forming part of the bond. The performance guarantee will be refunded at a rate of 50% following completion of the final stage of rehabilitation works and 50% at the conclusion of the three year monitoring period. Any such bond is to be accompanied by a bonding agreement and written authorisation from the owner of the land that the respondent may enter the site to complete or rectify any outstanding work. The respondent will recover the bond, or part thereof as appropriate, for any costs to the respondent in completing and/or rectifying the outstanding works.*"

19. Review and Update

In order to ensure that this Landfill Management Plan will be up to date and reflect the most recent landfill management practices, it will be essential that the plan be reviewed and updated on a regular basis.

19.1. Contingency and Response Plans

The contingency and response planning aspects of this plan will be reviewed and if necessary updated after an incident or if a future facility operating Licence renewal has amended contingency and response planning aspects that are not consistent with this current plan.

19.2. Landfill Management Plan

This Landfill Management Plan will be reviewed and updated in accordance with the following schedule:

- Year 5 (2020) - Review/confirm relevance and update as appropriate.
- Year 10 (2025) - Use as a basis for a complete review for the next ten-year period.

Appendices

Appendix No 1 - Asbestos Management Plan

Appendix No 2 - Dust Management Plan

Appendix No 3 - Fire Management Plan

Appendix No 4 - Rehabilitation Management Plan