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GREAT SOUTHERN LANDFILL FACILITY, LOT 4869 GREAT SOUTHERN HIGHWAY, SHIRE OF YORK

Great Southern Landfill Management Plan

MANAGEMENT PLAN

Submitted to:
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1.0 INTRODUCTION

This Landfill Management Plan (LMP) has been compiled as a guide for the ongoing development and operation of the Great Southern Landfill (GSL) facility to ensure that the facility is operated in a safe and environmentally sustainable manner and to maximise the efficiency of the operation whilst minimising environmental impacts on the surrounding area.

1.1 Background

Following an extensive planning approval process on 8 March 2016, the State Administrative Tribunal (SAT) approved the landfill facility, subject to a number of conditions (Matter N. DR292 2012). The landfill is also subject to an assessment by the EPA under Part IV of the Environmental Protection Act 1986. A works approval was previously granted for the site, however this was surrendered. A current works approval application lodged by Alkina for the same landfill is currently on hold, pending the outcome of the Part IV process.

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 potential environmental impacts.

1.3 Reference Documents

Licensing, planning and approvals documentation will be incorporated as they become available.

1.4 Environmental Commitment

Alkina Holdings Pty Ltd (Alkina) commits to develop, operate and close the GSL Class II facility in accordance with all relevant approval conditions, industry best practise and to minimise environmental impact.

2.0 FACILITY AND OPERATIONAL DESCRIPTION

2.1 Facility Overview

The landfill facility is located near the western edge of the Shire of York, Western Australia. The property is described as being Part of Lot 4869 on Plan 224502, in Certificate of Title Vol 285, Fol 78A, Great Southern Highway, Saint Ronans in the Shire of York (Appendix A, Figures 1 and 2).

The GSL will be located on the southern side of the Great Southern Highway approximately 90 km by road from the source waste processing facility in Bayswater and is 20 km west of the York Town site. The initial prescribed premise boundary, for development of the landfill cells and associated infrastructure and internal access roads, will encompass an area of approximately 84 ha (development footprint).

The landfill will be developed in stages with each stage consisting of a number of individual landfill cells to cater for approximately two to three years of waste deliveries. The volume of Cell 1 and Cell 2 will be 1.78 million (M) cubic metres (m^3) constructed first (and subject to the works approval application assessment.

2.2 Staged Development

The landfill cells will be developed as numbered starting with Cell 1 towards the south, followed by Cell 2 towards the north. The next cell to be developed is Cell 3, adjacent to Cell 2 along the northern boundary of the landfilling area. Cell 4 lies to the south of Cell 3 whilst Cell 5 will be adjacent to Cell 3 on the northern boundary. Cell 6 is adjacent to Cell 4 on the southern boundary and finally Cell 7 bounds both Cells 5 and 6 on the southern edge.

The landfill cell configuration is shown in Figure 1.

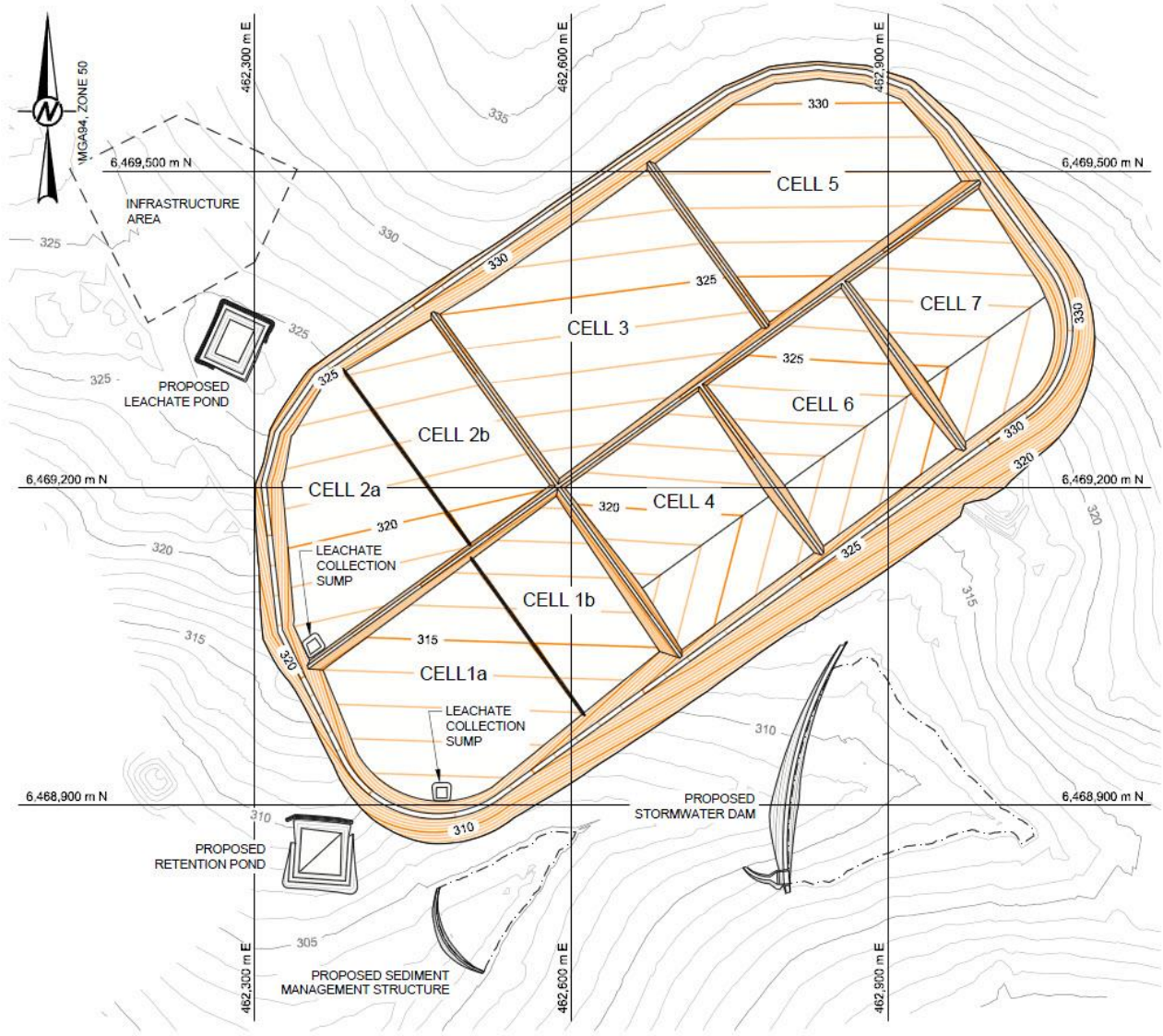

Figure 1: Landfill Cell Configuration

2.3 Landfill Life Expectancy

The GSL facility will accept between 150,000 and 250,000 tonnes of waste per annum. At this stage the facility will operate for approximately 28 years, dependent on achieved filling and compaction rates. The landfill will have a lifetime capacity of approximately 5.6 Mm^3 as detailed in Table 1 below.

Table 1: Landfill Cell Capacity

Landfill Cell	Available Airspace (m^3)	Annual Tonnage (t)	Life Expectancy (years)
Cell 1	790 000	790 000	4.0
Cell 2	990 000	990 000	5.0
Cell 3	860 000	860 000	4.3
Cell 4	870 000	870 000	4.3
Cell 5	680 000	680 000	3.4
Cell 6	800 000	800 000	4.0
Cell 7	610 000	610 000	3.1
Landfill Total	5 600 000	5 600 000	28.1

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

General landfill industry practice is to have an individual landfill cell completed within two to three 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 to three 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.

2.4 Facility Operational Overview

The primary operational activities on site include the following:

- Landfill cell development
- Waste acceptance
- 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, and
- Monitoring and maintenance of the closed landfill areas.

2.5 Facility Operating Hours

The facility operating hours are as follows:

- Monday to Friday – 6.00 to 17.00; Saturdays and Public Holidays – 7.00 to 16.00, and
- Sunday – Closed

The landfill site is permanently staffed during all hours of operation.

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

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

Appropriate signage is maintained at the main entrance to the site from Great Southern Highway, providing details to customers and the general public of the facility operating hours.

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

3.0 FACILITY OPERATING LICENCE

The landfill is to be operated in accordance with the DWER-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 is always readily available on site as a point of reference to guide facility operations.

The facility operating Licence is periodically renewed/amended by the DWER. The latest version of the Licence is used to guide facility operations.

4.0 OCCUPATIONAL HEALTH AND SAFETY

All landfill activities are 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 is ensured.

The landfill activities are governed by WorkSafe and the *Occupational Safety and Health Act 1984* and associated Regulations. A OSH plan for the facility will developed as a separate document.

5.0 STAFFING AND STAFF INDUCTION/TRAINING

*Table **2*** sets out the required on-site staffing levels to adequately operate the landfill facility.

Table 2: Staffing Structure and Responsibilities

Designation	No. *	Responsibility
Landfill Supervisor	1	Overall management of the site including all compliance requirements.
Weighbridge Operator	2	Waste acceptance 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

Notes: * 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 is 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 is also the Landfill Business Manager and administration support staff who assist in the smooth operation of the facility, but are not permanently based on site.

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

Workers and contractors will need to have demonstrated competencies for their respective roles. Activity specific training is also 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.

6.0 SITE INFRASTRUCTURE

6.1 Site Office, Crib Room and Ablutions

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

6.2 Vehicle Parking

Parking for private cars is provided at the weighbridge.

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

Operational equipment/machinery are parked on the landfill.

6.3 Fencing

6.3.1 Access Control

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

A combination of 1.2 m high farm fencing and 2.3 m high mesh and barbed wire security fencing will be used around the site infrastructure (e.g. landfill and ponds). Additional precautions will also be undertaken to exclude feral animal access

6.3.2 Litter Control

Immediately surrounding the active landfill area and the leachate ponds there is a 1.8 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 active landfilling there is a 1.6 to 4 m high temporary/mobile litter fence immediately adjacent to the landfill tipping area to improve litter management.

On a regular basis or at least weekly, the site operations staff 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.

Section 11.8 contains further detail on litter management for the facility.

7.0 LANDFILL PLANT AND EQUIPMENT

7.1 List of Plant and Equipment

The following is a list of plant and equipment to be utilised on site during both the construction and operational phases of the landfill:

Construction:

- Pad Foot Roller
- Smooth Drum Roller
- Grader
- 30 tonne Excavator
- Articulated Water Truck
- Articulated Dump Truck
- D9 Dozer
- 50 tonne Loader
- Wheel Tractor Scraper

Operation:

- 30 tonne Compactor
- 50 tonne Compactor
- D7 Dozer
- Dump Truck 6×4
- Excavator
- Water Truck 6×4
- Grader.

7.3 Plant and Equipment Operational Requirements

Light vehicles are used for general access around site.

The landfill waste compactors and D7 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 are required for the excavation, loading, hauling and tipping of cover material.

The water truck is used for dust suppression and firefighting.

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.

7.4 Plant and Equipment Maintenance

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

Records of all maintenance activities are to be kept on site and daily pre-starts will be undertaken to ensure plant is operating optimally.

7.5 Plant and Equipment Breakdown

With the exception of light vehicles, all landfill equipment listed above are seen as critical equipment for the efficient and effective operation of the landfill site and as such, there is 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 is 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 is "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 is temporarily replaced by a large dozer (minimum D9 or equivalent).

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

8.0 WEATHER

Basic weather data is collected from the Bureau of Meteorology (BOM) site to assist in the efficient management of the landfill activities. Local rainfall will also be recorded on site and operators will be expected to monitor the weather and plan activities accordingly.

9.0 SITE SECURITY

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

Due to the rural nature of the site, there is 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) are kept securely under lock and key as part of an alarmed system. It is probable that a staff member will live on the farm.

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

10.0 OPERATIONAL ACTIVITIES

10.1 Landfill Cell Development

The landfill is developed in a series of cells, with each cell being sized to accommodate approximately three to five years' landfill airspace requirements.

However, the actual life expectancy of each landfill cell is highly dependent on the quantity of waste being delivered to site.

10.1.1 Approval Requirements

All future landfill development on site is to be covered by a valid Licence Amendment.

New cells and any instrument amendment processed by DWER will require sufficient lead-up time for them to assess the application. The assessment could take several months (plan for up to eight months) for a major assessment and four months for a minor amendment application to be processed.

10.1.2 Timing of Development

The planning for the construction of the next landfill cell is to be programmed well ahead of the closure of the current active landfill cell. Site-specific factors that 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 four to six months prior to the current landfill cell reaching maximum capacity
- Annual waste disposal quantity / volumes
- Time of the year. Is extremely difficult to construct a landfill cell during the winter months. The ideal is 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 can 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 Licence Amendment
- Design and construction duration, and
- Duration for the DWER to:
  - review and approve the construction completion documentation and following this, and
  - prepare a licence amendment document to allow the new cell to be utilised.
  -

10.1.3 Sizing of Landfill Cells

Each new landfill cell is to be sized to accommodate between two and three year's waste disposal. Site specific factors that 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.

10.1.4 Cell Construction

Design

The landfill design has been developed in general accordance with Victorian EPA Best Practice Environmental Management; Siting, Design, Operation and Rehabilitation of Landfills (Vic BPEM). All future landfill design is to be developed in general accordance with this guideline, or any subsequent DWER 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 and hence future cell development will still be assessed based on risk to the environment

Stability Assessment

As part of the general industry practice, there is a need to carry out a landfill stability assessment for each Licence Amendment application to the extent required based on the site specific risks.

This has been done for the original Works Approval and has demonstrated that the design is stable and appropriate.

Construction

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

Construction is to be programmed to occur in the dry summer months. 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 is to be an extensive Construction Quality Assurance process that is followed during the landfill cell construction. All critical earthworks are to be undertaken with Level 1 geotechnical engineering supervision and testing. All lining and leachate system installation works is to 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 is to be prepared for submission to the DWER 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 DWER has provided a licence amendment for the operation of the new landfill cell. This can only occur after the CQA report and Compliance Documentation have been submitted to, reviewed and accepted by the DWER.

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 DWER 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.

10.2 Waste Acceptance and Receival

10.2.1 Reference Documents

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

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

The applicable waste acceptance criteria are to be strictly adhered to.

10.2.2 Material Types

Material types 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.

10.2.3 Landfill Operations Liability

The landfill supervisor has the ultimate liability for the acceptance of waste into the landfill. It is 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 is acceptable on site.

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

10.2.4 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).

10.2.5 Asbestos Waste

The landfill site accepts asbestos containing material.

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

An Asbestos Management Plan will be developed that addresses the receipt, handling and disposal of asbestos on site. The plan will cover the following aspects:

Prevention/Inspection

- All customers are advised that asbestos is only 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 is only 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 is managed in accordance with the Asbestos Management Plan.

Appendix B provides a copy of the Asbestos Management Plan.

10.2.6 Typical Non-Conforming Waste Types

Non-conforming waste could be the following:

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

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

10.2.7 Customer Enquiries

When customers make enquiries for the disposal of waste material, the onus is on the landfill supervisor to ensure that the customer provides adequate documentation to clearly substantiate what type the material is. This information is to 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 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.

10.2.1 Weighbridge

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

The following activities are undertaken in dealing with each waste load:

- Customers are 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 is not practical/possible to visually inspect the waste material at the weighbridge; however, an elevated camera is mounted on the weighbridge gatehouse to enable the weighbridge operator to, where possible, monitor the contents of the incoming vehicles.
- The incoming load is 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
  - Total GST charged for the load, and
- Once the vehicle has been weighed in, the vehicle progresses to the active landfill tipping area.

10.2.2 Waste Inspection

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

- At the weighbridge the vehicle driver confirms the waste type.
- As far as is practically reasonable, each load is 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 are obscured by the tarp, bin or vehicle.
- Enquiries are carried out in order to identify:
- Material type
- Material quantity
- Material origin
- Non-conforming material types.

- Material deemed conforming is allowed to progress to the landfill tipping area.
- Material deemed non-conforming is not allowed to progress to the tipping area and is sent off site.
- For conforming loads that are instructed to progress to the landfill tipping area, these loads are further inspected during the unloading process (improved inspection opportunity).
- On arrival at the tipping area, the vehicle reverses into a specific area as directed by the site operations staff. While the vehicle/bin is being unloaded, one of the facility operators inspects 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, and
- The landfill waste placement equipment then pushes the waste to the final disposal location. During this pushing activity, there is a further opportunity to identify any easily observable non-conforming waste material.

10.2.3 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 is separated and appropriately stored (typically stockpiled or placed in a waste bin located on the landfill area). If the customer is identified, then the customer is instructed to collect the waste and remove it from site. If the customer cannot be identified, then arrangements are made for the removal of the non-conforming waste material from site. These arrangements are 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 is to 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 is to still be scooped up by the landfill equipment and managed as described above.

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

10.2.4 Record Keeping

A record of the weighbridge database is maintained at the head office.

10.2.5 Tare Weight Recording

The weighbridge software has 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 is stored on the weighbridge software. Thereafter, it is only 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 is required to re-tare every 30 days.

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

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

10.2.6 Customer Information

On delivery of the first load of waste by a certain customer, the customer details are recorded into the weighbridge software. This information includes 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 are only accepted by pre-arrangement through head office.

10.2.7 Transaction Docket

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

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

The transaction docket contains 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 signs the docket (or enters in their pin code) and retains a copy for the customer's records. The original signed docket is temporarily filed in the weighbridge office and as a minimum, on a weekly basis, sent to the head office.

10.2.8 Payment

Payment is either via credit card or account.

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

No cash transactions are accepted.

10.3 Communication

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

Other site personnel also have either radio or mobile phone communication.

The landfill advertises which working channel is to be utilised on site so that waste delivery vehicles, if they have the appropriate radios, are able to communicate with the landfill operations personnel.

10.4 Waste Disposal and Placement

10.4.1 Vehicle Access

Vehicles access the site from Great Southern Highway and follow the 3 km internal road up to the weighbridge. On exiting the weighbridge, the delivery vehicle is instructed on how to get to the active tipping area and typically follow the appropriate site signage.

On exiting the facility, the delivery vehicle follows the reverse route.

The internal access road(s) from the weighbridge to the active tipping area are, from time to time to 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 is 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 can be marginally more difficult (highly dependent on the location and height of the active landfill area). Typically, where possible, the entrance route is to be downhill and the exit uphill. This can only occur when the tipping area is below the entrance level to the landfill.

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

- Location of current and future tipping areas
- How the individual waste cells are to 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.

10.4.2 Active Tipping Area

The waste tipping location within the active landfill cell is 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, and
  - Turning circle.

On arrival at the active tipping area, as directed by the spotter, the waste delivery vehicle stops on a trafficable area located close to the final waste disposal location and discharge its load. 4 m high mobile litter screens are 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 is 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 is broken up and compacted by the waste compactor. This is achieved by a minimum of three to five passes of the compaction vehicle. Subsequent loads of waste are placed on top of this waste and similarly broken up and compacted.

The waste tipping area is kept as small as possible, but to a maximum width of 30 m and a maximum height of 4 m.

This process is continued until the area of waste placement has reached its desired height or waste deliveries have ceased for the day. Thereafter, the compacted waste is 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 is placed over all waste that will not have subsequent waste placed over it within three months. This provides an improved cover to the waste mass over an extended period.

The formation of the waste mass within each landfill cell is in accordance with the individual landfill cell filling plans. The maximum slope of the internal waste batters is 1 V in 3.0 H, while external (final) slopes are 1 V in 5 H.

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

- Waste material deemed as suitable for cover material or road material is stockpiled separately for subsequent use
- Used car tyres are 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, and
- Asbestos waste is placed in dedicated areas within the landfill (in accordance with the site Asbestos Management Plan).

The placement of waste takes into account the physical and chemical properties of the waste. Where possible, sandy waste is placed on top of coarse waste in order to fill voids around the course material.

Acidic waste is not placed with alkaline waste (and vice versa). Flammable waste (plastic and vehicle tyres) is evenly distributed throughout the waste mass to reduce the chance of a large, uncontrolled fire within the landfill.

The landfill is to undergo progressive closure rehabilitation; hence, all waste is 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.

10.4.3 Vehicle Tipping Location

The vehicle tipping area is 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 is positioned as close as is possible to the final waste disposal location.

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

10.5 Recycling

There is no recycling on site. The facility is a landfill operation only and all recycling has happened prior to the waste being delivered to site. Incidental materials that can be recovered for recycling (e.g. steel) will be undertaken; stored in bins and removed when it is economically viable.

10.6 Cover Material Application

10.6.1 Requirement

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

Cover is applied to the landfill surface to achieve the following:

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

The use of cover material is optimised so that excessive cover material is not used unnecessarily. The amount of cover material used is highly dependent on the condition of the waste surface onto which it is being applied. The landfill operators ensure that the compacted waste surface is relatively smooth and firm before applying cover material. An irregular waste surface with excessive void space 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 is essential for the continuous operation of the landfills. The landfill operators always maintains adequate stockpiles of available cover material in close proximity to the active tipping face.

10.6.2 Waste Cover Options

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

- On-site excavation material from future cells or borrow areas;
- Soil that is received over the weighbridge (e.g. 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
  - Papier-mâché.

The most likely cover material source is on-site soils in combination with an alternative daily cover, thereafter, soil received over the weighbridge. The selection of the other materials is dependent on the quantity of cover material required and the availability of the first two choices.

10.6.3 Material Quantity

The expected volume of soil for daily cover usage over the life of the site is 560 000 m^3 (2170 m^3/month), which is based on the concurrent use of an alternative cover system.

10.6.4 Material Sources

The sources of daily cover material include:

- On-site cover. On site cover material will be obtained from either the next cell area or the identified borrow areas on the site. Material not suitable for embankment, subgrade or final cover construction will be used 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).
- Soil material specifically imported onto site. The cover material is sandy, rubble material from the Resource Recover Solutions Bayswater recycling process.

10.6.5 Daily Cover

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

10.6.6 Intermediate Cover

A soil intermediate waste cover is placed on all landfill slopes that are not going to be landfilled within three months. The intermediate cover is 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 is left in place, over time, erosion may reduce the cover layer thickness and it may be necessary to occasionally reinstate the intermediate cover material.

11.0 ENVIRONMENTAL PROTECTION ACTIVITIES

11.1 Concept

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

11.2 Contingency Planning

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

11.3 Surface Water Management

11.3.1 Concept

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

11.3.2 Regional and Local Surface Water Systems

The location of the GSL site relative to local and regional surface water drainage features is shown in Appendix A, Figure 3, indicating the proposed development site is located in the upper reaches of the Thirteen Mile Brook, close to the catchment divide with the adjacent Six Mile Brook. Both watercourses ultimately drain to the Avon River. A small, ephemeral creek is located directly adjacent to the proposed development site and flows into the Thirteen Mile Brook approximately 250 m to the south-west of the site.

Upstream of the development, near the headwaters of the Thirteen Mile Brook, a Rivercare project partnership between the former Department of Water and the Talbot Brook Land Management Association has been working to restore riparian vegetation along the banks of the Brook with the aim of reducing sediment and improving water quality.

11.3.3 Surface Water Management Measures

Stormwater Dam and Diversions

Stormwater drains and swales will serve as the principal stormwater conveyance and surface runoff management system for the landfill site. The diversion bunds and drains aim to maximise the contributing catchment area for the stormwater dam as well as minimising the risk of uncontrolled stormwater runoff entering the operational landfill site from upslope areas. The upstream catchments are small and surface runoff responses are likely to be sheet flow runoff during significant storm events. Therefore, nominal diversion infrastructure is recommended, consisting of 0.5 m bunds with a diversion drain aligned with the upslope edge of the bund to control and divert upstream runoff to the stormwater dam or around the site. The proposed drains are aligned around the perimeter of the active landfill area providing a drainage pathway to the stormwater dam.

A stormwater dam with a capacity of 36 000 m^3 is proposed for the site. The dam will be positioned so as to capture and manage stormwater runoff generated within the landfill site and to harvest natural runoff from upstream catchment areas (Appendix A, Figure 4). The latter would provide water for use on site during construction and operation (including a 500 m^3/y storage allocation/reserve for on-site fire risk management).

Outside the landfill perimeter bund is an access road and beyond that is a 1 m deep stormwater drain to divert any additional surface water flow away from the landfill footprint. This nominal stormwater diversion infrastructure is adequate to ensure that there is no surface water entering the landfill footprint.

Potentially Contaminated Surface Water

With regards to the potential for surface water contamination, there are a number of site-specific features/safeguards that are implemented to minimise the potential for any contamination of nearby watercourses. 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
- Erosion and sediment control to prevent sediments entering the surface water system
- 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
- Monitoring surface water quality (described in monitoring below)
- On-site management of operations involving the use of chemicals and managing spills (see section 11.14)

- Implementation of contingency actions identified

Based on the above, there are substantial surface water management mechanisms in place to prevent surface water contamination; however, within the landfill footprint, there is 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 is the most critical aspect when controlling surface water runoff. All exposed waste surfaces (uncovered or daily covered areas) slope into the active landfill; while all covered (intermediate or final cover) areas slope away from the active landfill.

During the formation of the individual waste lifts (up to 4 m high), care is taken to ensure that the surface is finished off with a definite fall into the active landfill area. All subsequent lifts follow this same shape. In the event of heavy rain, the surface water 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 are 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 is 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 is a minimum of a 500 mm earthen bund installed along the edge. This prevents any accidental surface water runoff from the active landfill area flowing down the intermediate capped area and off the landfill.

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

Sediment Management

The construction of each cell will require stripping of topsoil. Incident rainfall on the stripped area is likely to generate turbid runoff due to the absence of vegetation cover, and this runoff will require management throughout the construction works. To manage this, a temporary sediment fence may be installed around the downstream perimeter of the cell, which will remain in place until the construction of the cell has been completed. In addition a sediment management structure is located downstream of the primary drainage culvert.

During operation sediment control features will be incorporated into the stormwater management system where capped areas and cleared or disturbed areas are likely to contribute to increased sediment loads to the downstream environment. Sediment management requirements, specifications and designs will be based on the approaches recommended by IECA (2008). For the control of sediment likely to discharge from the landfill site the overall erosion and sediment control strategy will comprise of the following:

- Drainage control measures aimed at preventing or reducing soil erosion caused by concentrated flows and to appropriately manage the movement and separation of ‘clean’ and ‘impacted’ water through the site.
- Erosion control measures aimed at preventing or reducing soil erosion caused by rain drop impact and sheet flow (i.e. the control of splash and sheet erosion).
- Sediment control measures aimed at trapping and retaining sediment either moving along the land surface (bed load) or contained within flowing water.

The stormwater management strategy states that clean water is diverted around the site with a large proportion of diverted runoff discharging to the stormwater dam. Potentially impacted water will be managed, contained and monitored within the active landfill area, the adjacent retention pond and the sediment control structures. Turbidity of the collected water could be enhanced prior to discharge (if required) by coagulating and flocculating agents.

Silt fences and temporary bunds could be constructed on the covered landfill side slopes to minimise scouring and generation of sediments.

Shallow, vegetated stormwater swales are recommended along all road alignments and would provide an effective approach for the reduction of sediment loads by conveying a sheet flow of shallow depth through vegetation.

Erosion control measures will be provided in locations where significant flow velocities are expected, particularly in relation to the stormwater dam spillway. Additional temporary sediment controls, such as sand bags or silt fences, erosion protection mats and vegetation within the downstream channel are recommended to minimise the risk of erosion and scour impacts during significant runoff events.

11.3.4 Water Discharge

No uncontrolled surface water is to be discharged from within the landfill site.

11.3.5 Monitoring

During facility operations, regular monitoring of the condition of diversion drains is undertaken to ensure that the efficiency of the drains is maintained. This entails 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.

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

The surface water storage dam is sampled and analysed at least every six months to ascertain the effectiveness of the surface water management system. Additionally, an ongoing water monitoring plan including the measurement of surface runoff from the upstream catchment and variations in water storage within the stormwater dam will be carried out in order to better quantify the potential yield of the catchment.

Monitoring of the creeks around the site has been identified as a key requirement to assess and validate the reliability and effectiveness of the proposed stormwater management system. No surface water flow monitoring has been undertaken to date and flow gauging and the installation of continuous water level monitoring instrumentation is to be undertaken. Regular and ongoing monthly and quarterly surface water monitoring and sampling of the Thirteen Mile Brook will also be carried out. While specific monitoring requirements will be stipulated in the operating licence, the following is proposed (and will be updated according the regulator requirements)

Table 3: Proposed Surface Water Monitoring

Monitoring requirement: Surface water	Monitoring / sampling point	Parameters	Monitoring frequency
Collect baseline data for surface water quality	Surface water sampling Thirteen Mile Brook (nearby and downstream locations to be identified)	Field pH, EC, TDS, TSS, N as nitrate, ammonium, nitrite, Total nitrogen. Salinity as TDS, basic anions / cations	Opportunistic – when flowing, preferably within the first flush post-onset of rainfall
Monitor surface water receptors for nutrients, salinity & sediments	Stormwater dam, sediment retention dam, retention pond	Field pH, EC, TDS, TSS, water level?	monthly
		N as nitrate, ammonium, nitrite, Total nitrogen. Salinity as TDS, basic anions / cations	6-monthly
Monitor surface water receptor for contaminants	Stormwater dam, retention pond	Visual check for contamination (e.g. oily film, odour, colour, clarity etc – site specific procedure to be developed)	Prior to water being taken from dam / pond

Monitoring requirement: Surface water	Monitoring / sampling point	Parameters	Monitoring frequency
		Hydrocarbons (suite dependent on site-specific analysis of on site chemicals)	6-monthly

11.3.6 Risk Assessment

An environmental risk assessment associated with the management of surface water has been undertaken.

The risk assessment outlined in this document is based on the framework in the Australian Standard Risk Management (AS/NZS ISO 31000:2009) upon which the Victorian EPA Licence Assessment Guidelines have been based.

The full environmental risk assessment is included as Appendix D.

11.3.7 Surface Water Response Plan

In the event that the regular monitoring, or other monitoring of the surface water bodies identifies contamination above background levels, a revised response plan is to be implemented. This response plan is to incorporate the following:

- Identification of the elements that have exceeded the background levels. This potentially indicates the type of surface water management mechanism that has failed and resulted in the contamination.
- 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 (e.g. thicker intermediate cover in certain areas to improve erosion resistance).

Potential remediation measures include: source isolation removal; recovery bores; cut-off trench / sumps; combination of these and on-going monitoring.

11.4 Groundwater Management

11.4.1 Concept

The objective of groundwater management is to:

- Prevent groundwater mounding arising from potential leachate seepage interacting with landfill liner;
- Prevent leachate potential leachate seepage entering aquifers; and
- Preventing contaminants entering groundwater.

Groundwater contamination is an essential consideration when developing a landfill facility. Significant effort is made 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 are 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 is installed.

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

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

- Natural environment (low permeability soils)
- The substantial landfill lining system (with materials and installation to be verified by an independent quality assurance programme)
- Selective waste receival (only Class II material)
- Ongoing leachate management
- Surface water management
- Monitoring and implementation of contingency actions when required
- Progressive landfill closure
- Comprehensive capping system
- Cap rehabilitation, and
- Post closure repair and monitoring.

11.4.2 Groundwater Contamination Limits

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

11.4.3 Groundwater Management Measures

Subsoil Drainage System

The subsoil drainage system (SDS) for the GSL facility will comprise a network of drainage pipes laid in seepage interception trenches and connected to a common sump. The trenches will be excavated into the stripped ground surface and fall at a grade determined by the topography, expected to be between 1% and 3%. The construction of the SDS will be progressive, preceding the construction of each cell serviced by the system.

This will be supported by a vibrating wire or pneumatic piezometers installed beneath the liner to ensure the buffer remains intact and monitor the potential for groundwater mounding (as recommended by SRK Consulting)

Retention Pond

A detailed assessment of the retention pond capacity requirements cannot be made directly from available subsoil drainage information available at this stage. An initial retention pond size of 2000 m^3 is therefore proposed.

The water quality in the retention pond is generally expected to be suitable for release to the environment, with the extent of contamination, should it occur, expected to be minimal. For this reason the proposed liner system for the retention pond consists of:

- 500 mm thick compacted engineered clayey fill material
- 2.0 mm smooth HDPE liner.

11.4.4 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 is undertaken by a specialist contractor to monitor the condition of the groundwater to identify any contamination. Also supporting the groundwater well network, lysimeters could be installed in the buffer down-gradient of, and proximal to, landfill cells to monitor potential seepage through the base of the liner. The frequency of monitoring and the range of parameters to be analysed is as stipulated in the facility operating Licence. The following groundwater monitoring is proposed:

Table 4: Proposed Groundwater Monitoring

Monitoring requirement: groundwater	Monitoring / sampling point	Parameters	Monitoring frequency
Collect baseline data	MB04, MB05, MB06, MB10, MB11, MB12, GMB05, GMB03 MB13*, MB14*, GMB06* *bores may be destroyed during landfill construction.	Field pH, EC, water level.	Monthly
		Field pH, EC, water level. Salinity as TDS. Basic anions/cations.	6-monthly
Monitor groundwater bores for chemistry, nutrients, salinity, and contaminants.	MB04, MB05, MB06, MB10, MB11, MB12, GMB05, GMB03 MB13*, MB14*, GMB06* *bores may be destroyed during landfill construction.	N as NO_3, NH_4, nitrite, Total N. Salinity as TDS. Hydrocarbons (suite dependent on site-specific analysis of on-site chemicals).	6-monthly
Install instrumentation (e.g. vibrating wire or pneumatic piezometers)	To be determined (within the sub-base of landfill).	Separation distance to water table	Monthly
Lysimeters	To be determined (down gradient but proximal to landfill cells)	Leakage detection	Monthly

Subsoil drainage water management and storage requirements will be monitored and reviewed throughout the operation of the landfill facility. Development of additional retention pond storage capacity or variations to the water management plan (Sections 11.3, 11.4 and 11.5) will be carried out, if necessary, based on an analysis of the recorded data.

Discharge of water from the retention pond should only occur after confirmation that the water is not contaminated, monitoring will be undertaken on an as needs basis.

11.4.5 Risk Assessment

An environmental risk assessment associated with the management of groundwater has been undertaken.

The risk assessment outlined in this document is based on the framework in the Australian Standard Risk Management (AS/NZS ISO 31000:2009) on which the Victorian EPA Licence Assessment Guidelines have been based.

The full environmental risk assessment is included as Appendix D.

11.4.6 Groundwater Response Plan

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

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

The proposed contingency plan for managing risk to groundwater systems and environmental receptors is summarised in the Table below. A regular monitoring and sampling program for surface water and groundwater will alert to a potential impact to these systems. Surface water and groundwater sampling are to be conducted in accordance with the relevant Australian Standards, referenced below.

The contingency plan for groundwater and surface water quality guideline exceedances includes the following:

- Identify the type of contamination
- Review assessment criteria applicability
- Identify the contamination source
- Assess the immediate and long-term risk
- Isolate the contamination source
- Report contamination to DWER within an agreed timeframe
- Determine if recovery of seepage-affected groundwater or treatment or remediation is required
- Undertake groundwater monitoring following treatment/remediation
- Review management measures
- Potentially amend management measures.

Several potential remediation measures have been included in **Error! Reference source not found.**. Remediation may include one or more of the following:

- Isolation or removal of the contamination source
- Installation of a cut-off trench or sumps to recover groundwater
- Additional investigation and/or monitoring to better define a potential risk.

If contingency action is required, it will be necessary to tailor it to the situation at which point the detailed design of the remediation options will be determined. The results of the ConSim modelling suggest that a

shallow cut-off trench and/or sump arrangement would be the most practical method to recover seepage affected groundwater.

Table 5: Contingency action plan for managing risk to environmental receptors

Contingency Trigger	Management Criteria	Management Response	Potential Remediation Options
Leachate or other contaminants detected in surface water monitoring.	• Surface water sampling is to be conducted in accordance with AS/NZS 5667.4 and water samples are to be collected and preserved in accordance with AS/NZS 5667.1. • Water quality must not exceed the surface water guidelines listed in the 'Australian and New Zealand Guidelines for Fresh and Marine Water Quality Volume 1' (ARMCANZ and ANZECC, 2000) or an alternative appropriate trigger (e.g. background levels).	If contamination of surface water/groundwater occurs, the following actions will be undertaken: • Identify the type of contamination • Review assessment criteria applicability • Identify the contamination source • Assess the risk • Isolate the contamination source • Report contamination to DWER within 48 hrs • Determine if treatment or/remediation is required • Undertake groundwater monitoring following treatment/remediation • Review management measures • Potentially amend management measures.	Potential remediation measures include: • Source isolation/ removal • Recovery bores • Cut-off trench/sumps • Combination of the above • Ongoing monitoring.
Leachate detected in groundwater monitoring.	• Groundwater sampling is to be conducted in accordance with AS/NZS 5667.11. • All water samples are collected and preserved in accordance with AS/NZS 5667.1. • Compare the monitoring data to ANZECC 2000 Freshwater Slightly-Moderately Disturbed Ecosystems.		
Groundwater levels beneath landfill rising to within two metres (2 m) of base of liner	• Monitoring bore levels indicate excessive, ongoing groundwater level rise (see note 1). • Waterlogging near base of landfill, change in landfill structure (e.g. salt forming, dispersion). • Seepage in area beneath landfill site beyond pre-site landfill conditions.		
Leachate or other contaminants detected in storm water dam or	• Surface water sampling is to be conducted in accordance with AS/NZS 5667.4 and water samples are to be collected and preserved in		

Contingency Trigger	Management Criteria	Management Response	Potential Remediation Options
groundwater retention pond (from landfill interceptor drainage)	accordance with AS/NZS 5667.1. • Water quality must not exceed the surface water criteria listed in the 'Australian and New Zealand Guidelines for Fresh and Marine Water Quality Volume 1' (ARMCANZ and ANZECC, 2000).		
Note 1: Additional monitoring bores are required to monitor for leachate seepage near the landfill structure, to be installed once construction is complete.			

11.5 Leachate Management

11.5.1 Concept

Leachate management revolves primarily around minimising the amount of leachate being generated. This is achieved by ensuring that there is adequate surface water diversion away from the waste mass, that the appropriate final waste profile is 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 is 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.

11.5.2 Leachate Generation

The quantity of leachate generated during the operating life of the landfill is 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 have a significant influence on the quantity of leachate being generated on site.

The quantity of leachate produced within the landfill will typically be related to the amount of precipitation that percolates into or runs over deposited waste within the open working area and/or the amount that infiltrates through the final capped surface of the landfill. To minimise the amount of leachate produced, the landfill will be operated by keeping the exposed area of waste to a minimum with rehabilitation following shortly after completion of filling each cell. The volume of leachate generated in the landfill will be influenced by the size of the stage and the operational procedures adopted. Measures to reduce leachate generation will include:

- Diversion of stormwater away from the active waste disposal area to reduce leachate generation
- Progressive capping.

It is proposed that the landfill will be filled in sub-cell areas resulting in a high rate of rise and low risk of waste saturation before being capped.

11.5.3 Leachate Management Strategies

The landfill design will incorporate a leachate collection system extending across the base of each stage and along the toe of the side walls. The leachate collection system will intercept vertical and lateral leachate seepage occurring through the waste. The leachate collection system will be designed in general accordance with Vic BPEM.

Generally, the leachate collection gravel layer on the landfill base is sloped at approximately 3% to promote drainage in the desired direction. Bund walls, which contain perforated leachate collection pipes and a network of perforated leachate collection pipes located at 20 m spacing across the floor of the landfill will also aid in directing leachate.

The leachate header pipes direct leachate towards the leachate collection sumps at a nominal grade of 1%. Leachate will be removed from the sumps by progressive pumping via a leachate riser pipe to an on-site leachate storage pond, collected leachate can then be managed passively through evaporation losses (or enhanced evaporative options). Where excess leachate generation occurs above the design capacity of the leachate management system, collected leachate will generally be re-circulated into the landfill or, as an emergency measure, transferred offsite for treatment at a licenced treatment facility.

Supporting leachate management options to be utilised on site, in the order of priority, also 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 may also be used for this purpose.
- Micro-sprays or water cannon over the leachate pond surface or on the landfill surface (nozzle blockage is a concern with this method) – wind direction is 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 are to be pumped directly onto the incoming waste as it is placed and compacted in the landfill. The dry incoming waste (even in winter) absorbs a significant volume of leachate and the waste placement activities mix the moisture evenly through the waste mass, and
- In the case of an emergency, leachate is to be trucked off site to the Water Corporation or to a composting facility.

The evaporation and recirculation activities are far more efficient during summer; however, during winter, with a concerted effort during favourable weather conditions, reasonable leachate volumes can 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.

11.5.4 Leachate Pond

A space allocation has been made for additional leachate pond/s to cater for possible future leachate quantities.

It is intended that leachate will be directed by pumping to a leachate storage pond located to the north of the landfill. The first leachate storage pond will be constructed prior to the initial operation of Cell 1. The pond will have approximate dimensions of 40 m × 40 m and a capacity of around 2,500 m^3 at 2,0 m depth. and approximately 3,500 m^3 at crest level.

The leachate ponds have been designed with a maximum average operating depth of 2.0 m and an additional 500 mm freeboard, resulting in a total maximum average depth of 2.5 m.

The proposed liner system for the retention pond is to the same standard as the liner system for Cell 1 and Cell 2 and consists of:

- 500 mm thick compacted engineered clayey fill material
- Geosynthetic clay liner, and
- 2.0 mm smooth HDPE liner.

Leachate generation rates and moisture condition of incoming waste will be monitored for the first three months of the landfill commencing operations once the landfill commences to determine additional leachate storage capacity for future cells. By using real monitoring data, the modelling can be better calibrated to assess future needs, while providing adequate time to seek approval for additional ponds, if needed.

11.5.5 Leachate Evaporation

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

- Pond maximum evaporation area = 1 600 m^2
- Median annual evaporation = 1 415 mm, and
- Median annual rainfall = 589 mm.

Evaporation Volume = Area (0.8 × Evaporation – Rainfall) = 868 m^3/year/pond.

11.5.6 Leachate Extraction from Landfill

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

The automated pumping system is designed to maintain the head on the landfill liner to less than the prescribed maximum of 300 mm. The leachate pump switches on when the leachate level is 1300 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 (700 mm below the level of the liner).

The submersible pump is installed within the main 600 mm diameter leachate outlet sleeve. There is however one spare leachate extraction pipe that could be used for leachate extraction in the event that the main extraction pipe is damaged.

11.5.7 Accumulation Limits

The Vic BPEM and industry practice limit the maximum depth of leachate over the liner to 300 mm. 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 is to be a minimum 500 mm freeboard maintained in the leachate pond. This caters for extreme rainfall events and possible wind action, to prevent leachate flowing out of the ponds.

11.5.8 Leachate Pond Management

Ideally at the end of summer, all of the evaporation ponds are empty and the leachate sump(s) have less than 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 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 decreases. At some point, the rate of leachate generation becomes greater than the rate of evaporation from the waste surface.

This is the seasonal turning point at which leachate is started to be pumped into the leachate ponds. Throughout winter, there is a net generation of leachate and the ponds gradually start accumulating leachate until the summer seasonal tipping point is reached, where the evaporation from the waste surface is once again greater than the rate of generation within the landfill. Around this point in time, there is also a net evaporation of leachate from the leachate pond surface.

Throughout summer, leachate is gradually pumped out of the landfill and recirculated over the landfill until a stage is reached where the pond is once again empty in preparation for the following winter period. Ideally, all of the ponds are 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 is an indication that the pond utilisation and leachate management techniques are working well and that there is adequate capacity in the leachate ponds. However, if the ponds cannot be emptied by the end of March, this is 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 are able to store and evaporate all leachate on site for Cells 1 and 2. In addition, there is a component (20% to 40%) of leachate recirculation and evaporation onto the landfill surface that further reduces the quantity of leachate on site.

11.5.9 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 is, 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 is undertaken:

- Depth of leachate in the leachate sump(s) – initially measured weekly, at the beginning and end of the day of measurement. This may 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 pond – measured monthly but the freeboard levels will be recorded daily on operating days. A minimum 500mm freeboard it to be maintained on leachate ponds (which is designed to contain a 1 in 100-year 72 hour rainfall event for the site.
- The leachate infrastructure is to be checked, maintained and repaired as required. Monthly inspections are proposed as a minimum while pumps will be serviced in accordance with manufacturer specifications.
- Minimum pond freeboard calculated based on the monthly depth readings
- Volume of leachate pumped into the leachate pond – measured continuously via a flow meter, but recorded weekly
- Volume of leachate pumped out of the leachate pond – 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 provides sufficient information to gain an understanding of how the leachate generation is 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 is easily monitored by measuring the depth of leachate in the leachate sump. Measuring is achieved utilising an electronic measuring device inserted through one of the two spare leachate extraction pipes.

Ideally this measurement is 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 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.

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

The leachate sump headworks also include a flow meter, which is 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.

11.5.10 Risk Assessment

An environmental risk assessment associated with the management of leachate water has been undertaken.

The risk assessment outlined in this document is based on the framework in the Australian Standard Risk Management (AS/NZS ISO 31000:2009) on which the Victorian EPA Licence Assessment Guidelines have been based.

The full environmental risk assessment is included as Appendix D.

11.5.11 Leachate Management Response Plan

The regular monitoring of the leachate system provides insight into the system operations and if there are 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 noticeable decrease in the quantity of leachate being pumped out of the leachate sump, this could indicate the following:
- That there is a blockage in the leachate aggregate or leachate collection pipe work. The longer the pump cycle, the further away from the sump the blockage has occurred. Very short pump cycles indicate a blockage around the leachate sump.
- That the pump is losing efficiency and the need for replacement. This is typically associated with a longer than usual pump cycle, or
- That the leachate extraction pipe has collapsed and there is reduced access down the pipe. This is easily confirmed by the removal of the leachate pump. If the pipe has collapsed, the pump is stuck.
- If there is increased depth of leachate over the liner, this would indicate the following:
  - Problems with the pump float valves, or
  - Decreased pump efficiency, and
  - If there were 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 revised response plan is to be implemented. This response plan is to 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 (e.g. replace a pump)
- If not possible to rectify the problem (e.g. 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, and
- Consider amending the standard operating procedures if the current procedures are ineffective (e.g. damage to the leachate pond lining system).

Should the ongoing monitoring of leachate quantities on site indicate that there is a gradual net accumulation of leachate over time, the following contingency actions are to 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,
- Tanker excess leachate off-site to an authorised facility (especially during emergency situations).
- Pumping the excess leachate from the leachate pond into the lined retention pond (if there is capacity) for temporary storage during emergency situations. Storage in the retention pond will only be permitted to up to two weeks after which it must be pumped back, or removed for offsite disposal.
- As a last resort, and subject to design engineer approval, recirculation of the leachate throught he landfill (without flooding it or impacting the landfill stability).

From a day-to-day operational consideration, spare pumps (or readily available hire pumps), pipelines and fittings are kept on site so that in the event of a system breakdown, there are 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 proposes feasible solutions to those possible scenarios. In the event that an issue is identified, the appropriate specialist is to be engaged to develop a specific remedial solution. Depending on the nature of the issue, the DWER may need to be involved in the process.

Where it is determined that the freeboard limit has been breached, contingency measures will include, in order of preference:

Utilising a vacuum truck to transport excess leachate off site

Pumping excess leachate from the leachate pond to the lined retention pond (subject to it having capacity). Storgae of leachate in the retention pond will only be permitted for a maximum of two weeks, after which it must be pumped back to the leachate pond or disposed of as described above.

Recirculation of leachate through the landfill. This does not include irrigation of on leachate on the landfill area to assist with compaction and dust suppression.

11.6 Landfill Gas Management

11.6.1 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 is achieved by ensuring that there is an efficient gas extraction system installed within the waste and the appropriate consumption/combustion of the collected landfill gas.

A specialist landfill gas contractor will manage landfill gas. 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.

11.6.2 Landfill Gas Quantity

The quantity of landfill gas generation for the landfill was initially estimated for a waste placement rate of 250,000 tpa using GasSim. GasSim is a commercially available (and independently verified) landfill gas resource assessment and risk assessment model, developed by Golder for the Environment Agency in the UK, which models gas generation and recovery.

Based on the modelling, the predicted total gas generation will peak at 1 661 m^3/hr (90^{th} percentile), approximately 21 years after commencement. The gas generation assessment has been reviewed for an estimated waste placement rate of 200,000 tpa. With this reduced waste placement the gas peak will remain the same at 1 661 m^3/hr (90^{th} percentile), however, it will take longer for this peak to occur. The overall gas production for the landfill will remain the same.

The gas prediction will be reviewed and updated on a periodic basis following commencement of waste acceptance. This will allow Alkina to plan the installation of landfill gas collection infrastructure in order to maximise gas capture rates.

11.6.3 Landfill Gas Collection and Extraction

The intention of the landfill gas extraction system is 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 extraction system 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 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.
- The leachate drainage layer installation will extend 2 m (vertical) up the slope of the landfill as measured from the base of the landfill.
- The remainder of the slope will be covered with a soil protection layer. This will be to prevent a preferred flow path for gas to escape the landfill.
- As the final waste profile is progressively achieved, deep vertical wells (up to 20 m) will be installed on the surface. These wells will be installed at a spacing of 40 to 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.
- The 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 toe this manifold, and
- 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

11.6.4 Emission 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.

11.6.5 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 (no sensitive receptors in the proximity), 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, and
- At the landfill gas flare.

The landfill gas monitoring will also be supported by periodic inspections of the capping system to ensure it is still fit for purpose, and maintained / repaired as required.

The monitoring frequency is as stipulated in the facility operating Licence.

11.6.6 Risk Assessment

An An environmental risk assessment associated with the management of landfill gas has been undertaken.

The risk assessment outlined in this document is based on the framework in the Australian Standard Risk Management (AS/NZS ISO 31000:2009) on which the Victorian EPA Licence Assessment Guidelines have been based.

The full environmental risk assessment is included as Appendix D

11.6.7 Landfill Gas Response Plan

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

- Lower combustion efficiency of the flare could indicate that there is 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, and
- 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 is to be implemented. This response plan is to 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 (e.g. increase gas vacuum pressure)
- If not possible to rectify the problem (e.g. 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 (e.g. install additional extraction well), and
- Consider amending the standard operating procedures if the current procedures are ineffective (e.g. change specification of the gas pipe).

It is not possible to develop a response plan that covers each likely eventuality and proposes feasible solutions to those possible scenarios. In the event that an issue is identified, the appropriate specialist is to be engaged to develop a specific remedial solution. Depending on the nature of the issue, the DWER may need to be involved in the process.

11.7 Dust Management

11.7.1 Concept

The objective of dust management is to minimise significant impacts on amenity and the environment by preventing the generation of airborne particulates (dust) where possible and to ensure that no dust is emitted beyond the Lot 4869 boundary.

Excessive dust can have the potential for local impact. Dust emissions may arise via traffic on internal unsealed roads, loading and unloading of materials, operation of heavy equipment and from exposed surfaces such as material stockpiles or the active landfill face. The magnitude of impact will depend on the size of the operation, local topography, adjacent land use, prevailing wind speed/direction, and distance to the nearest sensitive receptor.

11.7.2 Nearest Receptors and Buffer Distances

The Environmental Protection Authority's (EPA) Guidance Statement No 3, Separation Distance between Industrial and Sensitive Land Uses, recommends a buffer distance of 150 m between a Class II or III landfill and a single residence. The distance between the proposed GSL and the nearest single residence is 1.9 km. The Guidance Statement also recommends a buffer distance of 35 m between a Class II or III landfill and the boundary of the property on which it is located. The proposed facility is located 600 m from the property's boundary.

Closest Residence

The closest residence to the property is approximately 1.9 km to the north-east of the landfill. The next closest residence is situated 2.4 km from the proposed facility. These distances were measured using Google Earth and are an approximate only. No residences have a direct line of sight to the proposed site; all are screened by vegetation and sloping hills due to the topography of the landscape.

Surrounding Land Uses

Two properties in the vicinity of the GSL facility have been identified in the Department of Agriculture and Food Western Australia (DAFWA) sensitive sites database. One is listed as a bio-dynamic site and the other as an organic site. The property boundary of the bio-dynamic site is approximately 2.5 km from the proposed landfill footprint whilst the organic site is approximately 2 km away.

Given the relatively large buffer distances between these properties and the proposed landfill and the planned management strategies for potential emissions originating from the landfill, the proposed development is expected to have no impact on either of the sensitive surrounding land uses identified.

11.7.3 Air Quality Standards

Dust falls under the broad category of particulate matter (PM), tiny particles of solid or liquid suspended in a gas (including dust, smoke, soot and droplets of liquid). For monitoring purposes PM generally falls within three main categories:

- PM_{10} particles with a diameter of 10 µm
- $PM_{2.5}$ particles with a diameter of 2.5 µm, and
- Total Suspended Particulate (TSP) particles with a diameter less than 50 µm.

The EPA requires that air pollutants meet ambient air National Environmental Protection Measure (NEPM) standards and goals. In Western Australia the NEPM standards are implemented under the National Environment Protection Council (Western Australia) Act, 1996. The standards contained in the NEPM for ambient air quality in relation to particulates are shown in *Table **6***.

Table 6: Standard and goals for particulates

Pollutant	Particulate Level	Time Period	Guidance
Total Suspended Particulate Matter	90 µg/m^3	Annual	NHMRC, 2002
Particulate matter <10 µg/m^3 (PM10)	50 µg/m^3	24 hour	NEPM, 2003
Particulate matter ,<2.5 µg/m^3 ($PM_{2.5}$)	25 µg/m^3	24 hour	NEPM, 2003

11.7.4 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, and
- Vehicle wheels spreading dirt around the site.

All identified sources are deemed relatively minor and easily manageable within the confines of the Prescribed Boundary and the larger Lot 4869.

Construction Activities

As part of the construction activity, the contractor is required to control dust. During construction, the primary source of dust generation is from vehicle movements along access roads and earthworks via heavy machinery.

Vehicle Movements along Access Roads

The type of construction materials used on the road surface significantly influences the generation of dust. The internal roads consist of either a gravel surface layer or a recycled road base layer (wearing course). This road construction material does result in dust being generated by vehicle movements along internal access roads; consequently, dust management strategies are required to be implemented. Speed is the primary cause of dust generation from vehicles moving along access roads.

Landfill Active Tipping Area Activities

The unloading, placement and compaction of waste material does not generate excessive dust. If a particular dusty load of waste material is 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 is the dusty load pushed and compacted into the landfill.

Loading and Unloading of Cover Material

Due to the nature of this activity it is difficult to adequately control dust emissions during adverse weather conditions; however, this activity is not a potential major contributor towards dust loading on site. The primary method for controlling dust emissions is, where possible, to delay these activities until weather conditions improve. Where this is not possible, due care is taken to place the material in vehicles and not drop it from a height. There is little option for change of methodology with regards to unloading of vehicles during adverse weather conditions.

There are; however, opportunities to load and unload vehicles further away from the site boundary to reduce the risk of dust emissions blowing beyond the boundary.

11.7.5 Dust Management Measures

Day to day monitoring of dust will be conducted by visual means. The appropriate action will be determined based on the degree of dust generated and the tasks at hand. Mitigating actions will commence prior to dust impact occurring. The following natural barriers will assist in limiting the spread of generated dust from the premises:

- Extensive vegetation exists within the Lot between the footprint of the proposed facility and the nearest residence. This will help reduce the wind speed in this direction and act as a filter for airborne particulate matter, and
- The vegetation along the access road will reduce disturbance to exposed layer of the gravel road and also assist in containing the dust generated by traffic to a certain extent.

As dust generating activities will occur in both the construction and operation stages of the landfill facility, the following mitigating measures may be employed during both stages:

- Watering down of all unsealed trafficable areas at the commencement of each working day
- Limiting the speed on the facility access road to 50 km/h and internal haul roads to below 20 km/h
- Where possible, activities that have a high potential for dust generation (excavation, unloading of material etc.) shall be halted during adverse weather conditions where strong winds are blowing towards the nearby receptor to the north-east
- In the event that dust management objectives are not being achieved due to weather conditions or other factors, only those activities that do not generate dust will be undertaken
- Instruction will be given to all employees and site personnel on how to use the equipment to minimise dust
- Reducing dump heights to a maximum of 3 m wherever possible
- Watering down of dust generating areas during construction and operation and maintaining a water supply on site for this purpose
- The access roads within the site will be watered down regularly throughout the day to minimise dust
- Good housekeeping practices will be adopted on site to minimise dust generation. All materials stored in locations that have the capacity to generate dust will either be adequately covered or wetted down during times conducive to dust generation
- Restricting traffic to most direct route on the site and prohibiting traffic on non-active areas
- Deliveries containing dry and/or dusty materials will be wetted down during the waste placement process
- If observations indicate that dust is being generated from within the site, additional dust management techniques will be adopted using water trucks or sprays for immediate action and mulching, hydro seeding or chemical crusting agents as a possible longer term solution
- All trucks entering and leaving the will be covered to prevent windblown emissions
- All trucks leaving the site will drive over a wheel cleaner prior to exiting the landfill infrastructure area, and
- The Site Supervisor will contact any complainants that have concerns related to dust and determine the nature of the nuisance and implement any changes necessary to mitigate dust generation and dust moving beyond the site boundary.

11.7.6 Water Source

The primary source of dust suppression water is from the stormwater storage pond and from alternate supplies such as groundwater supplies or obtaining water from external sources during extended dry periods.

The primary means of dust suppression along internal roads consists of watering via water tanker. The site water tanker is 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 required quantity of water is dependent on the ambient weather conditions (heat and wind speed), number of traffic movements and the performance of the road construction material (gravel or road base surface); however an allocation of 40 m^3 per day has be used in the Surface Water, Groundwater and Leachate Management Plan (Golder, 2015).

11.7.7 Monitoring

The site is surrounded by agricultural land under cultivation and cropping which provides potential for high levels of background dust generation. Dust generated within the site will be created during the construction of the facility, via transport across the unsealed roads and later during the placement of waste. The large buffer distance between the facility footprint and the property boundary serves to minimise the risk of dust leaving the property.

Dust emissions are visually monitored on a continuous basis by site operations staff. The facility also maintains a comprehensive complaints register, which is used as a gauge of success with regards to dust emissions management.

Climate Monitoring Equipment

The site will have equipment to monitor wind direction and temperature. A windsock will be installed on site to indicate the wind direction and approximate wind strength. High wind speeds will be determined by the windsock's angle relative to the mounting pole and via the use of hand held anemometers.

Background Dust Generation

Records such as date, time, wind patterns and atmospheric temperature will be kept regarding dust generation due to cultivation, harvesting, fire and other noticeable contributors to dust generation around the site.

Dust Monitoring Frequency

The performance of the proposed dust suppression measures will be assessed by monitoring physical and visible dust arising from within the site. The list of monitoring measures proposed for the assessing performance is shown below in *Table **7**Table **7***.

Table 7: Proposed Frequency and Responsible Personnel for Dust Monitoring

Programme	Frequency	Responsible Person
Visual inspection of dust leaving the boundary of the premise	Continuously during every operating day	Site Manager
Visual inspection of dust generation at the site access form the Great Eastern Highway	Twice Daily	Delivery Contractors
Visual inspection dust generation on internal haul road	Continuously during every operating day	Site Manager

Trigger Levels

Two trigger conditions are proposed for the commencement of dust management and stoppage of dust generation activities.

The first trigger level to action dust management measures will be generation of visual dust.

The second trigger level, and cause for the facility to cease its activities, is when strong winds are forecast by the Bureau of Meteorology (in the range of 26 to 33 knots). Work will be reduced in the presence of strong winds and low humidity until a time when conditions become more favourable. If any dust is observed leaving the property boundary then work will cease immediately, the cause thereof will be investigated and actions will be taken to resolve the problem before regular site activity recommences.

11.7.8 Dust Management Response

In the event that the regular dust monitoring identifies potential problems with the dust management activities, a revised response plan is to be implemented. This response plan is to 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 (e.g. increased use of the water tanker)
- If not possible to rectify the problem (e.g. dust from cover material handling), assess the likely impact on neighbouring properties and whether there are any contingency measures that could be implemented to minimise the impact (e.g. stop the activity or move further away from the site boundary), and
- Consider amending the standard operating procedures if the current procedures are ineffective (e.g. increase stockpiled material at the active tipping area during low wind periods to allow for suspension of this activity during high wind periods).
-

11.7.9 Risk Assessment

An environmental risk assessment associated with the management of dust has been undertaken.

The risk assessment outlined in this document is based on the framework in the Australian Standard Risk Management (AS/NZS ISO 31000:2009) on which the Victorian EPA Licence Assessment Guidelines have been based.

The full environmental risk assessment is included as Appendix D.

11.8 Litter Management

11.8.1 Concept

The objective of litter management is to minimise the generation of litter and ensure that litter that has been blown from the active landfill area is collected as soon as is practical with a focus on preventing litter emissions beyond the Lot 4869 property boundary.

All staff at the facility are expected to understand and follow the procedures outlined in order to reduce the amenity and environmental impacts caused by the spread of litter during the operation of the landfill facility.

11.8.2 Sources

Litter management is a crucial aspect of the environmentally-sound operation of a landfill. Windblown waste has the potential to cause a range of problems for the local community and environment if not managed correctly. Litter at landfill sites is largely associated with the delivery and unloading of waste rather than with compaction and burial operations.

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.
-

11.8.3 Litter Controls

Litter controls will be implemented at the GSL to keep the landfill and surrounding environment in a litter-free condition. Common litter controls that are employed at landfills around Australia and the world include:

- Contingency plan to deal with extreme events that could instigate gross litter problems
- Mobile litter screens that are easily erected, a minimum of 1.8 m high (preferably 4 m high) and able to withstand local wind conditions whilst loaded with litter
- All site fencing, gates and litter screen should be cleared of litter on a regular basis. Fences that are in close proximity to the active tipping face will require more frequent attention
- Progressive application of cover material during the course of operational days to ensure that only the minimum surface area of waste is exposed at any one time
- Independent audits of the litter control system and management plan to ensure their effectiveness, and
- Implementation of an appropriate communication strategy to ensure that all site staff and contractors understand the necessity for the covering of loads.

The GSL will employ a system of mobile and immobile litter screens in combination with daily litter inspections and systematic covering of waste.

11.8.4 Mitigation Strategies

In addition to fixed litter controls, there are a number of litter mitigation strategies that are to be employed in order to reduce litter emissions during daily operations on site.

Blown from Waste Delivery Vehicles

It is a road regulation that all waste delivery vehicles must be adequately tarped or covered while driving on public roads; consequently, all vehicles delivering waste to the site are either sealed or tarped vehicles. This adequately controls litter such that there are no litter emissions from these vehicles both during transportation and upon entering the site.

In the event that vehicles arriving on site are inadequately covered; the weighbridge operator advises the vehicle driver to improve the covering of the vehicle. This comment is recorded on the weighbridge docket. In the event of a second warning being issued, again the weighbridge docket is marked up, but in this case the responsible company is also to be advised. If the driver delivers a third unsuitably covered load, the head office is to 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 activity has the potential to result in significant litter generation as the waste is typically tipped from height onto the landfill surface. Influencing factors include:

- 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 boundaries as a minimum on a weekly basis.

Blown from Active Tipping Area during Pushing and Compaction of Waste

This activity also results in significant litter in as the deposited waste is pushed around the landfill surface. Influencing factors include:

- 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 boundaries as a minimum on a weekly basis.

Blown from Waste Delivery Vehicles Departing 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 is 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 can blow out of the vehicle although this source is considered to be minor. Influencing factors include:

- 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 Great Southern Highway, within the first kilometre of the site entrance, and
- Collecting litter blown beyond the Lot boundaries as a minimum on a weekly basis.

Litter generation and the appropriate management thereof is an ongoing aspect of landfill operations. There is no reasonable way to completely prevent the generation of litter; hence, an active litter management plan and subsequent strategies are required at all times.

11.8.5 Monitoring

Monitoring activities to determine the adequacy of litter controls and mitigation strategies are to include:

- Frequent inspections of the tipping face undertaken by the Site Manager
- Weekly inspection of the greater landfill site (within the Prescribed Boundary), Lot boundaries – beyond the site boundaries, including Great Southern Highway in the vicinity of the landfill entrance
- Monthly and periodic (following significant weather events) inspections to identify waste that has been washed away by stormwater or blown away from the tipping area

- Daily meteorological monitoring will be performed to assist with the planning and management of litter strategies
- Regular targeted inspections will be performed of the site boundary fences, specifically targeting ditches and access/haul roads, and
- Waste vehicle operators will be required to inspect their vehicles prior to leaving the site to ensure all doors are securely closed and no waste debris is left on the vehicle.

Targets

The GSL facility targets for litter management are to:

- Minimise litter blown beyond the active landfill and also beyond the Lot 4869 property boundary
- Have no litter beyond the Lot boundaries for more than a week (litter collection as a minimum on a weekly basis), and
- Repair any damage to the fence or litter screens as soon as practical after discovering the damage.

11.8.6 Litter Management Response Plan

In the event that routine litter monitoring identifies excessive litter blowing beyond the active landfill area or litter blown beyond the Lot boundaries remains beyond the boundary for more than a week, a revised response plan is to be implemented. This response plan is to 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 (e.g. increased use of litter screens/increased use of litter collection personnel)
- If not possible to rectify the problem (e.g. extreme weather conditions), assess the likely impact on neighbouring properties and whether there are any contingency measures that could be implemented to minimise the impact (e.g. additional litter collections), and
- Consider amending the standard operating procedures if the current procedures are ineffective (e.g. use of additional litter screens/installation of more perimeter litter fencing).
-

11.8.7 Risk Assessment

An environmental risk assessment associated with the management of litter has been undertaken.

The risk assessment outlined in this document is based on the framework in the Australian Standard Risk Management (AS/NZS ISO 31000:2009) on which the Victorian EPA Licence Assessment Guidelines have been based.

The full environmental risk assessment is included as Appendix D.

11.9 Odour Management

11.9.1 Concept

The objective of odour management is to minimise the generation of odour from the landfill and leachate management system and to provide a standard set of instructions and procedures to identify and mitigate odour emissions during the operation of the GSL facility.

All staff at the facility are expected to understand and follow the procedures outlined.

11.9.2 Nearest Receptors and Buffer Distances

The Environmental Protection Authority's (EPA) Guidance Statement No 3, Separation Distance between Industrial and Sensitive Land Uses, recommends a buffer distance of 150 m between a Class II or III landfill and a single residence. The distance between the proposed GSL and the nearest single residence is 1.9 km. The Guidance Statement also recommends a buffer distance of 35 m between a Class II or III landfill and the boundary of the property on which it is located. The proposed facility is located 600 m from the property's boundary.

Closest Residence

The closest residence to the property is approximately 1.9 km to the north-east of the landfill. The next closest residence is situated 2.4 km from the proposed facility. These distances were measured using Google Earth and are an approximate only. No residences have a direct line of sight to the proposed site; all are screened by vegetation and sloping hills due to the topography of the landscape.

11.9.3 Odour Science

The Odour Methodology Guideline (the Guideline) published by the then Department of Environment and Conservation (DEC) (now DWER) states that in order to accurately and completely describe an odour, four different characteristics are often considered:

- Odour detection threshold; the lowest odorant concentration necessary for detection by a certain percentage of the population (usually 50%). The concentration is defined as one (1) odour unit.
- Odour intensity; perceived strength of an odour above its threshold. Determined by an odour panel and described in categories that progress from 'not perceptible', to 'very weak', through to 'very strong'.
- Hedonic tone; the degree to which an odour is perceived as pleasant or unpleasant. It must be noted that such perceptions differ wildly from person to person and are strongly influenced by previous experience and emotions at the time of perception.
- Odour character; what the odour smells like. Facilitates differentiation between different odours and may change with dilution.

11.9.4 Sources

Odours are commonly generated in landfills as a result of the following:

- The decomposition of recently deposited wastes
- The presence of low concentrations of odorous substances in landfill gas which is produced some months after deposition, and
- Leachate in the active cell and in leachate ponds.

The potential for such odour emissions to affect the amenity of surrounding areas is influenced by factors such as:

- The rate at which odours are emitted, and
- The atmospheric conditions during which the emission takes place.

Putrescible Waste being Delivered and Unloaded at Active Tipping Area

Most putrescible waste arriving on site is not overly odorous as in the vast majority of circumstances the waste has not yet putrefied.

The degree of odour generation and the impact on receptors as a result of putrescible waste being delivered to site is influenced by the following factors:

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

Excessively odorous loads are an extremely rare occurrence on site and typically relate to a dedicated waste collection emanating from a single source (e.g. food processing factory). These loads are received directly from the waste generator and are not 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).

Fugitive Landfill Gas Emissions

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

The odorous component of the landfill gas is the hydrogen sulphide content, which is typically less than 1% of the gas volume. This has 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 is influenced by 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.

Leachate Ponds

Odour emissions from the leachate ponds are extremely low and hence, do not cause odour concerns. Odour from the leachate ponds 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 is influenced by 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.

11.9.5 Odour Management Measures

Tipping Area

The following management measures will be adhered to during waste receival:

- Tipping area to be restricted to a maximum length of 30 m
- Tipping area no more than 2 m in height, and
- Odorous loads to be prioritised for burial.

Landfill Cover

Landfill cover is an essential and necessary part of landfilling operations. There are a range of environmental and health impacts that can be mitigated through the use of landfill cover, including:

- Minimising landfill odours
- Controlling litter
- Fire prevention
- Controlling disease vectors such as birds, flies, mosquitoes and rodents
- Ensuring that the landfill is trafficable
- Limiting the infiltration of water, and
- Minimising the emission of landfill gas.

Cover Material

The cover material will typically be inert sand/soil. At least two weeks' worth of cover material will be available on-site under all weather conditions. A stockpile of the cover material will be located adjacent to the tipping face, wherever possible.

Waste will be covered at the end of every operating day to a minimum cover thickness of 225 mm.

Intermediate Cover

For surfaces that are expected to remain exposed for a period of ninety (90) days or more, an intermediate cover material will be applied to a minimum depth of 300 mm. The cover will be graded at a minimum slope of 2% away from the void face to promote water runoff and limit the potential for leachate build-up against the void face.

When these areas are due for further filling, the intermediate cover will be stripped off or ripped in order to minimise the potential for a perched leachate level to subsequently develop over the intermediate cover.

Further measures that will be put in place at the GSL facility to manage odours on a day to day basis include:

- Daily odour monitoring of the landfill and surrounds by site staff via a 'sniff test'. This test will be carried out in accordance with the United Kingdom Environmental Agency's Guidance for H4 Odour Management. Staff will use an Odour Audit Tool to record the results of the odour monitoring;
- Requirement for all loads arriving at and leaving the facility to be covered
- Complaints and Investigation Procedure in place to respond to any complaints from the local community
- Landfill gas capture system – operated by a specialist contractor
- Regular monitoring of emissions from the landfill surface
- Effective and responsible leachate management (immediately clearing any spillages and not allowing leachate to pond on the landfill), and
- Maintenance of temporary and permanently capped areas.
-

11.9.6 Mitigation Strategies

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

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

Putrescible Waste being Delivered and Unloaded at Active Tipping Area

- 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, and
- Application of adequate cover material.

When considering the acceptability of an odorous load, the landfill supervisor considers the following influencing factors:

- The customer's past performance with odorous 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.

Fugitive Landfill Gas Emissions

There are many factors that need to be managed to ensure the appropriate control of landfill gas on site. There are also many landfill activities 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 DWER 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

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 odorous 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 Surface of 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 is a minor source of odour emissions.

The degree of odour generation on site and the impact on receptors is 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
- 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.

11.9.7 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 is founded around "nil" odour, "noticeable" odour and "unreasonable" odour.

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

Unreasonable odour is a level of odour that is deemed by the person undertaking the monitoring as being unreasonable. The level of what is deemed unreasonable is 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 DWER sets a target of 500 odour units emitted from a single source and this is used as the benchmark for third-party olfactory monitoring should it be undertaken.

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

11.9.8 Monitoring

As part of normal operations, site staff are aware of typical odour levels associated with daily activities. Should any unusual odour levels be experienced, the site staff immediately report the occurrence to the site supervisor, who investigates the cause and takes appropriate action. It is acknowledged that site staff do become desensitised to odour after being exposed to the same odour for an extended period.

The facility maintains a comprehensive complaints register, which is used as a gauge of success with regards to odour emissions management.

Formal, on-site odour monitoring by site staff consists 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 includes 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 include:

- Accessible points along the Lot 4869 property boundary
- 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 is influenced by the following:

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

Staff members will be trained to monitor odour around the site; only one staff member undertakes the site monitoring at any one time. This training includes:

- 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, and
- Data recording and record keeping.

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

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

- Consideration of 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 wind speed is low.

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

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

11.9.9 Risk Assessment

An environmental risk assessment associated with the management of odour has been undertaken.

The risk assessment outlined in this document is based on the framework in the Australian Standard Risk Management (AS/NZS ISO 31000:2009) on which the Victorian EPA Licence Assessment Guidelines have been based.

The full environmental risk assessment is included as Appendix D.

11.9.10 Odour Management Response Plan

In the event that odour monitoring or complaints identify excessive odour emissions from site, a revised response plan is to be implemented. This response plan is to 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 (e.g. change leachate pumping rates)
- If not possible to rectify the problem (e.g. 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 (e.g. lower the leachate discharge pipe to below the level of the leachate to prevent aeration during pumping), and
- Consider amending the standard operating procedures if the current procedures are ineffective (e.g. change leachate pumping schedule).

11.10 Noise Management

11.10.1 Concept

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

All personnel are expected to understand and follow the standard set of instructions and procedures to identify and mitigate noise emissions.

11.10.2 Nearest Receptors and Buffer Distances

The Environment and Protection Authority's (EPA) Guidance Statement No 3, Separation Distance between Industrial and Sensitive Land Uses, recommends a buffer distance of 150 m between a Class II or III landfill and a single residence. The distance between the proposed GSL and the nearest single residence is 1.9 km. The Guidance Statement also recommends a buffer distance of 35 m between a Class II or III landfill and the boundary of the property on which it is located. The proposed facility is located 600 m from the property's boundary.

Closest Residence

The closest residence to the property is approximately 1.9 km to the north-east of the landfill. The next closest residence is situated 2.4 km from the proposed facility. These distances were measured using Google Earth and are an approximate only. No residences have a direct line of sight to the proposed site; all are screened by vegetation and sloping hills due to the topography of the landscape.

Surrounding Land Uses

Two properties in the vicinity of the GSL facility have been identified in the Department of Agriculture and Food Western Australia (DAFWA) sensitive sites database. One is listed as a bio-dynamic site and the other as an organic site. The property boundary of the bio-dynamic site is approximately 2.5 km from the proposed landfill footprint whilst the organic site is approximately 2 km away.

Given the relatively large buffer distances between these properties and the proposed landfill and the planned management strategies for potential emissions originating from the landfill, the proposed development is expected to have no impact on either of the sensitive surrounding land uses identified.

11.10.3 Outdoor Noise Levels

*Table **8*** shows the maximum noise levels for various types of premises in accordance with the Regulations. The applicable type of receiving premises for the proposed development is:

- Noise sensitive premises – 0700 to 1900 hours Monday to Saturday.

Table 8: Premise Outdoor Noise Levels

Type of Receiving Premise	Time of Day	Assigned Level (dB)		
		L_{A10}	L_{A1}	$L_{A\ max}$
Noise sensitive premises: highly sensitive area (i.e. within 15 m of a dwelling)	0700 to 1900 hours Monday to Saturday	45 + IF	55 + IF	65 + IF
	0900 to 1900 hours Sunday and public holidays	40 + IF	50 + IF	65 + IF
	1900 to 2200 hours all days	40 + IF	50 + IF	55 + IF
	2200 hours any day to 0700 hours Monday to Saturday and 0900 hours Sunday and public holidays	35 + IF	45 + IF	55 + IF
Noise sensitive premises: any area other than highly sensitive area	All hours	60	75	80
Commercial premises	All hours	60	75	80
Industrial and utility premises other than those in the Kwinana Industrial Area	All hours	65	80	90
Industrial and utility premises in the Kwinana Industrial Area	All hours	75	85	90

Note: The L_{A10} noise level is the noise that is exceeded for 10% of the time. The L_{A1} noise level is the noise that is exceeded for 1% of the time. The L_{Amax} noise level is the maximum noise level recorded. IF = Influencing Factor

The Regulations 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.

The Regulations also require noise emissions from the site to be free of annoying characteristics (tonality, modulation and impulsiveness). The use of diesel-powered heavy equipment may result in tonal characteristics in the emitted noise, and as such an influencing factor of +5 dB (A) will need to be applied to the receivers' predicted noise level.

11.10.4 Sources

Potential sources of noise emissions include:

- Vehicles and mobile plant moving around the site (refer to Section 8.1 for full list), and
- Reversing beacons on vehicles.

11.10.5 Noise Control Measures

There are a number of noise mitigation strategies that are employed in order to reduce noise emissions on site.

Vehicles and Mobile Plant Moving Around Site

This is typically a function of speed. With the site speed limit being a maximum of 40 km/hr, this is sufficient to minimise the noise emissions from this source.

An additional contributing factor to noise from vehicles and mobile plant is the noise power levels from the individual vehicles or mobile plant. This issue is primarily related to the larger pieces of equipment such as waste compactors, dump trucks and dozers.

The degree of noise generation and the impact on receptors is influenced by 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.

Reversing Beacons on Vehicles

If noise from reversing beacons is identified as a problematic source, the reversing beacons are to 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.

Mitigation Strategies

GSL will implement the following management and mitigation measures to further minimise the likelihood of noise generated on-site effecting the aural amenity of nearby sensitive receptors (including staff):

- Personnel will have access at all times to operational manuals for equipment being utilised and must be familiar with the procedures detailed in the operations manual
- Requirement for staff wear appropriate hearing protection if in close proximity to machinery for extended periods
- Speed restrictions will be enforced on the internal access roads (60 km/h between Great Southern Highway and the right-angled turn in the access road and 40 km/h everywhere else)
- Appropriate signage is maintained displaying a contact number to call in the event of a complaint from a member of the public. GSL will record any complaints received; including the date, nature and resolution action of any complaints
- Following complaints, the source of any excessive noise is identified and work practices modified or rescheduled to reduce or eliminate the risk of future events

- Heavy machinery and mechanical plant used on-site will be fitted with acoustic panels and mufflers (exhaust silencers), and
- Mobile plant used on site is regularly serviced including exhaust mufflers.

11.10.6 Monitoring

In order to confirm compliance with the Regulations, an Environmental Noise Assessment will be undertaken. Noise monitoring will be undertaken once during the operational phase of the facility. The monitoring event during the operational phase will take place during the first three months of the facility's operational life. The objective of the monitoring event will be to confirm that the site is fully compliant with the ENPR and the monitoring events will be carried out in accordance with *AS/NZS 1269.1:2005 Occupational noise management Part 1: Measurement and assessment of noise emission and exposure*.

Additionally, the facility will maintain a comprehensive complaints register, which is to be used as a gauge of success with regards to noise emissions management.

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

11.10.7 Risk Assessment

An environmental risk assessment associated with the management of noise has been undertaken.

The risk assessment outlined in this document is based on the framework in the Australian Standard Risk Management (AS/NZS ISO 31000:2009) on which the Victorian EPA Licence Assessment Guidelines have been based.

The full environmental risk assessment is included as Appendix D.

11.10.8 Noise Management Response Plan

In the event that the noise monitoring or complaints identify excessive noise emissions from site, a revised response plan is to be implemented. This response plan is to 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 (e.g. only move cover material when the site is not busy – only minimal vehicles moving around site)
- If not possible to rectify the problem (e.g. site too busy and cover material needs to be moved), assess the likely impact on neighbouring properties and whether there are any contingency measures that could be implemented to minimise the impact (e.g. install sound suppressors on the dump truck and excavator), and
- Consider amending the standard operating procedures if the current procedures are ineffective (e.g. move cover material early in the morning as opposed to towards the end of the day).
-

11.11 Topsoil Management

11.11.1 Concept

The objectives of topsoil management are to:

- Provide sufficient stable topsoil material for rehabilitation
- Optimise the recovery of topsoil for rehabilitation
- Identify soil resources and stripping guidelines
- Identify surface areas requiring stripping (to minimise over clearing)
- Manage topsoil reserves so as to not degrade the resource
- Identify stockpile locations and dimensions, and
- Identify soil movements for rehabilitation use.

The management of topsoil during construction and the associated sediment control measures employed have been developed in accordance with the recommendations of the International Erosion Control Association (IECA).

11.11.2 Topsoil Management

The stripping of topsoil will occur progressively, staged in a manner that follows the construction of the cells. Topsoil will be stripped to a depth of 300 mm across the footprint of each cell, an area of approximately 12.5 ha. Topsoil will be stripped whilst in a moist condition to prevent clodding or hard-setting due to the potentially high silt/clay content. Therefore, no stripping should take place immediately following prolonged rainfall or irrigation.

Stockpiling will occur in a designated area north of the landform. Stockpiles will be limited to a height of 1.5 m with batter slopes of 1V:1H. Since topsoil material is deemed unsuitable as engineered fill, the stockpiles will remain in place until required for re-use in final capping or landscaping works. Topsoil will be stockpiled separately from any sub-soil materials (e.g. soil excavated from sub-soil drainage trenches) and clear signage erected. The surface of the completed stockpiles will be left in a “rough” condition to help promote water infiltration and minimise erosion prior to vegetation establishment.

The stockpile area will be contained by a low temporary bund constructed from suitable fill material. A sediment-fence will be installed around the inside perimeter of the bund and between stockpile types (topsoil upper 50 mm; topsoil lower 200 mm; sub-soil) to prevent migration of eroded soil particles outside of the stockpile area and cross-mingling of soil types.

11.11.3 Post-closure

For the minimisation of sedimentation post-closure, emphasis will be placed on re-vegetation of slopes and reinstatement of endemic soils to the surrounding area, as this will provide a more robust long-term mitigation measure than the continued reliance on control structures. The post-closure land use will be a return to grazing.

11.12 Vermin / Feral Animal Management

11.12.1 Concept

The objective for vermin management is to ensure that best practicable measures are in place to control vermin on site so as to prevent infestations occurring and to preserve the health, welfare and amenity of people, staff and nearby land users by meeting accepted guidelines, standards and criteria.

Landfills are by nature attractive sites for vermin infestations due to the presence of food wastes and still waters. If uncontrolled, pests such as flies, mosquitoes, rats, cats, foxes, pigs and birds can affect public health and surrounding ecosystems.

A Feral Animal Environmental Management Plan exists as a separate document to specifically address the management of foxes, feral cats and pigs. The plan details actions, targets, monitoring and reporting initiatives. This environmental management plan requirement was identified by the EPA in the Environmental Scoping Document as part of the 2019 Part IV EP Act referral.

The main reasons the management of pests is required have been outlined by the Department of Biodiversity, Conservation and Attractions (DBCA) as:

- To protect and maintain key environmental and other assets/values
- Being a good neighbour to adjoining landholders
- To comply with required legislation and codes
- To mitigate the transmission of disease vectors
- To reduce the economic impact of pests, and
- To reduce the impact of pests on opportunities for public use and amenity.

11.12.2 Sources

Potential sources of vermin include:

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

11.12.3 Vermin Management Procedures

The following general preventative or corrective measures are available:

- Limiting access to the landfill as a source of food by exclusion measures
- Regular pushing up and compaction of the waste.
- Immediate covering of odorous wastes received.
- Application of adequate cover material.
- Progressive closure of completed landfill areas.
- Monitoring and inspections. Weekly inspections of the site undertaken to identify if there are any vermin present on and around the landfill to complement infrared movement-detection cameras set up at strategic locations within the landfill boundary fence. The inspection is carried out by site operational staff.

- Should vermin be identified on site, the appropriate eradication procedures are undertaken (dependent on the vermin type). This involves professional pest controllers being utilised to manage the situation. Typically vermin could include:

Rodents

Rodents will primarily be controlled by suitably qualified staff using baiting stations and commercially available rodenticides. The services of a specialist pest control contractor will be engaged to provide a pest prevention service for rodents, if required. Bait boxes which will be installed around the site infrastructure and landfill footprint. The boxes will be inspected and baits topped up as required (providing a measure of activity). An inspection register will be maintained along with the following information:

- Safety Data Sheets (SDS) for rodenticides used
- Details of operator training and qualifications, and
- Map showing the locations of all on-site bait stations.

The following precautions will be employed to minimise the likelihood of the baiting system causing secondary poisoning of other species:

- First generation warfarin-based anti-coagulant poisons will be employed, which have been shown to reduce the risk of secondary poisoning
- Rodenticides will be housed in clearly-marked and tamperproof bait stations that will be checked regularly for damage and replaced as needed
- Dead rodents will be removed as soon as they are discovered to prevent scavengers from ingesting them, and
- The storage and disposal of empty rodenticide containers will be conducted in accordance with the Guidelines for the safe use of pesticides in non-agricultural workplaces (2007) and AS 2507-1998 *The storage and handling of agricultural and veterinary chemicals*.

European Fox

The presence of foxes within the agricultural landscape is known, and confirmed with a baseline feral animal survey completed in 2019. They were the most common feral animal identified during the surveys. They present a significant hazard to livestock farmers and to native fauna.

The main methods for the control of foxes have been summarised in *Table **9*** below.

Table 9: Control Methods for Foxes

Method	Description
Exclusion	A two-metre high chain link fence will be constructed and maintained around the landfill and leachate infrastructure. Fence construction will be such as to preven access from either digging under, or climbing over the fence. This could include installing a 400 mm skirt / apron fence around the base of the landfill fencing, or creating a hardstand inder the fenceline and the access gates with a reduced gap to the floor so animals cannot dig their way into the landfill. The ability to climb over will also be constrained by design (netted ceiling overhang) or electrification of the outside perimeter with two live wires (one near the base and the other near the top). Gates will be locked when the site is left unattended.
Shooting	Night shooting is an effective method for controlling foxes in combination with lures. This will need to undertaken in such a manner that the infrastructure lining is not put at risk from being damaged.

Method	Description
Poisoning	Meat or eggs laced with 1080 poison may be used to control foxes by an authorised person. Precautionary measures will need to be implemented to prevent domestic animals not inadvertently being poisoned..
Den destruction	Destroying dens identified within the property
Trapping	Cage traps or, leg-hold traps similar to those used for dingoes and foxes have proven to be quite effective.
Coordination	Coordinating feral animal control initiative with neighbours to maximise effectiveness

Feral Cats

Feral cats pose a significant problem to native Australian wildlife and efforts to control populations have had varying success. They are present Australia-wide under all climatic extremes and in vastly different types of terrain. Landfills present an attractive habitat for feral cats due to the presence of food waste and possible prey.

The main methods for the control of feral cats have been summarised in *Table **10***below.

Table 10 : Control Methods for Feral Cats

Method	Description
Exclusion	Regular boundary fencing has failed to stop the spread of feral cats in a wide variety of contexts. Feral cats have been successfully prevented from climbing over netted fences that incorporate an electric wire mounted 15 cm from the top and 10 cm outwards from the fence. Non-electrified fencing should utilise a netted ceiling or curved overhang to prevent cats from climbing straight over the fence.
Shooting	Night shooting is an effective method for controlling feral cats due to their distinctive green eye-shine. Fox whistles have been used to great effect to attract feral cats for culling.
Poisoning	Fresh meat baits containing 1080 poison may be used to control feral cats under an Australian Pesticides and Veterinary Medicines Authority (APVMA) permit. It must be noted that only authorised persons can supply and use 1080 baits.
Lures	Audible recorded lures for feral cats mimic the distress call of a small animal and can be used to draw a predator to a bait or trap site.
Trapping	For true feral cats, leg-hold traps similar to those used for dingoes and foxes have proven to be quite effective. Semi-feral cats are easily trapped in wire ‘treadle-type’ box traps.

GSL will engage the services of an appropriately qualified and experienced animal control contractor on an ‘as needed’ basis to ensure that feral cats do not become a problem at the landfill facility. It is envisaged that the contractor will conduct a site assessment and control program on a yearly basis (at minimum).

Birds

Some birds can been classed as vermin and the common methods used to control them include:

- Falcons and decoys
- Distress calls
- Blank-firing guns, and/or
- Trapping.

If required, a specialist bird control contractor will be employed to implement and maintain the bird control measures on site. These measures will be based on the contractor's expertise and experience, and as such could be subject to change, depending on what is found to be the most effective measure. The main method to control birds on site will be the progressive covering of waste during operating days and to cover all waste in accordance with the VIC-BPEM for Landfills.

In addition to this, staff will carry out a visual checks for evidence of bird activity within the boundaries of the site on a daily basis. Details of these daily checks will be recorded on the daily check sheets and kept on site.

Flies and Mosquitoes

The main mechanism for the controlling of fly infestation will be via the daily covering of waste, in accordance with the VIC-BEPM. If any area of the landfill appears to be suffering from an increased fly population, then additional cover will be applied to this area in the first instance. In the unlikely event that this control measure does not successfully control the fly population, fly spraying will be employed. The following precautions and procedures will be implemented in order to minimise the occurrence of secondary poisoning in the surrounding environment:

- Spraying to be carried out by appropriately trained and qualified personnel equipped with the requisite personal protective equipment (PPE)
- Only the affected areas will be sprayed (i.e. the working face or the cover mats)
- Fly spraying will only take place in favourable weather conditions (i.e. wind speeds between 3 and 15 km/h, wind direction away from sensitive areas, no temperature inversion layer present and temperatures below 28°C), and
- Fly spraying will not take place in the vicinity of any watercourses.

Details of any fly spraying undertaken will be recorded on the daily site condition report. Copies of operators' training qualifications and the SDS for any insecticides used will be kept in the on-site office.

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

There is the potential for mosquito breeding on site. The control of mosquitoes is primarily 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 is an operational need to store water on site; hence, it is not possible to eliminate all water bodies; however, it is possible to eliminate vegetation within the storage ponds and dams.

Due to the chemical composition of leachate and the non-existence of vegetation within the leachate ponds, these ponds are not 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 are to be used to reduce the breeding of mosquitoes and hence reduce exposure of people to mosquito bites. Approaches include physical, biological, chemical and cultural mosquito control.

11.13 Fire Management

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

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

Consequently there is a risk of fire within the landfills.

The risk of landfill fires is 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 firefighting equipment on site:
- The water tanker is the primary firefighting piece of equipment on site
- Sufficient stockpiles of cover material is 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 is stored on site (in storage dam or designated storage tanks), and
- The water tanker is always left full to be able to react immediately to a fire, and
- 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 will be developed that addresses this aspect.

11.14 Chemical and Fuel Management

The objective of chemical and fuel management is to ensure that best practicable measures are taken to prevent fuel and chemical spills (such as hydrocarbon) that may adversely affect the environmental values or the health, welfare or amenity of people and nearby land users by meeting accepted guidelines, standards and criteria.

Sources

Hydrocarbons include a wide range of products ranging from petroleum through to heavier lubricants both naturally occurring and synthetic. Products that will be used on site include fuels, oils hydraulic fluids, lubricants and greases. GSL understands that hydrocarbons (spills or leaks) can impact the environment and that these need to be managed by using concrete bunded areas, designated refuelling areas and adequately bunded storage pallets to ensure that any spills or leaks are managed quickly, effectively and safely.

Potential sources of spills include:

- During refuelling of diesel storage tank
- During refuelling of machinery or generators
- As a result of an accident, and

- As a result of workshop operations.

It is the responsibility of all employees and contractors to ensure chemicals and fuels are stored in accordance with the *Code of Practice for the Storage and Handling of Dangerous Goods* and all spills are managed immediately, as they occur.

Fuel for mobile plant and equipment is stored in purpose built, self-bunded fuel dispensing containers. These units come with their own fuel pump, bowser and spill kit. The maximum quantity of diesel stored onsite for landfill plant and equipment will be approximately 35 000 L and for oil approximately 1 000 L.

There are also 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 L, but occasionally in 25 L drums. The maximum quantity of lubricants and grease stored on site for maintenance will be approximately 400 L.

The fuel tank will be installed and commissioned in line with the *Dangerous Goods Safety (Storage and Handling of Non-explosives) Regulations 2007* and Australian Standard AS 1940 *The storage and handling of flammable and combustible liquids*. Oils and lubricant storage containers will be stored within the workshop area on bunded pallets. Spill kits will be located throughout the facility to clean up any fuel or chemical spills. A register of spill events will be maintained for future reference.

Management Strategies

The following management strategies will be implemented at the GSL facility to reduce the likelihood of spills. The strategies are based on prevention, confinement, containment and clean-up:

- Operational staff will be required to attend chemical spill awareness and response training as part of their induction.
- The quantity of chemicals and fuels stored will be kept to a minimum
- Self bunded tanks, pallets or concrete bunds will be used for storing chemicals and diesel
- The bunded tanks and concrete pads will be surrounded by a 2 m wide gravel apron to minimise the risk of fire and grassed areas within 30 m of these areas will be cleared or regularly trimmed to maintain a low fuel load
- Fire extinguishers will also be placed near high risk areas. The Fire Management Plan will outline the procedures for chemical and fuel fires at the site
- All chemicals will be stored as per manufacturer's recommendations and material data safety information sheets will be made available to all staff
- Safety Data Sheets (SDS) will be maintained for all chemicals and fuels on site, with SDS made available to all staff. Staff will need to use PPE as per the manufacturer specifications.
- The workshop and apron areas will be sealed with concrete or asphalt
- Mobile pumps used throughout the site will be located within spill trays
- With the exception of the diesel powered generator all refuelling of mobile plant will be undertaken in the designated bunded refuelling areas (or on the active landfill area for example the compactor and excavator)
- All chemical storage and workshop areas will have strategically placed spill kits, which will include absorptive materials e.g. containing zeolite or diatomaceous earth. Through good house-keeping practices, leaks and spills will be readily identified, contained and cleaned up.
- Strategic stockpiles of earth will also be retained on site to be used to contain any larger spills to be used for containment, minimising risk of contaminant release into the environment.

- On site equipment will be mobilised (e.g. front-end loader) as a priority to contain spills with suitable bunding, if needed.
- Appropriate contingency plans have been developed and implemented to manage spills or accidents in the landfill management plan known as the Emergency Procedures Guide and Contingency Plan
- Minor spills fuel (<5 L) are cleaned up and placed in the landfill. Bacteria breakdown dissipates small quantities of fuel or lubricants in the same manner as any other organic waste stream
- Any spillages of greater than 5 L will be contained and quarantined for disposal at an authorised facility and notification / reporting to DWER will be consistent with licence condition requirements. The spillage clean up methodology is dependent on the size of the spill and in accordance with the DWER requirements
- Any hazardous waste arising from spent chemicals, contaminated soil in the event of a leakage and petroleum waste will be stored on an impervious hardstand and transported off site for final disposal by a licenced contractor, and
- Empty chemical and fuel containers will be collected for recycling or disposal by an appropriately licensed contractor.

11.15 Noxious Weed Management

There are no known declared weeds present on site.

The potential sources of weed introduction and or infestation could include:

- 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 neighbouring land owners.

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 few weeds observed on site.

This situation is expected to continue during the operation of the landfill as all waste received on site is immediately delivered to the landfill, placed, compacted and covered daily.

Any weeds within the waste are well contained and covered over within the landfill.

The landfill operations and the surrounding land owners will work closely together to ensure that there is adequate management of weeds on site.

12.0 CONTINGENCY PLANNING

All site staff are 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 are implemented to ensure on-site activities are carried out as programmed and in accordance with standard operating procedures. The site supervisor is responsible to ensure that all landfill related activities are undertaken at the appropriate time and to the required standard.

Contingency (and emergency) planning forms part of the environmental and operational management of the site and include the following as part of the procedures:

For chemical (including leachate and hydrocarbon) spills / incidents:

Objectives:

Prevent any discharge to the environment, minimise impacts where these do occur and remediate (clean-up) without compromising safety, and monitor success.

Response strategies:

Stabilise the incident (e.g. isolating the source and incident area, switching off pumps etc)

Confine the incident to prevent the spread of the product /spill to the environment by either (or combination) damming, diverting, absorption/ adsorption, or covering.

Clean-up and recovery with appropriate disposal (methodology will depend on nature and quantity) to ensure no residual risk remains.

Reporting and investigation, includes notification to DWER as per the licence conditions while an on-site investigation will be undertaken to prevent a repeat and implement additional / alternative controls and demonstrate clean-up has been completed.

Monitor to ensure residual impacts and the defective infrastructure / procedures are repaired, replaced or rectified.

Contingency measures to prevent contaminated waters migrating into aquifers:

These measures are detailed in the Golder Technical memo: *GSL Inland Waters – Hydrogeological conceptualisation and contingency planning*, Ref 1777197 -051-Rev1, dated 13 November 20219). Table 8 in the document identifies strategies to manage impacts to surface water, groundwater and environmental receptors while Table 9 identifies monitoring requirements for managing these risks. Table 10 in the Golder document (repeated as *Table **11*** below) presents a contingency plan for managing these risks.

Table 11: Contingency action plan for managing risk to environmental receptors

Contingency Trigger	Management Criteria	Management Response	Potential Remediation Options
Leachate or other contaminants detected in surface water monitoring.	• Surface water sampling is to be conducted in accordance with AS/NZS 5667.4 and water samples are to be collected and preserved in accordance with AS/NZS 5667.1. • Water quality must not exceed the surface water guidelines listed in the 'Australian and New Zealand Guidelines for Fresh and Marine Water Quality Volume 1' (ARMCANZ and ANZECC, 2000) or an alternative appropriate trigger (e.g. background levels).	If contamination of surface water/groundwater occurs, the following actions will be undertaken: • Identify the type of contamination • Review assessment criteria applicability • Identify the contamination source • Assess the risk • Isolate the contamination source • Report contamination to DWER within 48 hrs • Determine if treatment or/remediation is required • Undertake groundwater monitoring following treatment/remediation • Review management measures • Potentially amend management measures.	Potential remediation measures include: • Source isolation/ removal • Recovery bores • Cut-off trench/sumps • Combination of the above • Ongoing monitoring.
Leachate detected in groundwater monitoring.	• Groundwater sampling is to be conducted in accordance with AS/NZS 5667.11. • All water samples are collected and preserved in accordance with AS/NZS 5667.1. • Compare the monitoring data to ANZECC 2000 Freshwater Slightly-Moderately Disturbed Ecosystems.		
Groundwater levels beneath landfill rising to within two metres (2 m) of base of liner	• Monitoring bore levels indicate excessive, ongoing groundwater level rise (see note 1). • Waterlogging near base of landfill, change in landfill structure (e.g. salt forming, dispersion). • Seepage in area beneath landfill site beyond pre-site landfill conditions.		
Leachate or other contaminants detected in storm water dam or groundwater retention pond (from landfill interceptor drainage)	• Surface water sampling is to be conducted in accordance with AS/NZS 5667.4 and water samples are to be collected and preserved in accordance with AS/NZS 5667.1. • Water quality must not exceed the surface water criteria listed in the 'Australian and New Zealand Guidelines for Fresh and Marine Water Quality Volume 1' (ARMCANZ and ANZECC, 2000).		
Note 1: Additional monitoring bores are required to monitor for leachate seepage near the landfill structure, to be installed once construction is complete.			

Monitoring

Monitoring is undertaken to pre-emptively identify emission risk and also detect any polluting activities so the required remediation can be undertaken

- 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
- The ongoing monitoring and reporting of litter washed or blown beyond the Prescribed Boundary, and
- Mobile equipment breakdown and back-up options

The site supervisor is responsible to ensure that the appropriate contingency planning is 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 are taken to identify, implement and record system improvements.

13.0 REPORTING OBLIGATIONS

13.1 Quarterly Landfill Levy Returns

It is 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 is made to the DWER.

This in an accounting function that is carried out by the head office. The site supervisor ensures that the appropriate weighbridge data is transferred to head office to facilitate the submission of the landfill levy return.

13.2 Annual Reporting

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

The following are the reports that are required:

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

13.3 Incident Reporting

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

The following are the reports that are required:

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

14.0 COMMUNITY COMMUNICATION

There was significant community resistance to the development of the landfill facility.

It is important to appreciate that the community are not supportive of the landfill development; hence, every effort is 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 is maintained on site and the immediate, local community is provided with the contact details of the weighbridge operator and the site supervisor.

In addition, the site entrance signage clearly indicates the after-hours contact details of the site supervisor.

15.0 COMPLAINTS MANAGEMENT

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

All complaints relating to the landfill operation are entered into the Complaints Register. The Register records, 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 DWER 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, and
- Outcome of the complaint investigation.

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

16.0 LANDFILL CLOSURE AND REHABILITATION

Landfill closure is a critical activity on the landfill site. The appropriate and comprehensive closure of the landfill has a significant impact on reducing the environmental emissions from the site and greatly assist in the timely stabilisation of the waste mass. A separate Landfill Closure Objectives and Measures document has been generated for the ERD.

Landfill capping and rehabilitation will progressively be undertaken as the landfill develops. The current objective for the site post landfilling will be to return it to farming (potentially cropping and or grazing).

The overarching objective for Site closure is to a deliver safe, stable and non-polluting landform that is suitable for agreed post closure land use/s.

The following closure objectives have been developed for the proposed GSL.

Safe

- Materials harmful to human health will be encapsulated or remediated
- Potential attractants to disease vectors and vermin will be encapsulated or removed
- Final landforms and land use/s will not pose unacceptable risks to people or fauna
- Infrastructure will be removed unless agreed to by regulators and post-relinquishment landowners/managers.

Stable

- Final landform will be geotechnically and erosionally stable.

Non-Polluting

- No deterioration of groundwater quality caused by seepage of recycled leachate from the landfill cells and recycled leachate pond
- No deterioration of downstream surface water resulting from seepage or run off from the landform (including sediment)
- Contaminated soils and groundwater will be remediated as required for the post closure land use.

16.1 Closure Measures

Final Landform Concept

For areas disturbed by landfill activities (i.e. the landfill footprint), the objective of the final landform will be to restore the landform to enable future reuse of the Site in accordance with the proposed post-closure land use.

The final landform will be above the natural ground level but designed to tie-in with the existing topography of the surrounding area. It will be free draining and undulating (dome shaped) with inclines of 1V:5H, or 20 %, whilst the highest point will be approximately 35 m above the ground surface.

The conceptual final waste landform for the landfill is shown in Figure 2. Closure and Rehabilitation of the landfill, which will include construction of the capping layers and stormwater measures, should occur as a cell or cells reach final height. This will assist in minimising infiltration into the landfill and reducing the production of leachate.

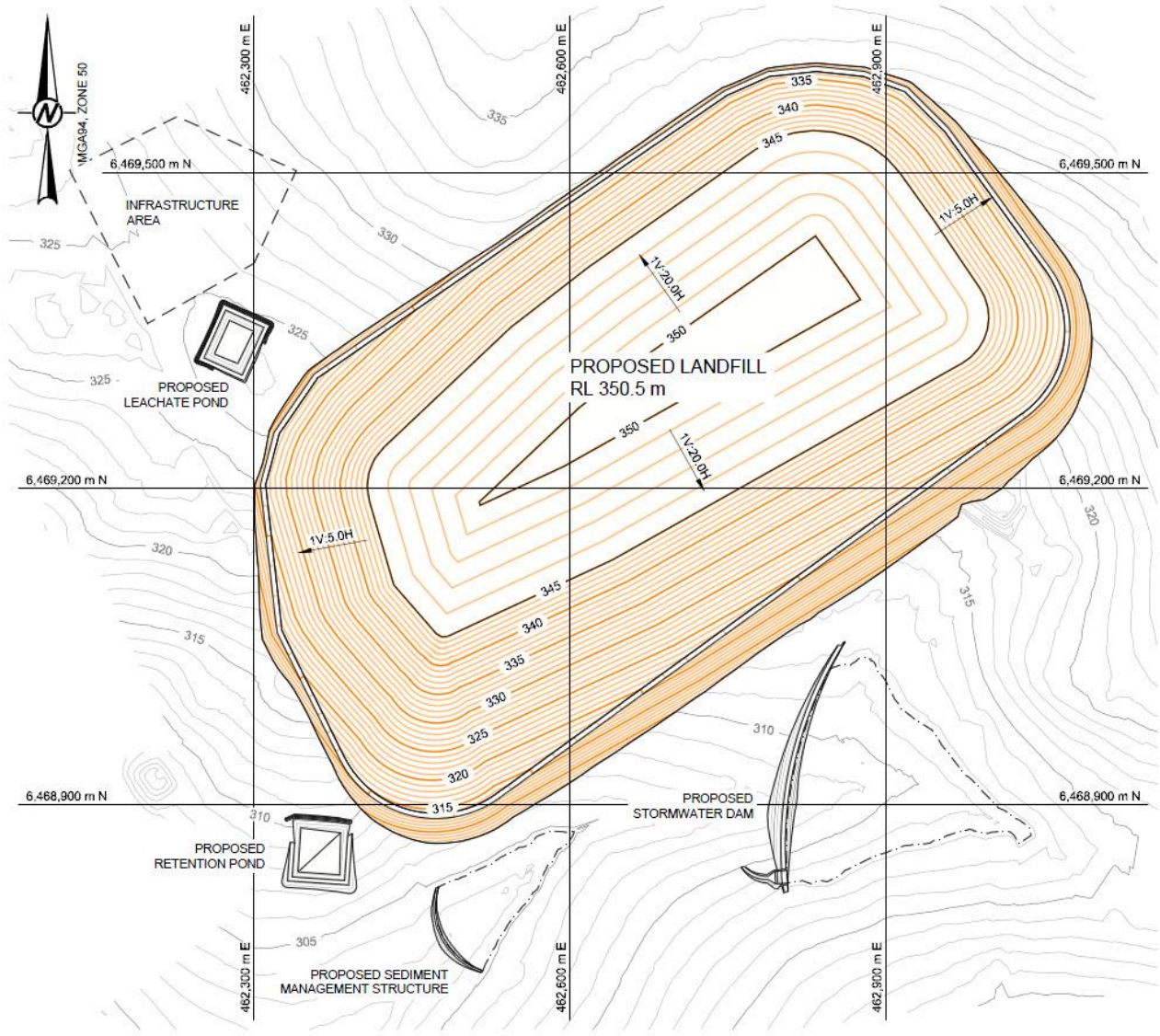

Figure 2: Conceptual Final Waste Landform

Cell Capping

The objectives of the capping are as follows:

- minimising infiltration of water into the waste, ensuring that the infiltration rate does not exceed the seepage rate through base of the landfill
- providing a long-term stable barrier between waste and the environment in order to protect human health and the environment
- preventing the uncontrolled escape of landfill gas, and
- providing land suitable for its intended after use.

The final capping design will be developed prior to commencing capping, but a conceptual capping system has been developed for the site, with the intent to achieve the above objectives. The conceptual capping detail is shown in Figure 3 and comprises a low permeability engineered liner and drainage layer, overlain by 1 m of soils.

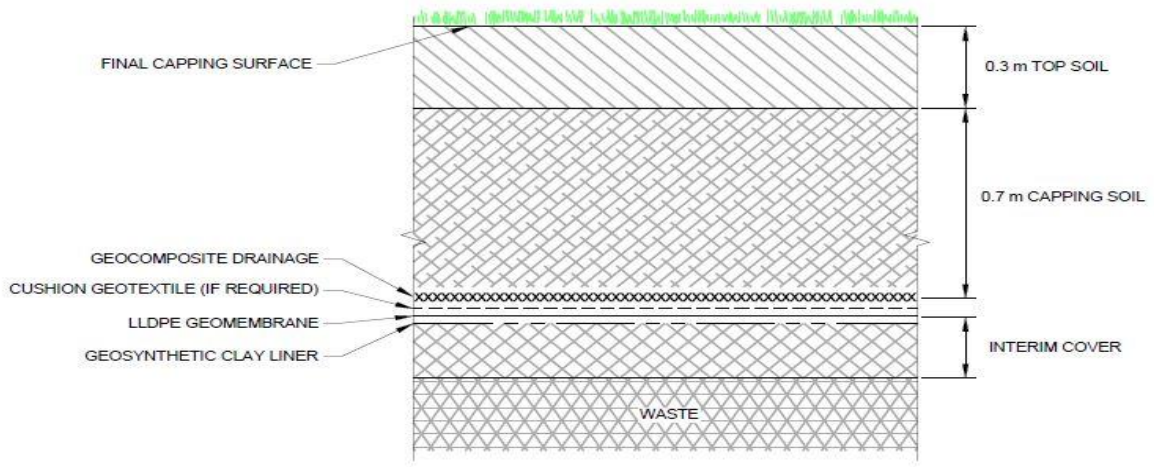

Figure 3: Conceptual Capping Detail

Closure and rehabilitation of the landfill, which will include construction of capping layers and stormwater measures, should occur as a cell or cells reach final height.

Surface Water and Sediment Management

The Site is located in the upper reaches of the Thirteen Mile Brook, close to the catchment divide with the adjacent Six Mile Brook. Both watercourses ultimately drain to the Avon River. A small, ephemeral creek is located directly adjacent to the proposed development site and flows into the Thirteen Mile Brook approximately 250 m to the south-west of the site.

The overall surface water and sediment control strategy for closure comprises:

- Drainage control measures aimed at preventing or reducing soil erosion caused by concentrated flows over the final landform (i.e. landform reshaping).
- Erosion control measures aimed at preventing or reducing soil erosion caused by rain drop impact and sheet flow (i.e. landform reshaping, capping and revegetation of the final landform surface).

- Sediment control measures aimed at trapping and retaining sediment on site (i.e. a Sediment Management Structure).

Operational water bodies (e.g. stormwater dam, retention ponds) that are no longer required will be decommissioned, backfilled and rehabilitated during the closure works period.

Leachate Management

The operational leachate collection and treatment system, including subsurface drainage management measures, will need to be inspected and maintained for as long as the landfill is actively generating leachate. Following this period, the leachate collection and storage infrastructure will be decommissioned and removed. The disturbance footprints will be reshaped to align with surrounding contours and will be revegetated.

Leachate generation will be reduced through progressively reshaping to the final landform shape and capping waste as soon as possible after the final top of waste is achieved.

The final landform will be reshaped to shed surface water, and along with the low permeability capping system, infiltration into the landfill will be minimised to reduce ongoing leachate generation.

Remediation

The GSL landfill closure will also involve remediation of any contaminated soils and groundwater to a level required for the post closure land use/s.

Revegetation

Disturbed areas will be revegetated using native species and/or other vegetation based on the selected post closure land use/s (e.g. pasture or cropping). Planting of at least 300 native tree seedlings will commence within three years of operation to provide future black cockatoo habitat on the property. This will be done with appropriate weed control to ensure their survival. Infill planting will be undertaken as required

On the landfill itself, direct seeding will be used to establish shallow-rooted native grasses, herbs and shrubs. At this stage it is proposed that deep-rooted overstorey species are not established on the landfill cells as their roots may damage the underlying capping system. However, should alternative capping technology be developed in the future allowing for deep-rooted over-storey species, such flora may be considered.

Where possible, and in consideration of the post closure land use, reestablishment of fauna habitat will be an objective of the revegetation plan.

Progressive Closure

The landfill will be progressively closed as individual landfill cells or portions of the landfill reach the ultimate design profile, these areas will be reshaped to the final landform profile, capped and revegetated.

The benefits of progressive closure include:

- Progressively closing off portions of the site
- Increased ability to shed surface water off the landfill and reduce the quantity of leachate being generated
- Reduced ongoing closure liability costs

- Reduced potential attractors to disease vectors, including reduced odour, vermin and other feral animals
- Using the capping costs incurred, as a guide to assist in determining the closure reserves that will be required towards the end of the life of the landfill and during the post closure period
- Reduced litter generation
- Improved aesthetics.

Post-closure Monitoring and Maintenance

A post closure monitoring and maintenance plan will be developed in future versions of the GSL Closure Plan and will be aligned with closure objectives and completion criteria.

The Vic BPEM Guidelines state that the typical period for aftercare for a putrescible landfill is approximately 30 years. The following areas relevant to the GSL will be considered in the post closure monitoring and maintenance plan:

- Maintenance of landfill cap to address any areas of erosion, restore any depressions, and seal and monitor cracks caused by settlement
- Monitor and maintain revegetation (e.g. reseeding, weed management)
- Maintenance and operation of leachate collection and treatment system
- Maintenance and operation of landfill gas extraction system
- Monitoring of groundwater, surface water, landfill gas, leachate and settlement.

Post-closure monitoring activities developed for the facility are outlined in Table 1 of the Golder Technical Memorandum: Proposed Great Southern Landfill – Landfill Closure Objectives and Measure, dated 29 May 2020 (Reference no: 1777197-048-M-Rev1). These will be incorporated in the Landfill Management Plan once finalised.

17.0 REVIEW AND UPDATE

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

17.1 Contingency and Response Plans

The contingency and response planning aspects of this plan is to 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.

17.2 Landfill Management Plan

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

- Year 5 (2023) – Review/confirm relevance and update as appropriate.
- Year 10 (2028) – Use as a basis for a complete review for the next ten-year period.

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APPENDIX A

Figures

Location Map – see Figure 1 of ERD

Site Layout – see Figure 3 of ERD

Local catchment map – see Figure 26 of ERD

Surface water and leachate management map - see Figure 27 of ERD

APPENDIX B

Asbestos Management Plan

Separate document not included for the purposes of the ERD

APPENDIX C

Fire Management Plan

Not included as part of the ERD.

The plan will be updated in consultation with appropriate authorities prior to commencing construction of any infrastructure.

APPENDIX D

Environmental Risk Assessment

Desktop Environmental and Social Risk Assessment – Great Southern Landfill (Golder 2017 – ERD appendix 5.8))

Risk and Potential Impacts	Control Measures	Residual		
		Likelihood	Consequence	Risk Level
Groundwater				
Deterioration/contamination of groundwater quality caused by seepage of recycled leachate from the landfill cells and recycled leachate pond during their operation.	Recycled leachate will be managed through a hierarchy of minimising generation, effective capture and storage and removal. Recycled leachate head on the landfill liner will be maintained at a maximum of 300 mm in accordance with the Vic-BPEM guidelines, industry practice and typical landfill licensing conditions. The collected recycled leachate will be pumped into the recycled leachate pond for storage and evaporation. A site specific water management plan will be developed for the site. The water management plan will describe the maintenance and operation of the recycled leachate management infrastructure, the performance benchmarks for the recycled leachate pond and the appropriate escalation procedures for equipment malfunction, recycled leachate release, recycled leachate pond overfilling and extreme weather events. It will also include management measures appropriate to the scale and nature of the groundwater contamination risk, including: • A groundwater monitoring program • A contingency plan should groundwater monitoring indicate evidence of potential contamination. In addition to a liner and recycled leachate management system and surface water management measures in accordance with Vic-BPEM requirements and industry practice, the groundwater at the site is protected by a clayey soil layer. Subsequently, surface water and groundwater interaction at the site is expected to be minimal.	2	2	4 (Low)

Risk and Potential Impacts	Control Measures	Residual		
		Likelihood	Consequence	Risk Level
Deterioration/contamination of surface water or groundwater quality caused by on-site spills (such as hydrocarbons, saline, or other contaminated materials) during construction or operational activities.	Chemicals and fuels used for landfill construction and operations will be stored appropriately to minimise the risk of impact on the environment. The storage and handling of chemicals and fuels will be in accordance with the *Dangerous Goods Safety (Storage and Handling of Non-explosives) Regulations 2007* and Australian Standard AS 1940 *The storage and handling of flammable and combustible liquids*. The following management measures will be implemented at the landfill site: • The quantity of chemicals and fuels stored will be kept to a minimum • Bunding of appropriate capacity will be provided for liquid storage areas • Appropriate contingency plans will be developed to manage spills or accidents • All refuelling of mobile plant will be undertaken in a designated bunded refuelling area • All chemicals will be stored as per manufacturers recommendations • Safety Data Sheets (SDS) will be maintained for all chemicals and fuels on site, with SDS made available to all personnel associated with the construction and operation of the landfill • In the event of a spill or leakage the contaminated soil will be excavated, stockpiled in a secure area and tested for the concentration of the chemical pending final disposal into an appropriately licensed landfill site by a licensed contractor, and • Empty chemical and fuel containers will be collected for recycling or disposal by an appropriately licensed contractor. Furthermore, the construction contractor shall be aware of the anticipated groundwater conditions and excavations shall be dewatered as necessary with the resulting water pumped to appropriate temporary storage facilities as required.	2	2	4 (Low)

Risk and Potential Impacts	Control Measures	Residual		
		Likelihood	Consequence	Risk Level
Septic system causing contamination of surface water and/or groundwater	The septic system to be installed at the Great Southern Landfill will be appropriate for the estimated volume of sewage waste generated at the landfill. Approval/s for the septic system will be obtained from the relevant authorities prior to installation. Approved temporary ablution facilities will be used during the landfill construction phase. These facilities will be serviced regularly as appropriate with waste material removed for disposal at an off-site licenced facility.	3	1	3 (Very Low)
Surface Water				
Emissions to surface water, including sediment, caused by managed stormwater during landfill construction and operation.	The design of the Great Southern Landfill and associated infrastructure, including the leachate pond, stormwater dam, retention pond, hardstand areas, road drainage and culverts have been designed for storm events. Furthermore a site-specific water management plan will be developed that will include surface water management, monitoring and contingency actions. The water management plan will detail management measures appropriate to the scale and nature of the risk, including: • Maintenance of the stormwater dam, drains and culverts on the site • Management of erosion • Response to extreme storm events. Surface water flows during construction will be managed by the construction contractor in accordance with the relevant specification. The construction contractor shall take precautions to prevent soil erosion from any land used or occupied during landfill construction and shall employ stormwater control measures to prevent contamination of surface waters. For example, the surface water collected from the construction area shall be diverted to the stormwater dam for use in construction activities and dust suppression. The construction contractor shall not discharge any water containing levels of sediment, salt, organic matter, hydrocarbons or other contaminants that are incompatible with the receiving water body without prior treatment and approval.	2	2	4 (Low)

Risk and Potential Impacts	Control Measures	Residual		
		Likelihood	Consequence	Risk Level
Air				
Emission of landfill gas adversely impacting air quality and therefore the health of site workers, the community and fauna.	A Site Management Plan (SMP) for the landfill facility will be implemented. The SMP will include landfill gas management, monitoring and contingency actions and will detail management measures appropriate to the scale and nature of the landfill gas risk, including: • Progressive installation of an appropriate landfill gas collection system • Progressive capping of cells to limit gas escape • Regular review of the landfill gas management system design as waste is placed to optimise the quality and volume of gas generated together with the opportunity for power generation • Provide adequate condensate collection and drainage points in the landfill gas collection systems to avoid blockage by water vapour • Use of vertical and/or horizontal landfill gas extraction wells • Install vertical wells with care to avoid penetrating the basal landfill liner • Strategically locate the landfill gas management systems to minimise the potential for damage caused by settlement, vandalism, animals, natural processes or operational machinery • Conduct scheduled monitoring and maintenance of gas extraction wells • Modifications to the gas collection system design after the construction phase will be recorded and maintained at the landfill site.	3	1	3 (Very Low)
Emission of landfill gas introducing an explosion risk due to generation of methane.		1	4	4 (Low)
Emission of landfill gas contributing to greenhouse gas emissions (from methane and carbon dioxide).		3	1	3 (Very Low)
Emission of carbon dioxide from plant and machinery during landfill construction and operations.	All plant and equipment shall have appropriate emission control devices and be maintained regularly to achieve optimum performance. All plant and machinery will be inspected daily as part of normal pre-start procedures. Inspections will include checking of mufflers, exhaust systems and fuel and oil lines and reservoirs.	3	1	3 (Very Low)
Dust emissions caused by vehicle movement during construction works potentially adversely impacting air quality and therefore the health of site workers and fauna, and dust deposition to flora.	Alkina will maintain a suitable buffer from the landfill facility to the site boundary. Furthermore, various construction and operational management plans will be developed and implemented as part of the SMP. These management plans will include dust management and contingency actions detailing the management measures appropriate to the scale and nature of the dust risk, including:	3	1	3 (Very Low)

Risk and Potential Impacts	Control Measures	Residual		
		Likelihood	Consequence	Risk Level
Dust emissions caused by wind blowing from the active tipping face potentially adversely impacting air quality and therefore the health of site workers and fauna, and dust deposition to flora.	• Covering/sealing all vehicles carrying waste • Only removing vehicle covers in the vicinity of the tipping face of the active cell • Sealing the landfill entry road from Great Southern Highway to the landfill site with bitumen • Using water trucks to supress dust on unsealed roads, exposed stockpiles and the active landfill cell(s) when required • Directing vehicles entering and leaving the site to pass over a mud shaker to remove dust from the tyres and underbody of the vehicle • Only operating vehicles on designated roads and tracks • Restricting the speed of vehicles accessing the site to 50 km/h on Entry roads and 30 km/h within the landfill facility • Monitoring exposed and disturbed areas for dust emissions • Maintaining a complaints register detailing dust emissions complaints and actions.	3	1	3 (Very Low)
Dust emissions caused by progressive construction activities of new landfill cells, including development of borrow areas, potentially adversely impacting air quality and therefore the health of site workers and fauna, and dust deposition to flora.		3	1	3 (Very Low)
Dust emissions caused by spillage of waste and debris from trucks during transport and tipping potentially adversely impacting air quality and therefore the health of site workers and fauna, and dust deposition to flora.		3	1	3 (Very Low)
Dust emissions caused by soil removal/clearing works during construction potentially adversely impacting air quality and therefore the health of site workers and fauna, and dust deposition to flora.		3	1	3 (Very Low)
Dust emissions caused by grading works potentially adversely impacting air quality and therefore the health of site workers and fauna, and dust deposition to flora.		3	1	3 (Very Low)

Risk and Potential Impacts	Control Measures	Residual		
		Likelihood	Consequence	Risk Level
Dust emissions caused by material loading/unloading potentially adversely impacting air quality and therefore the health of site workers and fauna, and dust deposition to flora.		3	1	3 (Very Low)
Dust emissions caused by stockpiling activities and wind erosion of stockpiles of capping materials potentially adversely impacting air quality and therefore the health of site workers and fauna, and dust deposition to flora.		3	1	3 (Very Low)
Odour				
Emission of odour from waste adversely impacting air quality and therefore the health/comfort of the local community and native fauna.	The landfill site is located 1.9 km from the nearest sensitive receptor (residence), which combined with the intervening landform and vegetation provides a considerable buffer minimising the risk of odour impacting the amenity of the surrounding environment. Furthermore, a Landfill Management Plan and Landfill Gas Management Plan will be developed for the landfill facility that will include odour management, monitoring and contingency actions. The Landfill Management Plan and/or Landfill Gas Management Plan will detail management measures appropriate to the scale and nature of the odour risk, including: • Daily covering of active landfill cell with 300 mm thick soil cover or alternative cover materials • Progressive covering of waste to limit oxygen availability and aerobic decomposition • Immediate burial of odorous waste loads • Development and implementation of a landfill gas collection system • Effective collection and management of leachate • Progressive capping of landfill cells to contain landfill gas • Monitoring landfill gas at the gas extraction wells and the site boundary, and • Maintenance of on-site buffers.	3	1	3 (Very Low)
Emission of odour from leachate pond adversely impacting air quality and the health/comfort of the local community and native fauna.		3	1	3 (Very Low)

Risk and Potential Impacts	Control Measures	Residual		
		Likelihood	Consequence	Risk Level
Noise				
Generation of noise due to landfill construction works, including activities at proposed borrow areas (such as operation of vehicles and other equipment) adversely impacting sensitive offsite receptors and native fauna.	Acoustical treatment measures incorporated during landfill construction and operation, together with the distance to the nearest sensitive receptors, will minimise the impact of noise levels to acceptable limits or below. Management plans will be developed for the construction and operation phases of the landfill facility, which will include noise management, monitoring and contingency actions. The management plans will detail management measures appropriate to the scale and nature of the noise risk, including: • Compliance with relevant sections of the *Environmental Protection Act 1986* and the *Environmental Protection (Noise) Regulations 1997*. • Identifying and managing the operating hours of noise intensive machinery • Restricting construction working hours • Implementing buffer zones or bund walls to provide acoustic screening where predicted noise impact would be above the guideline thresholds • Training staff in the effective operation of plant and equipment • Maintaining equipment and its noise control instruments as per manufacturer's recommendations. • Maintaining a complaints register.	2	1	2 (Very Low)
Generation of noise due to landfill operational activities (such as operation of vehicles and other equipment) adversely impacting sensitive offsite receptors and native fauna.		2	1	2 (Very Low)
Light				
Light pollution that intrudes on an otherwise natural or low-light setting.	The landfill site is located in a remote rural area (approximately 1.9 km from the nearest residence), which combined with the intervening landform and vegetation provides a considerable buffer minimising any impacts from light emissions, although activities associated with the construction and operation of the landfill are not expected to generate any adverse light emissions.	2	1	2 (Very Low)

Risk and Potential Impacts	Control Measures	Residual		
		Likelihood	Consequence	Risk Level
Flora				
Disturbance to and/or clearing of vegetation as a result of construction activities.	The landfill has been specifically located to minimise clearing of any remnant bushland on the project site. Limited clearing is required for a strip of bushland near the site entry and isolated trees. Topsoil to a depth of 200 mm shall be removed from the landfill development area and stockpiled for future use (soil from cropping and non-cropping areas will be stockpiled separately). Topsoil will be deposited in rows no higher than 3 m and no wider than 15 m to aid the preservation of soil microbes. Despite the low risk of adverse impact to native vegetation the management plans for the construction and operation phases of the landfill facility will include vegetation management, measures appropriate to the scale and nature of the native vegetation risk, including a weed management strategy.	3	1	3 (Very Low)
Introduction of weeds as a result of increased vehicle movement on site during construction works.		3	1	3 (Very Low)
Introduction of weeds as a result of increased vehicle movement on site during operational activities		2	3	6 (Moderate)
Fauna				
Disturbance to and/or clearing of native vegetation as a result of construction works resulting in the reduction of fauna habitat.	As the area has already been cleared for productive farmland, no substantive vegetation habitat exists (there will be minimal clearing required, limited to scattered trees with little to no habitat value). Regardless, construction and operational management plans will be developed which will include fauna management measures appropriate to the scale and nature of the fauna risk.	3	1	3 (Very Low)
Disease vectors and vermin (including flies, mosquitoes, mice, rats, cats, foxes and birds) emanating from the landfill due to following practices, potentially posing a risk to public health: • Exposed food wastes • Windblown food waste • Access to voids in the waste mass due to poor cover or compaction • Still waters at the landfill.	A Landfill Management Plan will be developed for the landfill facility that will include vermin management, monitoring and contingency actions. The Landfill Management Plan will detail management measures appropriate to the scale and nature of the vermin risk, including: • Cover waste at the end of every day with 300 mm thick cover material and alternative cover systems on the working face only • Check areas previously covered regularly and apply more cover where required • Cover/seal waste delivery trucks • Inspect trucks for spilled waste before they depart the tipping face • Bury odorous or decayed waste promptly • Monitor site fencing and waste transport routes to remove waste deposits • Maintain sufficient gradient for stormwater runoff to minimise the accumulation of standing water	3	2	6 (Moderate)

Risk and Potential Impacts	Control Measures	Residual		
		Likelihood	Consequence	Risk Level
	• Only water bodies required for fire, sedimentation and leachate control will be permitted on site • Maintain site fencing to keep larger animals away from the site • Utilise scare devices and traps, when required, subject to approvals • Engage pest exterminators to minimise infestations of vermin, subject to appropriate approvals • Utilise bird control measures such as anti-perch strips on buildings, acoustic bird scaring devices and other techniques, as required, and • Inform neighbouring land users of the process to register vermin or bird complaints. Investigate and action any complaints as they arise.			
Waste				
Windblown litter beyond the landfill boundary causing visual amenity impacts due to: • Uncovered vehicles transporting waste into the facility • Waste tipping operations • Exposed surfaces of the landfill • Poor cover and/or compaction of the waste • Fauna disturbance	A Waste Acceptance Manual for the landfill will be implemented. The manual will be used by landfill personnel as a reference for the day to day operations concerning receipt and management of waste at the landfill. Furthermore, a Landfill Management Plan will be developed for the landfill facility that will include litter management, monitoring and contingency actions. The Landfill Management Plan will detail management measures appropriate to the scale and nature of the litter risk, including: • Using enclosed/sealed trailers to transport waste • Construction of a 1.8 m high fence around the site perimeter • Erection of portable litter screens downwind of the active face • Operating one active tipping face at any time • Minimising the surface area of the tipping face • Compacting waste immediately following placement • Watering the active face on dry and windy days or when required • Daily cover of the active tipping area • Prompt covering and capping of completed cells • Conducting regular litter patrols around the active cell fence and site fence to collect windblown litter • Maintaining a complaints register.	2	1	2 (Very Low)
Mismanagement of refuse generated during construction activities.	All waste, including foodstuffs, shall be handled and disposed of in accordance with the relevant specification and applicable regulations. For example, separate labelled waste receptacles will be provided on site for temporary storage of waste types prior to removal for off-site reuse, recycling or disposal	2	1	2 (Very Low)

Risk and Potential Impacts	Control Measures	Residual		
		Likelihood	Consequence	Risk Level
Visual Amenity				
Landfill landform visual impact to the surrounding area.	The landfill site is located in a remote rural area (approximately 1.9 km from the nearest residence), which combined with the intervening landform and vegetation provides a considerable buffer minimising impacts to visual and landscape amenity.	2	1	2 (Very Low)
Hazardous Materials				
Asbestos and other hazardous waste material causing health impacts to people or fauna.	A Waste Acceptance Manual for the landfill will be implemented. The manual will be used by landfill personnel as a reference for the day to day operations concerning receipt and management of hazardous waste at the landfill. For example, the acceptance and management of asbestos waste at the landfill will be undertaken in accordance with Asbestos Waste – Transport, Receipt and Disposal as detailed in the Waste Acceptance Manual.	2	2	4 (Low)
Fire				
Fire outbreak on site within the landfill cells or surrounding area, potentially impacting air quality, the health of site workers, the community and fauna, vegetation and public safety.	A Fire Management Plan (FMP) for the landfill facility will be developed which includes fire management, monitoring and contingency actions. The FMP details management measures appropriate to the scale and nature of the fire risk, including: • Fire prevention • Site firefighting infrastructure, including water tanks and stormwater dam • Fire response procedures • Firefighting equipment, such as a water truck • Storage of flammable materials • Maintenance of fire breaks.	2	2	4 (Low)

Risk and Potential Impacts	Control Measures	Residual		
		Likelihood	Consequence	Risk Level
Traffic				
An increased traffic flow within the area due to vehicles accessing the site.	A Landfill Management Plan will be developed that will include waste haulage vehicle management, monitoring and contingency actions. The plan will detail management measures appropriate to the scale and nature of the traffic risk, including: • Addressing the primary aspects of the haulage operation as they impact the Great Southern Highway, and motorists on the Highway including: • Vehicle and trailer type, size and general specifications including colour schemes • Haulage vehicle operating schedules and turnaround times • Driver rest and fatigue management procedures • Vehicle litter clean down procedures and overall cleaning schedules. • Upgrading the intersection of Great Southern Highway and the landfill entry road to provide a through lane for eastbound vehicles and an acceleration lane for road trains exiting the site to Perth. The intersection will be designed and constructed to Main Roads WA requirements.	2	2	4 (Low)

Likelihood		Consequence				
		Catastrophic	Major	Significant	Minor	Insignificant
		5	4	3	2	1
Almost certain	5	25 (VH)	20	15	10	5
Likely	4	20	16 (H)	12	8	4
Possible	3	15	12	9 (M)	6	3
Unlikely	2	10	8	6	4 (L)	2
Rare	1	5	4	3	2	1 (VL)

(VL) Very Low Risk	No additional controls necessary. Continue to monitor risk.
(L) Low Risk	Consider additional controls to further reduce risk.
(M) Moderate Risk	Controls must be implemented to reduce risk.
(H) High Risk	Risk unacceptable; do not proceed without controls, minimum of 'engineering controls'.
(VH) Very High Risk	Risk unacceptable; do not proceed without controls, elimination or substitution.