EPA REFERRAL DOCUMENT: ALLAWUNA LANDFILL

Proposal to develop a Class II or III landfill in the Shire of York.

Volume 1 of 4: Referral Document
Volume 2 of 4: Drawings
Volume 3 of 4: Appendices A to H
Volume 4 of 4: Appendix I - Community and Stakeholder Consultation Record (CONFIDENTIAL)

March 2013

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ACRONYMS

AHIS	Aboriginal Heritage Inquiry System
BOM	Bureau of Meteorology
C&I	Commercial and Industrial Waste
CFA	Country Fire Authority
DAFF	Department of Agriculture, Fisheries and Forestry
DAFWA	Department of Agriculture and Food WA
DEC	Department of Environment and Conservation
DFES	Department of Fire and Emergency Services (Formerly FESA)
DoW	Department of Water
EP Act	Environmental Protection Act 1986 (Western Australia)
EPBC Act	Environmental Protection and Biodiversity Conservation Act 1999 (Federal)
FAQ	Frequently Asked Questions
GCL	Geosynthetic Clay Liner
HDPE	High Density Polyethylene
HELP	Hydrological Evaluation of Landfill Performance
IFD	Intensity Frequency Duration
MSDS	Materials Safety Data Sheet
MSW	Municipal Solid Waste
NGERS	National Greenhouse and Energy Reporting System
OSHE	Occupational Health, Safety and the Environment
SEAVROC	South East Avon Voluntary Regional Organisation of Councils
UTM	Universal Transverse Mercator
VIC-BPEM	Victorian Best Practice Environmental Management Landfill Guidelines 2010
WALS	Western Australian Landfill Services
WA EPA	Western Australian Office of the Environmental Protection Authority

UNITS OF MEASURE

ha	Hectares
kg CO_2-e	Kilograms carbon dioxide equivalent
km	Kilometres
L/ha/day	Litres per hectare per day
m	Metres
m GDA94	Elevation (metres) above the Geocentric Datum of Australia (1994)
m^2	Square metres
m^3	Cubic metres
mm	Millimetres
m/day	Metres per day
m/s	Metres per second
m/year	Metres per year
T/annum	Tonnes per annum

COORDINATE SYSTEM

Unless otherwise stated, all coordinates described in this document are in Universal Transverse Mercator (UTM) Zone 50 Easting and Northing Formats, with GDA94 vertical datum.

GLOSSARY OF TERMS

Acid Sulphate Soils

Soils that are rich in iron sulphides and will leach sulphuric acid when exposed to oxygen and rehydrated.

Advection

The transport of a fluid or sediment due to the fluids bulk motion.

Aerobic Decomposition

The break-down of biodegradable organic materials by microorganisms in the presence of oxygen.

Aggregate

Rock material of specified hardness and particle size distribution used in construction.

Alluvial Deposition

The shaping of the landscape by depositing loose, unconsolidated material that has been eroded by water.

Anaerobic Decomposition

The break-down of biodegradable organic materials by microorganisms in the absence of oxygen.

Cohesion

A measure of the strength with which material is bound together. The component of a materials shear strength which is independent of interparticle friction.

Compactor

A specialised machine (plant) used for moving and compressing waste in a landfill.

Culvert

A drain or pipe that allows water to flow under a road.

Diffusion

The transport and distribution of a dissolved species due to a concentration gradient in their carrying medium (typically air or water).

Equipotentials

Lines of equivalent hydraulic head defining groundwater elevation and flow direction. Equipotentials are to groundwater as contour lines are to topography.

Finite Element Modelling

A mathematical modelling technique where a system of partial differential equations are approximately solved to determine the behaviour of a structure, heat, fluid or electromagnetic field.

Flare

A device used to safely burn landfill gas, converting its constituent methane into carbon dioxide.

Friction Angle

A measure of the drained shear strength of a material, as determined by applying the Mohr-Coulomb equation for effective stress.

Groundwater

The water found in the subterranean saturated zone below the water table.

Geomembrane

A low permeability synthetic barrier used in geotechnical construction to control fluid or gas flow.

Geosynthetic

A polymer product designed to solve a particular engineering problem. Encompasses geotextiles, geogrids, geonets, geomembranes and geosynthetic clay liner.

Geotextile

A permeable fabric material used to separate, filter, reinforce, protect or drain soil.

Laterite

Iron and Aluminium rich soil material formed by the prolonged and intense weathering of rock material by the infiltration of water.

Landfill Gas

A mixture of carbon dioxide and methane that is released by the decomposition of putrescible material in a landfill.

Leachate

Water that is released by decomposing waste, has come into contact with decomposing waste or has come into contact with other leachate.

Nutrients

Chemicals and elements that are essential for an organism to live and grow. In an environmental water quality context typically refers to nitrogen and phosphorous.

Permeability (Hydraulic Conductivity)

A measure of the ease with which fluids may move through a porous media. Expressed as a velocity.

Pocket Road Train

A vehicle consisting of a prime mover and two trailers with a total length not exceeding 27.5 m.

Polyethylene (PET)

A thermoplastic polymer of long carbon chains. The most common plastic.

Shear

A material failure mode characterised by surfaces sliding past one another.

Stormwater

Surface water runoff generated by rain events.

Subgrade

The compacted soil material under the landfill liner.

Swan Coastal Plain

The region bound by Moore River, the Gingin Scarp, the Darling Scarp, The Whicher Scarp, Eagle Bay and the Indian Ocean Shoreline.

Topography

The contours, grades, elevations and slopes of the Earth's surface.

Vector

An organism which may transmit infections from one host to another.

Weighbridge

A large balance calibrated and certified to weigh vehicles.

1 EXECUTIVE SUMMARY

This document describes in detail the environmental factors considered in the assessment of Allawuna farm as an appropriate site for the construction of a landfill. A comprehensive review of site environmental conditions with reference to current legislature, assessment guidelines and industry best practice has established that the development of a landfill on the site does not pose any significant environmental risk.

SITA Australia (SITA) believes that an EPA determination of 'not assessed' is appropriate for this proposal. The proposal does not involve any processes or actions that constitute a significant impact on or risk to the environment.

SITA has comprehensively considered the construction and operational phases of the project and determined potential environmental impacts in the context of the technical design and operational control features of the site.

Site assessments for flora and fauna, surface water, geology, seismology, groundwater, drinking water supply catchments, pollution, greenhouse gas emissions, land contamination and surrounding land uses have all shown that the development of the Allawuna Landfill, as proposed will not have a significant impact on the environment.

The location and large size of the site allows a 1.9 km buffer distance to the nearest residence, maintenance of a large internal buffer distance between the site boundary and landfilling activities and separation from nearby water courses and nature reserves.

The site geology, consisting of very low permeability clay material is ideal for siting a landfill. The thick (6.5 m to 9.5 m) confining surface clay layer protects the underlying groundwater from contamination.

Modern technical design features and proposed management processes work with the existing environmental variables to create multiple layers of protection against impact on the surrounding environment.

SITA has also engaged a comprehensive community and stakeholder consultation program, seeking to inform the surrounding community and public at large about the proposal, the environmental factors considered and address community questions, doubts and concerns about the development.

The site environmental investigation process has determined that Allawuna is an excellent site for a landfill. As such SITA Australia believes a determination by the EPA of 'not assessed' would be an appropriate outcome for this referral submission.

SITA is committed to environmental protection and regulatory compliance. By using modern construction technology, industry best practice landfill operations management strategies and maintaining an open rapport with development stakeholders SITA will maintain its position as The Leader in Resource Recovery.

2 INTRODUCTION

2.1 THE PROPONENT

SITA Australia Pty Limited (SITA, Proponent) (**ABN** 70 002 902 650) is a leading multinational waste, recycling and resource recovery service provider. SITA has 100 operations across Australia including composting facilities, resource recovery facilities, materials recycling facilities, depots, transfer stations and nine landfills. Since opening the very first engineered landfill in Australia at Lyndhurst in Victoria in 1991 SITA has continued as a leader in landfill and waste management technology. With 2.5 million tonnes of waste landfilled in Australia in 2011 and the successful operation of the Shale Road Landfill in South Cardup since 1999, SITA has a wealth of experience in the effective operation of landfill facilities.

SITA has a significant presence in Western Australia and currently provides collection and disposal services for a variety of clients including local governments, service industries and commercial enterprises.

The Proponents contact details are as follows:

Address

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116 Kurnall Road
Welshpool WA 6106

Key Contact

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State General Manager
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Mobile: 0458 001 121
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Further information about SITA Australia can be found at www.sita.com.au.

2.2 CONSULTANT

Bowman & Associates Pty Ltd (**ABN** 22 112 399 514) is an Environmental Engineering Consultancy specialising in waste management, environmental impact assessment, environmental approvals, project management, tender preparation, transport logistics and waste management technology assessment. Bowman & Associates are assisting SITA with the development of this proposal.

The Consultants contact details are as follows:

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2.3 NEED FOR A NEW LANDFILL

SITA currently operates the Shale Road Landfill at South Cardup through its subsidiary Western Australian Landfill Services (WALS). The South Cardup facility is approaching capacity, with less than five years of estimated airspace remaining. A new landfill is required to be up and running by the year 2016 to receive the waste stream when Shale Road is complete.

While SITA makes a considerable contribution to resource recovery in the Perth metropolitan area, recycling 150,000 tonnes of material in 2011 alone, landfills are still an essential component of the waste management hierarchy for the final disposal of wastes that cannot be reused or recycled.

In line with the directive of the Department of Environment and Conservation to locate any new landfill developments off the Swan Coastal Plain, SITA has chosen a site in the Shire of York for the development of the Allawuna Landfill. The site has been subjected to a thorough environmental investigation, as described in this document. The investigation has shown no significant environmental impacts are likely to arise from the establishment or long term operation of the Allawuna Landfill.

A variety of potential landfill locations and transportation systems were investigated as part of the site selection process. The site selection process is described in **Section 3.2**.

The establishment of the landfill may support the South East Avon Voluntary Regional Organisation of Councils (SEAVROC) Strategic Waste Management Plan, which calls for the investigation and establishment of a regional landfill for the shires of York, Beverly, Brookton, Cunderdin and Quairading. The Allawuna Landfill could potentially receive waste from these shires.

2.4 SUMMARY OF PROPOSED DEVELOPMENT

The proposed Allawuna Landfill will be constructed as a Class II or Class III lined landfill, designed to accept putrescibles wastes. The facility will incorporate a composite liner system to contain the leachate generated by the waste mass for appropriate treatment on site.

The facility will accept between 150,000 and 250,000 tonnes of waste per annum. At this stage the facility will have a nominal life of 37 years, dependent on achieved filling and compaction rates. The landfill will have a lifetime capacity of approximately 12.8 million cubic metres.

In designing the facility and developing this referral document the following environmental factors have been considered:

- Community and stakeholder concerns and expectations,
- Separation distances to sensitive land uses,
- Potential impacts during both construction and operational phases,
- Flora and fauna in the works area,
- The geotechnical stability of the final landform,
- Flow of surface water and groundwater from the site,
- Performance of the composite lining system,
- The volume, quality and management of landfill leachate,
- Potential odour impacts on sensitive receptors,
- Potential noise impacts on sensitive receptors, and
- Post closure site rehabilitation and management.

Further regulatory approvals submissions and detailed landfill design are planned to follow this referral with a view to beginning works at the site in 2014.

2.5 GUIDING LEGISLATION AND DOCUMENTS

This referral has been prepared with reference to a number of key legislative Acts, Regulations and best practice design documentation, as currently endorsed by the Department of Environment and Conservation (DEC). This document is specifically written to address the requirements of Part IV of the Western Australian *Environmental Protection Act 1986* (EP Act).

The key guiding documents for the development of this referral have been:

- The Western Australian *Environmental Protection Act 1986*,
- The Federal *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act), and
- The Victorian EPA, 2010, *Best Practice Environmental Management: Siting, Design, Operation and Rehabilitation of Landfills* Guideline (VIC-BPEM).

A comprehensive list of technical and legislative references can be found at **Section 12**.

Further to the above documents, consultation with the significant project stakeholders including the Western Australian Office of the Environmental Protection Authority (WA EPA), DEC, Department of Water (DoW), Department of Fire and Emergency Services (DFES) (Name changed from the Fire and Emergency Services Authority (FESA) in December 2012), Shire of York, Local Indigenous Elders and the wider York community has directed the development of this referral document.

3 PROPOSAL

3.1 LOCATION AND SITE DESCRIPTION

The proposed Allawuna Landfill is to be located at:

Lots 9926, 26934, 4869 and 5831 Great Southern Highway, Saint Ronans in the Shire of York.

An aerial view locality plan is attached on **Drawing ALLA-EPA-01**.

The site is located on the southern side of Great Southern Highway approximately 80 km by road from Perth and 20 km by road from York. The site was selected as the optimal choice after investigation of nineteen potential sites undertaken by SITA.

The Allawuna site is currently a farm, and is zoned as General Agriculture (Shire of York 2012). The total area of the lots is 1,500 ha. Approximately 25 % of the site is uncleared remnant bushland, with the remainder being cleared land used for either sheep grazing or broad acre cereal cropping.

The large size of the site enables significant buffer distances to be maintained and infrastructure to be sited without disturbing areas of remnant natural vegetation. In the proposed design the nearest sensitive receptors (two single residences) are 1.9 km and 2.4 km from the proposed landfill footprint respectively. The Mount Observation Picnic Area, while not classified as a sensitive receptor under the EPA guidelines has been identified as an area of local amenity. The picnic area is located 4.6 km from the proposed landfill footprint.

Drawing ALLA-EPA-02 shows the lot cadastral boundaries and general site configuration. **Drawing ALLA-EPA-03** shows control points for the limits of the waste placement area on the lot.

3.2 SITE SELECTION PROCESS

The Allawuna farm site was determined to be the optimal location for a landfill to replace the Shale Road Landfill. Twenty six potential sites were identified, with nineteen shortlisted for assessment based on the following criteria:

- Located off the Swan Coastal Plain,
- Land for sale (freehold), or possibly for sale, subject to approaching the owner,
- A large site to maintain ownership of buffer distances,
- Close to a main road for truck access,
- Realistic travel distance from the Welshpool Transfer Station to the landfill, and
- Not in an area where landfill is explicitly prohibited.

Upon further investigation of site specific features SITA selected Allawuna Farm as the best option.

The potential for transporting waste by rail from Welshpool to either Allawuna or a site further afield was investigated, however the costs to completely redevelop SITA's existing infrastructure for this mode of transport and developing rail siding infrastructure at each end were prohibitively high and seen as not commercially viable.

3.3 NEIGHBOURING PROPERTIES

There are 21 properties within 2.5 km of the site boundary. The owner of each property has been identified by SITA and special consideration given to ensure they remain informed as the landfill development process continues.

3.4 PREMISES CLASSIFICATION

The proposed landfill will be developed to an appropriate standard for licensing as a Prescribed Premises Category 64 Class II or Class III putrescible landfill.

In accordance with the *Landfill Waste Classification and Waste Definitions 1996 (As amended December 2009*; DEC 2009) for a Class II or Class III landfill, the proposed Allawuna Landfill may receive the following types of waste:

Clean Fill

Material that will have no harmful effects on the environment and which consists of rocks or soil arising from the excavation of undisturbed material.

Type 1 Inert Waste

Non-hazardous, non-biodegradable (half-life greater than two years) wastes containing contaminant concentrations less than Class I landfill acceptance criteria but excluding paper and cardboard (paper and cardboard are biodegradable materials and are therefore considered as putrescible waste), and materials that require treatment to render them inert (e.g. peat, acid sulphate soils).

Putrescible Waste

Component of the waste stream likely to become putrid - including wastes that contain organic materials such as food wastes or wastes of animal or vegetable origin, which readily bio-degrade within the environment of a landfill.

Contaminated solid waste meeting waste acceptance criteria specified for Class II and Class III landfills (possibly with specific licence conditions)

Waste containing chemical substances or wastes at concentrations above background levels that present, or have the potential to present, a risk of harm to human health or the environment.

Type II Inert Waste (with specific licence conditions)

Waste consisting of stable non-biodegradable organic materials such as tyres and plastics, which require special management to reduce the potential for fires.

Type I Special Waste

Waste which includes asbestos and asbestos cement products.

Type II Special Waste

Waste consisting of certain types of biomedical waste that are regarded as hazardous but which, with the use of specific management techniques, may be disposed of safely within specified classes of landfill.

Waste types outside of these definitions will not be received at the Allawuna Landfill.

3.5 REGULATORY APPROVAL REQUIREMENTS

The development of the Allawuna Landfill is subject to rigorous regulatory controls under both environmental and planning legislation.

The key legislation is:

Environmental Protection Act 1986 (WA); and

Planning and Development Act 2005 (WA).

The sections which follow provide further detail on the regulatory assessment and approval processes relevant to the Allawuna Landfill under this legislation.

3.5.1 PART IV ENVIRONMENTAL PROTECTION ACT

Part IV of the *Environmental Protection Act* contains the statutory process for environmental impact assessment of 'significant proposals'. A 'significant proposal' is a proposal likely, if implemented, to have a significant effect on the environment.

The Part IV process is instigated by referral to the EPA pursuant to section 38. The EPA must decide whether or not to assess a proposal referred to it. This decision is based on the potential impact(s) of the proposal on the environment and the EPA's determination of the significance of those impacts.

This referral Document provides a comprehensive review of the existing environmental conditions at the proposed development site and the likely impacts of implementing the Allawuna Landfill. The significance of the likely impacts has been thoroughly considered by the Proponent as part of its planning process. The Proponent is firmly of the view that the Allawuna Landfill proposal does not meet the significance threshold for a Part IV assessment. The siting, design, planned management, planned operation and future rehabilitation of the site all accord with best practice guidelines for landfill facilities and the proposal has been designed to minimise the potential for detrimental environmental impact.

While the proposal may not be assessed under Part IV, detailed environmental assessment and operational regulatory oversight of the Allawuna Landfill will be achieved pursuant to the Works Approval and Licensing requirements in Part V of the *Environmental Protection Act*.

3.5.2 PART V ENVIRONMENTAL PROTECTION ACT

Works Approvals and Licences under Part V of the *Environmental Protection Act* regulate emissions and discharges from 'prescribed premises'. The Allawuna Landfill is a prescribed premises and subject to the Part V regime. The Department of Environment and Conservation is responsible for administration of Part V of the *Environmental Protection Act* and has strong regulatory powers to manage and protect the environment.

A Part V Works Approval will be required for the construction of the site infrastructure and landfill cells. The primary purpose of a Works Approval is to ensure that the potential adverse environmental impacts of a proposal are properly assessed and that these impacts will be prevented or minimised during the construction and operation of the premises. The application process will involve assessment of the Allawuna Landfill by the DEC and the imposition of appropriate conditions to regulate relevant emissions and discharges.

Following construction, a Part V Licence will be required for the operation of the premises. The primary purpose of a Licence is to manage those discharges which require ongoing adaptive management, monitoring and reporting to ensure that they are prevented, minimised or their impact on the environment remains within an acceptable range. Again this process will involve assessment by the DEC and the imposition of conditions regulating the operation of the Allawuna Landfill.

Part V of the *Environmental Protection Act* also regulates clearing of native vegetation. As the site is predominantly cleared cropland, only a small number of scattered remnant trees will be cleared for the development. Clearing will be conducted in accordance with Part V and the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004*.

3.5.3 DEVELOPMENT APPROVAL

The Allawuna Landfill site is located on land zoned General Agriculture under the Shire of York Town Planning Scheme No.2. A landfill falls within the 'industry – noxious' use. This use is permitted in the General Agriculture zone, subject to planning consent being granted by the local government authority.

The Proponent will submit a development application for the Allawuna Landfill to the Shire of York pursuant to the Town Planning Scheme and the *Planning and Development Act*. Given the estimated cost of the proposal, the development application will be determined by the Wheatbelt Joint Development Assessment Panel (**JDAP**).

There are a number of matters the JDAP will have regard to in considering the development application, including the principles of orderly and proper planning, amenity of the locality, traffic and capacity of the road system. Approval of the development application will be subject to the conditions imposed by the JDAP.

3.6 KEY LANDFILL DESIGN PARAMETERS

A summary of the key landfill design parameters is presented below in **Table 1**.

Table 1: Landfill Design Parameters

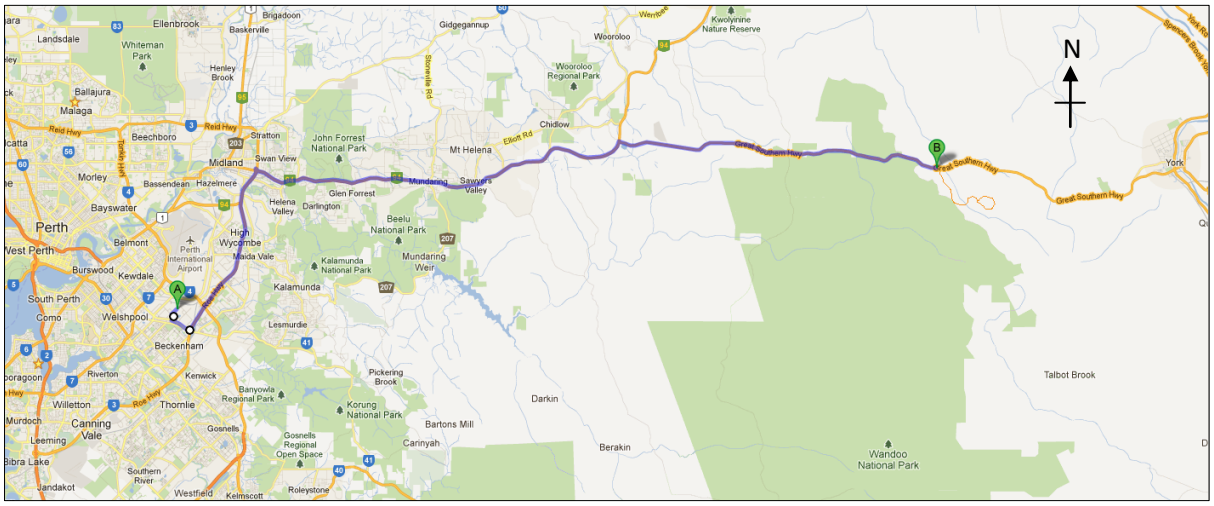
Parameter	Units	Value
Total site area	ha	1,516
Area of waste placement	ha	52.0
Landfill volume	m^3	12,862,890
Annual Quantity of Waste	T/annum	150,000 to 250,000
Average depth of waste placement	m	24.7
Maximum height of capped landfill	m GDA94	327.5
Total waste capacity	m^3	11,099,029
Total waste tonnage	tonnes	10,147,990
Nominal Landfill Life Expectancy	years	37

3.7 LOGISTICS

The development of the Allawuna Landfill will generate road train vehicle movements between SITA's waste transfer station on Kurnall Road in Welshpool and the landfill site. The development will also eliminate the current transfer vehicle movement to the Shale Road Landfill on South Western Highway.

The transfer road trains will be Restricted Access Vehicles (RAV) Class 2, Category 3 in a pocket road train configuration, with a maximum length of 27.5 m. The pocket road trains will travel along the existing RAV Network 4 road system to the site via Roe Highway, Great Eastern Highway and Great Southern Highway.

Figure 1: Waste Transfer Road Train Route



Source: Map data ©2012 Google

The existing RAV Network 4 intersections along the route are all sufficiently developed to accommodate the small increase in road train volume associated with the landfill development.

When operating at maximum capacity one road train will depart the transfer station every 20 minutes for a total of 24 deliveries to the Allawuna Landfill per day. If additional cover material is required for landfill operations up to one additional truck per day carrying recycled brick road base or similar material may also access the site, as is currently the practice at Shale Road Landfill.

The development of the site will have a negligible effect on the road network in the metropolitan area and a minimal impact on Great Southern Highway vehicle volumes. As road train loads are evenly distributed across the day, the impact on peak traffic times is also considered to be negligible.

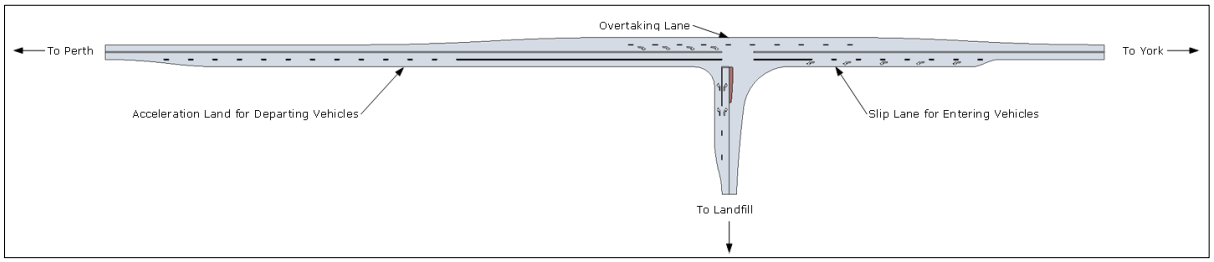
A comprehensive review of the available traffic data from the Main Roads WA (MRWA) *Traffic Digest* compared with the proposed increase in vehicle movements found the increase in Great Southern Highway vehicle volumes would be less than 3% on 2008/09 volumes.

During harvest season an additional 2 road trains a day laden with grain will depart the site.

A small number of light vehicle movements for Landfill staff entering and departing the site in the morning and evening will also occur. The expectation is that most employees will be residents of the York area, with an expected 30-40 vehicle movements a day between York and the site. This volume represents a 2-3% increase in traffic between York and Allawuna.

SITA is consulting with MRWA to determine an appropriate intersection upgrade of the Great Southern Highway at the entrance to the site. The currently proposed design incorporates a standard MRWA Type B rural right turn treatment incorporating road widening for eastbound overtaking of vehicles entering the site, a westbound entry deceleration lane and a westbound exit acceleration lane. **Figure 2** shows the currently proposed intersection treatment (November 2012).

Figure 2: Conceptual Design for Entrance Road Upgrade



SITA will secure the appropriate approvals from MRWA before commencing development of the site. The improvement of the site entry will be financed by SITA.

3.8 INDIGENOUS AND EUROPEAN HERITAGE

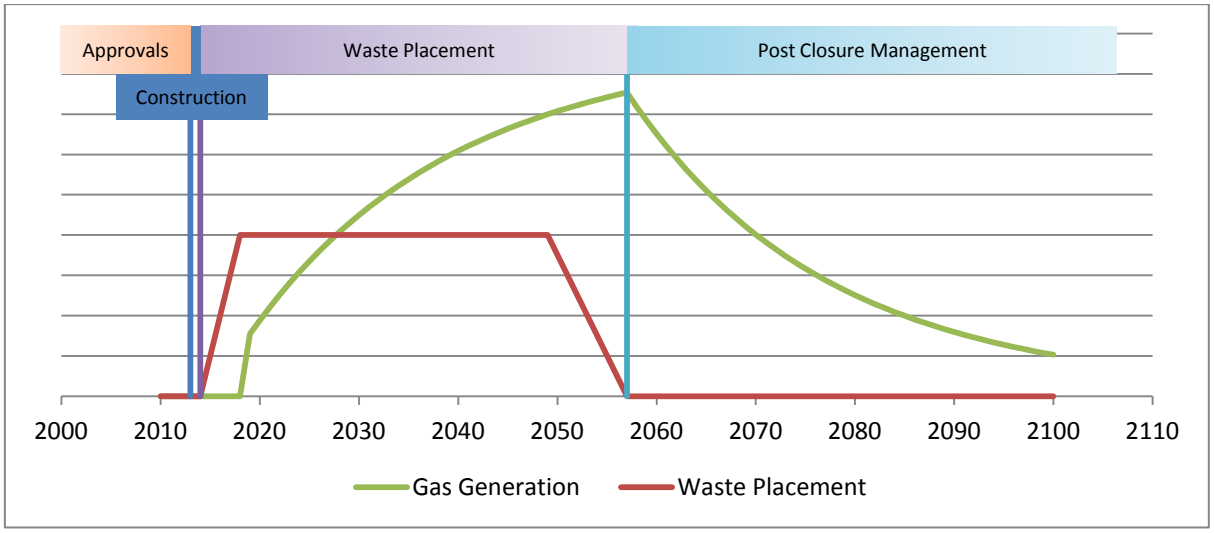
A review of the Aboriginal Heritage Inquiry System (AHIS) on the 24th October 2012 found no registered Aboriginal Sites or Heritage Places on the Allawuna site.

The Proponent contacted three Elders of the Local Indigenous Community and met to discuss the development as part of the community and stakeholder consultation program. The Elders indicated that the location of the landfill and the surrounding development area are not a place of significance for the local indigenous people. The historical path of indigenous people travelling from the Midland area to the York area is closer to the major water courses and away from the development site.

3.9 PROJECT LIFECYCLE

The Allawuna Landfill project is characterised by four key development phases: Approvals, Construction, Waste Placement and Post Closure Management. **Figure 3** shows the approximate timing and duration for each of these periods in the context of waste placement volumes and electricity generation using landfill gas as a fuel source.

Figure 3: Project Lifecycle



4 PROCESS DESCRIPTION – LANDFILL CONSTRUCTION

4.1 CLEARING OF VEGETATION

A small number of scattered remnant trees on the mostly cleared cropland will be cleared for the development. The investigation of the flora in the development area is discussed in more detail in **Section 7.1**.

4.2 ACCESS ROAD

The intersection of the site access road and Great Southern Highway will be upgraded to the requirements of MRWA. The track from the highway to the landfill will be widened and surfaced to an appropriate standard for regular heavy vehicle movements. Significant deposits of gravel material for road making are evident in the landfill construction works area. The requirement to import fill material for landfill construction activities is expected to be minimal. The access road will be wide enough for vehicles travelling in opposite directions to pass each other and of an appropriate form for the site speed limit(s).

Appropriate signage will be installed along Great Southern Highway identifying the landfill and warning of trucks entering and departing the site.

4.3 CREEK CROSSING

An appropriately sized culvert will be installed on the property across 13 Mile Brook to enable vehicle access to the landfill. The crossing is proposed to be located in an area where the creek is deep and narrow with stable geology on both banks.

A permit will be acquired from the DoW for the creek crossing in accordance with the requirements of the *Rights in Water and Irrigation Act 1914*.

4.4 WEIGHBRIDGE

A 30 m long weighbridge certified to 100 tonnes will be installed for the weighing of incoming material.

4.5 LINED LANDFILL CELLS

The landfill will be constructed using a phased methodology to distribute capital expenditure and limit the potential for infrastructure degradation. Cells are sized to fill in two to three years of operation. An indicative layout of cells 1 and 2 can be seen on **Drawing ALLA-EPA-07**.

Each cell is shaped to facilitate free draining of the floor for leachate collection from a sump area. The base of the cells will be double lined with a layer of low permeability clay or Geosynthetic Clay Liner (GCL) under a 2 mm thick high density polyethylene (HDPE) geomembrane liner. A protective cushion geotextile will support a network of HDPE pipes and highly permeable drainage aggregate. The aggregate protects the liners from damage and facilitates the collection of leachate. The aggregate layer is separated from the waste by a layer of geotextile.

4.6 STORMWATER DAM

A stormwater dam constructed of the low permeability clay material found on the site will be constructed at the south eastern corner of the landfill.

4.7 LEACHATE DAMS

Two leachate evaporation dams will be constructed to the west of the landfill. The leachate dams will be lined with low permeability clay and HDPE to an equivalent standard to the landfill cells.

4.8 OTHER LANDFILL INFRASTRUCTURE

Appropriate sheds, offices, workshops, laydown areas, water tanks, paving, signage and stormwater drainage will be constructed around the site. A conceptual layout of the site can be seen on **Drawing ALLA-EPA-02**.

4.9 CONSTRUCTION QUALITY ASSURANCE

The execution of the works will be subject to a rigorous quality assurance program. The quality assurance program will have a particular emphasis on the environmental performance of the lined landfill cells, leachate dam and stormwater management infrastructure.

Construction of supporting embankments and subgrades will be validated through survey by a licensed surveyor and compaction testing by a National Association of Testing Authorities (NATA) accredited laboratory.

Installation of GCL and HDPE liner components will be observed and verified by an appropriately qualified independent third party.

5 PROCESS DESCRIPTION – LANDFILL OPERATIONS

This section summarises the proposed operations at the Allawuna Landfill site. Comprehensive plans for Waste Acceptance and Management, Water Management, Noise Management, Dust Management, Odour Management, Vermin Management, Landfill Gas Management, Fire Management, Fuel and Chemical Management and Site Security will guide the daily operation of the landfill. These supporting management plans are described in **Section 8**.

5.1 OPERATING SCHEDULE

The facility will operate from 7 am to 5 pm Monday to Friday and from 7 am to 4 pm on Saturdays. The Saturday schedule will be followed for public holidays but the site will remain closed for New Year's Day, Good Friday and Christmas Day.

When operating at full capacity waste transfer road trains will be received at regular 20 minute intervals throughout the day.

5.2 WASTE TRANSFER

Waste is accepted by SITA at the Welshpool Resource Recovery Centre waste transfer station. Waste will be loaded into transfer pocket road trains, weighed and delivered to the Allawuna Landfill.

Waste from other commercial collectors operating in the York region, or local government collections may also be delivered to the Allawuna Landfill.

The landfill will not be accessible to the general public.

5.3 WASTE ACCEPTANCE AND MEASUREMENT

Signs will be established that indicate the type of wastes permitted at the Landfill. Random verification inspections of waste types delivered to the landfill will be performed with a frequency of 1 in 10 vehicles and for every new customer or new origin of waste. Mirrors, video cameras and/or viewing platforms will be strategically installed to allow inspection of the incoming waste. There will be waste isolation areas to hold any non-conforming waste and procedures will be implemented to deal with such wastes.

Each vehicle accessing the site to deposit waste will be weighed on entry and exit at the weighbridge. The mass of waste, type of waste and delivering vehicle will be recorded in a database for future reference. In the case of failure of the weighbridge typical waste delivery data will be used to estimate the weight of incoming waste.

5.4 LANDFILLING

The placement and covering of waste will be in accordance with the VIC-BPEM guidelines for landfills. Cover material and internal roads will be made from material excavated during cell construction or waste materials with appropriate properties for vehicle traffic such as builders' rubble, crushed concrete or shredded wood. The strategies employed will aim to prevent windblown litter, control birds and prevent vermin at the site. The waste will be placed by maintaining one active tipping area that is as small as possible. The landfill will be effectively compacted to minimise long term settlement and maximise the use of the available airspace. The compactor will make three to five passes over waste that has been placed in 500 mm layers. Emplaced waste will be completely covered at the end of each day. Waste will be placed in layers of not more than 2.0 m deep to a maximum height as shown on **Drawing ALLA-EPA-05**. A multi layer capping system will be constructed on top of the emplaced waste to seal the landfill.

5.5 LEACHATE MANAGEMENT

Water that has been in contact with waste is classified as leachate and must be appropriately managed to prevent release into the environment. The leachate will be collected and pumped back into the landfill to allow faster decomposition of waste. If the quantity of leachate produced is in excess of the recirculation requirement then it will be collected in a leachate dam for future recirculation or be allowed to evaporate. Leachate may also be trickled onto the surface of the active cell area for evaporation or removed by an approved contractor for offsite treatment.

5.6 LANDFILL GAS MANAGEMENT

Landfill gas will be collected for flaring, and, when commercially viable, for power generation through the operational life and post closure management periods of the Allawuna Landfill. Best practice design and construction procedures will be employed for the landfill gas collection system.

5.7 SITE STAFFING

The landfill facility will require adequate staffing to ensure proper management of the facility.

During the operational phase the landfill staff will include:

- Site Manager,
- Weighbridge Attendant,
- Plant Operator(s) – Compactors, dozer, water truck, grader and excavator, and
- Landfill General Hand(s) – Litter control and site maintenance.

The landfill staff responsibilities are summarised below:

Site Manager:

- Oversee the effective operation of the landfill, including environmental compliance,
- Conduct the day to day operation of the landfill,
- Supervise site personnel,
- Prepare waste acceptance data, maintenance of onsite records related to complaints register, budgets and income generation,
- Coordinate and follow up staff issues or site specific issues to upper management,
- Coordinate construction activity for capping, leachate, stormwater and landfill gas management,
- Report to the appropriate statutory and regulatory authorities, and
- Act on complaints.

Weighbridge Attendant:

- Gate house operation, generating dockets for disposal fees (money will not be collected at the site),
- Litter collection,
- Amenity cleaning and maintenance,
- General site maintenance,
- Deal with landfill users and respond to their enquiries,
- Screen incoming vehicles for unacceptable waste, and
- Perform additional duties as delegated by the Site Manager.

Plant Operator:

- Qualified in operating the compactor, water truck, excavator and grader and any other plant employed on the site,
- Contribute to keeping a clean site through assisting with litter management, site maintenance, ensuring the fencing remains sound and general cleaning duties,
- Ensure all directions issued by Site Manager are carried out,
- Identify unacceptable materials at the tip face according to the landfill licence guidelines,
- Maintain a safe tipping area, and
- Cover waste at the end of the day or as per the management measure adopted.

Landfill General Hand:

- Collection of litter,
- Management of leachate,
- Maintenance of litter fences,
- Direction of landfill traffic,
- General site repairs and maintenance,
- Relieve the weighbridge attendant, and
- Perform additional duties as delegated by the Site Manager.

The total number of Plant Operators and Landfill General Hands will scale with the volume of waste being received.

SITA will also require services from contractors for maintenance and upkeep of plant and machinery used in the site. Adequate staff training including general induction training and site specific induction training will be provided to make staff aware of potential dangers and hazards while performing their respective responsibilities. Occupational Health, Safety and Environment (OHSE) training will be included in all site visitor inductions and will be offered to waste collectors using the site for waste disposal.

5.8 ENVIRONMENTAL MONITORING, REPORTING AND REVIEW

In accordance with the expected licence conditions for the future landfill site a comprehensive environmental monitoring and reporting program will form part of the operations at the landfill.

Once operational the Annual Report will incorporate waste volumes and types received, ground water monitoring data, waste placement volumes, locations of any asbestos and/or clinical waste, spill and response records and any incidences of fire.

Coupled to the annual reporting process will be an annual review of operating procedures and their effectiveness at the site. SITA has a commitment to consistently improving performance to reflect current best practice, international standards and technologies in landfill operations.

6 LANDFILL DESIGN

6.1 DESIGN CONSIDERATIONS

The primary design focus for the development of the Allawuna Landfill site is environmental protection. By adherence to the appropriate legislature and best practice guidelines the Allawuna Landfill will be a safe facility with multiple synergistic environmental protection features. Where it is practicable to use site specific features to exceed the minimum best practice performance requirements the design team will proactively do so.

Another consideration of critical importance is the development of site specific solutions. Best practice design features are adapted to suit the Allawuna climate, topography, geology, existing environment, available resources and regional, social and environmental context. There is no single best formula for all landfill applications. As such the development of the Allawuna site has been carefully tailored to fit site requirements.

A combination of existing site characteristics, engineering design features and effective management strategies work to minimise the risk of impact on the surrounding environment.

Functionality is another important consideration in the design process. SITA and Bowman & Associates have drawn on many years of landfill operations experience to streamline the daily functions of the site. When a site operates smoothly, maintaining compliance with environmental protection requirements becomes much easier.

The long term evolution of the site has also been considered in the design process. Infrastructure has been sited to facilitate future expansion. The materials specified for use in construction of critical components, including environmental barriers, will all have a working lifespan longer than that of the landfill. The final landform after 30 to 50 years of waste placement has been carefully considered.

6.2 LANDFILL FOOTPRINT

The ultimate footprint of the landfill used for the placement of waste covers an area of 520,000 m^2. Control points identifying the limits of the landfill footprint are shown on **Drawing ALLA-EPA-03** and summarised in **Table 2**.

Table 2: Control Points for Landfill Footprint

Point	Easting	Northing	Point	Easting	Northing
1	462801.327	6469581.220	17	462790.829	6468767.179
2	462857.370	6469582.598	18	462720.720	6468778.314
3	462909.828	6469562.826	19	462652.772	6468798.866
4	462951.018	6469524.799	20	462588.245	6468828.456
5	463095.876	6469327.287	21	462528.334	6468866.534
6	463240.733	6469129.774	22	462474.150	6468912.397
7	463262.644	6469086.140	23	462426.696	6468965.193
8	463268.999	6469037.730	24	462386.852	6469023.944
9	463259.093	6468989.919	25	462355.356	6469087.562
10	463234.025	6468948.020	26	462332.791	6469154.869
11	463184.369	6468897.289	27	462328.228	6469199.290
12	463128.283	6468853.773	28	462337.259	6469243.022
13	463066.807	6468818.276	29	462359.045	6469282.002
14	463001.081	6468791.457	30	462391.561	6469312.608
15	462932.320	6468773.812	31	462570.733	6469435.751
16	462861.801	6468765.670	32	462749.905	6469558.893

6.3 BUFFER DISTANCES

The landfill and infrastructure locations have been selected to provide appropriate buffer distances to the surrounding nature reserves, sensitive receptors, public use areas, surface waters and property boundaries.

Buffer distances are summarised in **Table 3** below.

Table 3: Buffer Distances

Buffer Description	Separation Distance (m)
Landfill to Property Boundary	600
Landfill to Nearest Neighbouring Dwelling	1,900
Landfill to Mount Observation Picnic Area	4,600
Landfill to Wandoo National Park	1,000
Leachate Dams to 13 Mile Brook	230
Landfill to 13 Mile Brook	350

The Guideline *Separation Distances between Industrial and Sensitive Land Uses* (EPA 2005) requires a minimum separation between landfill activities and a single residence of 150 m. The guideline also requires a separation distance of 500 m to any subdivision development. Given the rural location of the landfill, future subdivision is unlikely. Regardless, the internal 600 m buffer on the property will be owned by the Proponent and easily maintained against any future development in the area.

6.4 SEPARATION TO GROUNDWATER

The base of the landfill has been designed to maintain a minimum separation of 3 m from the depth of the confined groundwater, as determined by the installation of bores across the site. The base surface of the landform can be seen on **Drawing ALLA-EPA-04**, with the required cut and fill areas identified on **Drawing ALLA-EPA-06**. Sections of the landform showing the separation to groundwater can be seen on **Drawing ALLA-EPA-08**.

The depth to groundwater in the vicinity of the first two cells will be confirmed by further bore exploration as part of the detailed design for EP Act Part V Works Approval.

6.5 PHASED CONSTRUCTION

The landfill will be constructed in a series of cells, each one with an approximate 2 to 3 year filling life. **Drawing ALLA-EPA-07** shows the conceptual sizes and locations of cells 1 and 2.

The landfill is divided into three stages of construction. The first stage will involve the construction of cells on the western side of the landfill. The second stage will involve construction of cells on the eastern side of the landfill. The third and final stage will fill the valley created between the stage one and stage two landforms.

6.6 LINER SYSTEM

The liner is a composite environmental barrier system that protects the surrounding environment from the impacts of leachate and landfill gas migration. The liner system has been designed to comply with

the VIC-BPEM. The main engineering components of the proposed liner configuration will include the following (as shown in **Drawing ALLA-EPA-09**):

- Compacted and rolled subgrade,
- A Geosynthetic Clay Liner (GCL) will be installed over the base of the landfill cells and on the side slopes. The GCL will have a hydraulic conductivity of less than 1×10^{-9} m/s. The GCL will help in limiting contaminant migration, water seepage and landfill gas migration,
- A 2.0 mm thick High Density Polyethylene (HDPE) membrane liner will be placed directly above the GCL and will also limit contaminant migration and control landfill gas migration,
- A non-woven geotextile cushion layer will be placed on top of the HDPE liner to serve as a protective layer, minimising the risk of damage or puncture during installation of the drainage layer and operation of the landfill,
- A 300 mm aggregate layer will be laid on top of the cushion layer to act as a leachate drainage layer. The hydraulic conductivity of the drainage layer will be greater than 1×10^{-3} m/s,
- Leachate collection pipes will be installed in the drainage layer, and
- A non woven geotextile layer will be placed on top of the aggregate to serve as a separation layer from the waste.

All the above mentioned synthetic layers, excluding the aggregate drainage layer, will run along the side walls to adjacent cells and will be tied to the top of the slope in an anchor trench. The structure, layer thickness and hydraulic conductivities of the liner system components are described in **Table 4**.

Table 4: Landfill Liner Configuration

Layer	Material	Thickness	Hydraulic Conductivity (m/s)
Waste	Waste	25 m nominal	$\approx 10^{-4}$
Separation Geotextile	Non-woven polyester geotextile	2 mm nominal	$\geq 10^{-3}$
Drainage Layer	20 – 40 mm aggregate, HDPE pipes	300 mm minimum aggregate thickness	$\geq 10^{-3}$
Cushion Geotextile	Non-woven polyester geotextile	6 mm nominal	$\geq 10^{-3}$
Geomembrane	HDPE	2 mm	$\leq 10^{-14}$
GCL	Powdered Bentonite Clay	5 mm	$\leq 10^{-9}$
Subgrade	Compacted Natural Material	300 mm	2×10^{-10}

The hydraulic conductivity of the subgrade was determined by performing a falling head permeability test on material extracted from the sump area of the landfill footprint. The material was reworked to 95% standard compaction for the test, which is considered conservative as the *in situ* material is well consolidated and undisturbed. The permeability of the clayey subgrade beneath the landfill is far less than that required in the VIC-BPEM for landfill liners.

6.6.1 LINER LIFETIME

The life of the geomembranes will vary across landfills. It will depend on the temperature and the nature of waste being placed in the landfill; the higher the temperature in the landfill the shorter the life of the liner. A range of studies conducted on geomembranes used as landfill liners indicate a life span from 20 years to indefinitely (Rowe & Islam 2009). We expect the HDPE liner to have a life of at least 100 years, during which time the waste will decompose completely and cease to generate landfill gas and leachate and become benign. Provided an effective final capping system is maintained to prevent infiltration of water, the benign waste will remain entombed within the landfill and will not generate further leachate. The waste composition itself will not degrade the liner.

6.7 LINER SEEPAGE MODELLING

The potential for leakage from the base of the landfill liner at the Allawuna site has been modelled after Muller and Seeger (2002) using a statistical analysis of baseline geomembrane behaviour and liner installation quality. Given the extremely low permeability of the HDPE geomembrane, on the order of 1 x 10^{-15} m/s (Giroud and Bonaparte 1989), liner leakage is best evaluated by considering the quality of the installation, rather than the miniscule advective (pressure head) and diffusive (concentration gradient) transport processes across the liner. For a defect free geomembrane of thickness 2mm, under a leachate depth of 300 mm, the advective/diffusive leakage rate is approximately 0.39 L/ha/day (Giroud and Bonaparte 1989).

There are two potential failure modes for the composite liner system; the first (and most likely) is the penetration of the HDPE geomembrane only due to either poor installation or manufacturing defects. In this case the GCL layer below the HDPE liner retards the flow of leachate. The second mode of failure is the penetration of both the geomembrane and the GCL, such that leachate may flow directly into the subgrade. This failure mode would be caused by heavy plant driving on the liner or sharp objects being placed in the first landfill waste lift.

Modelling has been undertaken after Muller and Seeger (2002) to determine leachate leakage rates under various scenarios. The modelling is considered to be conservative, as leachate head for most of the landfill cell is negligible, with ponding occurring only in the sump, which will have an extra layer of HDPE to further limit the risk of seepage. The results are presented below in **Table 5**.

Table 5: Liner Leakage for Various Scenarios

	Typical Installation		Poor Liner Installation and Maintenance		Poor Installation, Maintenance and Leachate Management	
Leachate Head (m)	0.3		0.3		0.5	
2 mm Defect Free Geomembrane Leakage (advective and diffusive forcing) (L/ha/day)	0.3888		0.3888		8.197	
	Frequency (/ha)	**Leakage (L/ha/day)**	**Frequency (/ha)**	**Leakage (L/ha/day)**	**Frequency (/ha)**	**Leakage (L/ha/day)**
Defects (Geomembrane Manufacture)						
3mm HDPE Pinholes	5	0.0079	10	0.0158	10	0.0262
Defects (Geomembrane Installation)						
10 cm Round Installation Defects	5	0.0264	10	0.0527	10	0.0873
Poor Weld Seams (m/ha)	3	0.0005	30	0.0052	30	0.0086
Operational Damage (Geomembrane and GCL Penetrated)						
Large Tear (1 m radius)	0	0.0000	2	0.0276	2	0.0415
Small Puncture (10 cm radius)	10	0.0138	15	0.0207	15	0.0311
Slice (Total Length) (m/ha)	3	0.0078	5	0.0259	5	0.0432
Total Liner Leakage (L/ha/day)		**0.445**		**0.537**		**8.43**

The low permeability of the *in situ* material forming the subgrade powerfully limits the flow of leachate, even if both layers of the containment system are breached. The required VIC-BPEM maximum leakage rate criteria of 10 L/ha/day for type 3 putrescible landfills will be met even under the poorest installation and operational management conditions.

The hierarchy of control for limiting leachate leakage to groundwater is as follows:

- Manage and Minimise Leachate Head,
- Maintain Liner Integrity, and
- Ensure Quality Installation.

The rate of leachate leakage to the ground below the landfill cell is most dependent on leachate head. Appropriate monitoring and leachate sump emptying procedures will ensure that if any leachate is generated, a maximum head of 300 mm, as per the VIC-BPEM, is maintained.

The Proponent, through the contractor installing the liner system, will be responsible for proving appropriate quality assurance in both the manufacture and installation of the GCL and the HDPE geomembrane.

6.8 GEOTECHNICAL STABILITY MODELLING

The stability of the landfill as it fills and as a completed final landform is an important consideration for environmental protection. Both circular slope and sliding block (shear) failure modes have been considered in the stability investigation.

The zone of particular interest is the shearing interface between the layers of the composite liner system. An analysis of interface friction angles and potential block failure modes has been undertaken to determine the weakest liner component interface.

Two dimensional finite element modelling was undertaken using the SLOPE/W modelling package to assess the stability of the following landfill features:

- The final landform post closure and capping, and
- The internal waste batter slope when a cell is partially filled.

The factors of safety described in **Table 6** have been determined as appropriate minimums for this project based on typical regulatory requirements around the world, as there is no specific guidance from the Western Australian regulatory authorities.

Table 6: Minimum Factors of Safety for Geotechnical Stability

Failure Mode	Minimum Factor of Safety
Final Landform – Circular Slope Failure	1.5
Final Landform – Sliding Block (Shear) Failure	1.5
Interim Waste Batter Slopes – Circular Slope Failure	1.3

Material properties defined as typical parameters for the modelling are shown in **Table 7**.

Table 7: Material Properties for Geotechnical Modelling

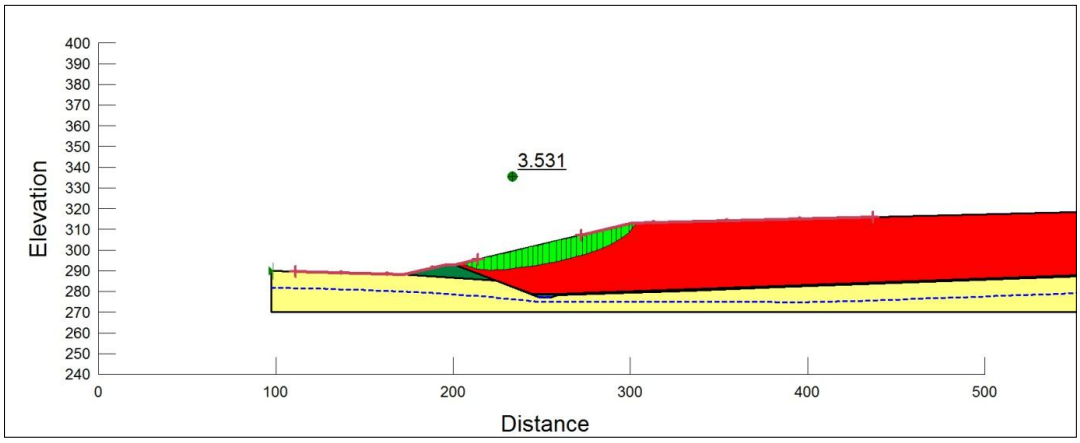
Material	Unit Weight (kN/m^3)	Cohesion (kPa)	Friction Angle (degrees)
Natural Ground	20	5	32
Clayey Engineered Fill (Bunds)	15	5	28
Waste	8.31	5	30
GCL	17	0	30.6
HDPE Geomembrane (smooth)	12	0	10
Aggregate Drainage Layer	12	0	20
Geotextiles	14	5	20

6.8.1 FINAL LANDFORM STABILITY

The profile of the final landform has been assessed for stability in a circular slope failure mode using the SLOPE/W two dimensional finite element modelling package. Section B on **Drawing ALLA-EPA-08** was used for the modelling as it is representative of the longest and steepest batter slopes of the design landform.

The modelling shows that the weakest slope is the 1:5 gradient capped waste batter at the south western corner of the landform. The Factor of Safety for this slope failure mode is 3.531.

Figure 4: Critical Failure Slope for Final Landform

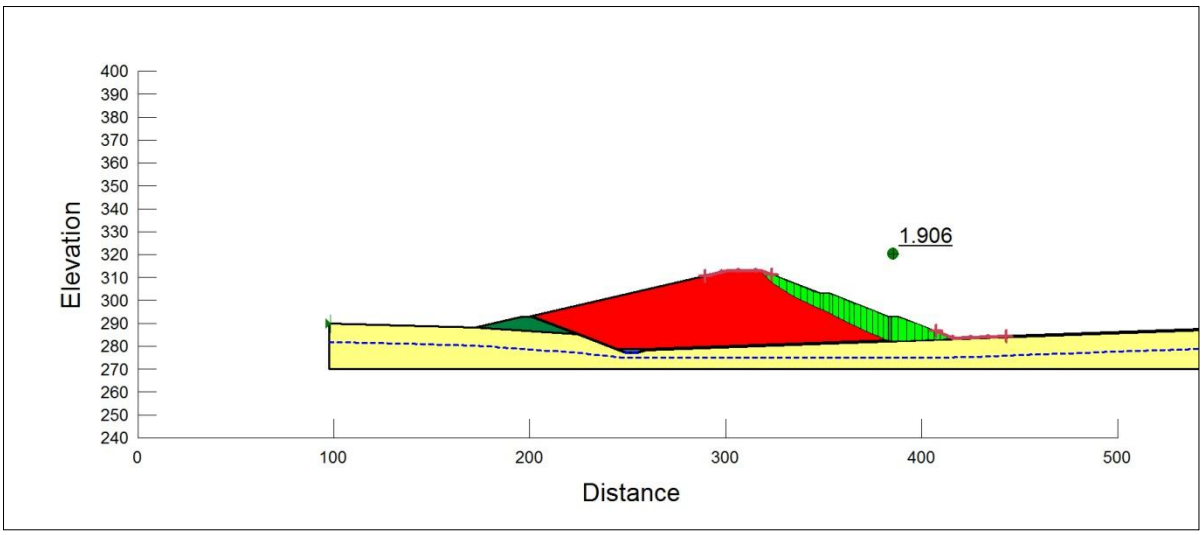


6.8.2 INTERIM INTERNAL WASTE BATTER STABILITY

The profile of interim internal waste batters has also been assessed for stability. Internal batters for completed cells are constructed at 1:3 gradient with a 5 m wide bench every 10 m lift in vertical height.

The modelling shows that at the deepest part of the landfill, with three batter slopes and two interim benches, a Factor of Safety for slope failure of 1.906 is maintained.

Figure 5: Critical Failure Slope for Internal Batters



6.8.3 LINER MATERIAL INTERFACE FRICTION AND SHEAR FAILURE ANALYSIS

Block failure analysis of the potential failure modes of the landfill liner system has been undertaken. The interfaces between all materials in the lining system have been considered, and a review of long term studies of liner performance undertaken. Typical, upper and lower limits for the interface friction angles are presented in **Table 8** below.

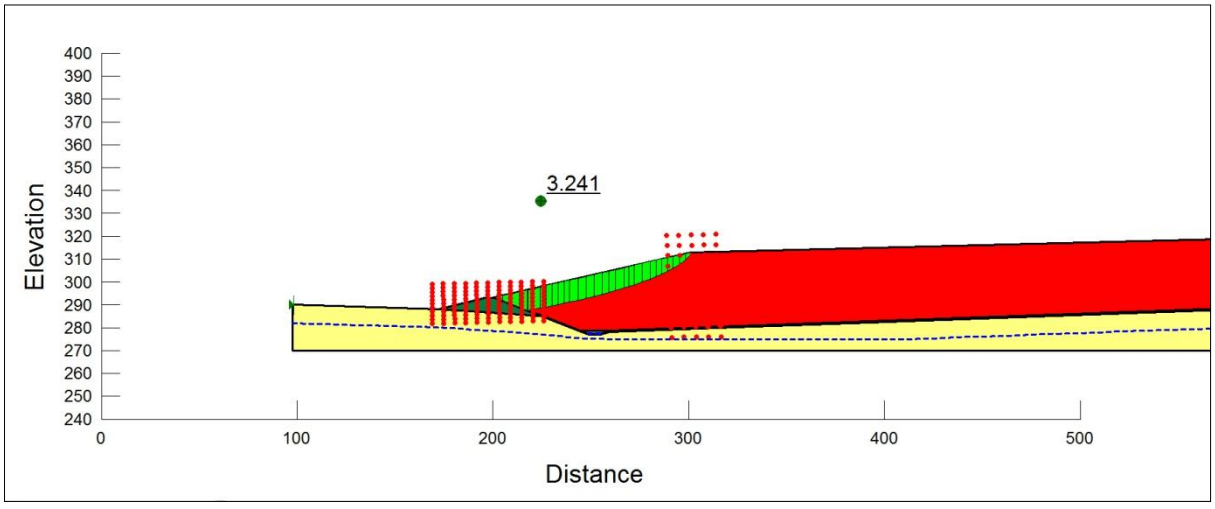
Table 8: Frictional Strength of Liner Component Interfaces

Interface	Friction Angle			Factor of Safety for Failure at Minimum Reported Shear Strength
	Typical	Low	High	
Waste – Geotextile	20	17.8	32.2	3.209
Geotextile – Drainage Aggregate	20	17.8	28	3.209
Drainage Aggregate – Cushion Geotextile	20	17.8	28	3.209
Nonwoven Cushion Geotextile – Smooth HDPE	10	7.3	35	3.206
Smooth HDPE – Nonwoven GCL Surface	10	7.3	35	3.206
Textured HDPE – Nonwoven GCL Surface	20	18	35	3.295
Reinforced GCL Woven/Nonwoven, Needle Punched, Internal Shear, Peak Strength	30.6	11.9	49.2	3.256
Woven GCL Surface – Compacted Subgrade	25	23	28	3.261

The safety factors associated with the strength of each interface have been determined from block failure modelling of the Allawuna landform in SLOPE/W. The interface between the cushion geotextile and the smooth HDPE geomembrane is shown to be the weakest plane. This is an intentional design feature, in line with the VIC-BEPM and will prevent gouging of the HDPE surface by the drainage aggregate and enable some degree of movement as the waste mass settles over time.

Block failure analysis has been undertaken to investigate the Factor of Safety in the failure of this interface for both typical values, and the lower limits of literature values. Under typical conditions, the resulting Factor of Safety is 3.241. With conservative literature estimates the Factor of Safety is determined as 3.231.

Figure 6: Block Failure Analysis using Typical Friction Parameters



The low design angle of the base of the landfill and uniform surcharge of waste make the shear loading on the liner small and the landform very stable.

Literature sources for interface shear properties can be found in **Section 12.1**.

6.8.4 SENSITIVITY ANALYSIS FOR STABILITY AS WASTE DECOMPOSES

The loading of the liner and associated normal stress forcing shear failure is largely dependent on the composition and compaction of the waste deposited into the landfill. Furthermore, waste properties may change over time with decomposition and settlement, so assessing model sensitivity to changing waste properties is an important analysis. Sensitivity analysis has been performed to evaluate the change in safety factor (if any) associated with heavy and light and cohesive and non-cohesive wastes. The liner properties have been maintained as described above, with typical values.

Table 9: Stability Sensitivity Analysis for Changing Waste Properties

Waste Type	Unit Weight (kN/m^3)	Cohesion (kPa)	Friction Angle (degrees)
Heavy, Poor Cohesion	15	0	35
Heavy, Good Cohesion	15	25	20
Typical	8.31	5	30
Light, Poor Cohesion	4.12	0	35
Light, Good Cohesion	4.12	25	20

Waste Type	Factor of Safety for Final Landform Block Shear Failure	Factor of Safety for Final Landform Circular Slope Failure	Factor of Safety for Internal 1:3 Batter Circular Slope Failure
Heavy, Poor Cohesion	3.543[1]	3.545[1]	2.173
Heavy, Good Cohesion	2.881[2]	2.897[2]	1.563
Typical	3.241[3]	3.531[3]	1.906
Light, Poor Cohesion	3.543[1]	3.545[1]	2.314
Light, Good Cohesion	3.560[4]	4.006[3]	2.755

1 – Failure Mode – Failure within waste mass along batter surface.
2 – Failure Mode – Waste pushes bund along natural ground
3 – Failure Mode – Waste slides up and over bund wall.
4 – Failure Mode – Retaining bund slope failure more likely than waste slope failure.

The sensitivity analysis shows that for a variety of waste properties, a safety factor of above the determined threshold of 1.5 for final landform batter slopes and liner shearing is easily maintained.

Internal temporary batters sloped at 1:3, with a 5 m horizontal bench for every 10 m of vertical height, have also been show to exceed the safety factor of 1.3 for a variety of waste compositions.

A list of literature sources for waste geotechnical parameters can be found in **Section 12.2**.

6.9 LEACHATE MANAGEMENT INFRASTRUCTURE

Effective management of leachate is essential to protect the surrounding environment, especially surface waters and groundwater. The infrastructure will be appropriately constructed for durability, redundancy, reliability and safe performance during extreme weather events.

6.9.1 LEACHATE GENERATION MODELLING

The upper limit for landfill leachate generation has been determined using the Hydrological Evaluation of Landfill Performance (HELP) model. In line with the VIC-BPEM the limit of leachate production has been determined by modelling a 42,000 m^2 waste cell (the size of cell 1) with a single 2.0 m waste lift over two consecutive wet (90th percentile) rainfall years. To ensure a 'worst case scenario' in the model the waste mass is initialised at saturation, with no capacity to retain incoming rainwater.

Rainfall, temperature and solar radiation data was established from the Bureau of Meteorology (BOM) thirty year climate normal dataset for the years 1961-1990 for the York Post Office weather station.

Figure 7, **Figure 8** and **Figure 9** below show rainfall and leachate generation for typical, 1-in-10 (90th percentile) and maximum rainfall years.

Figure 7: Typical Leachate Generation

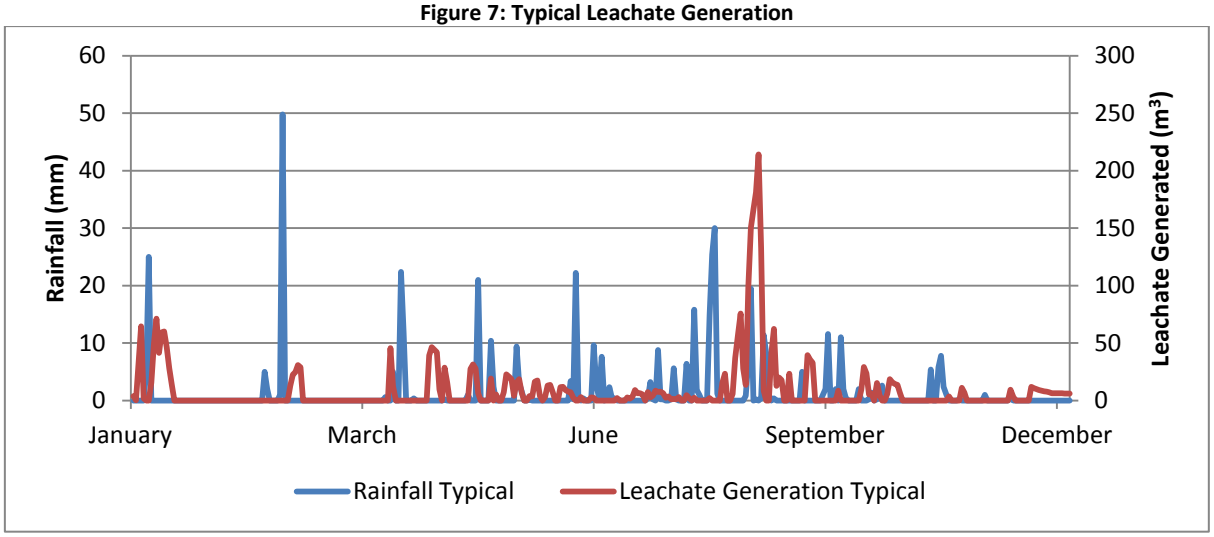


Figure 8: Wet (90th Percentile) Year Leachate Generation

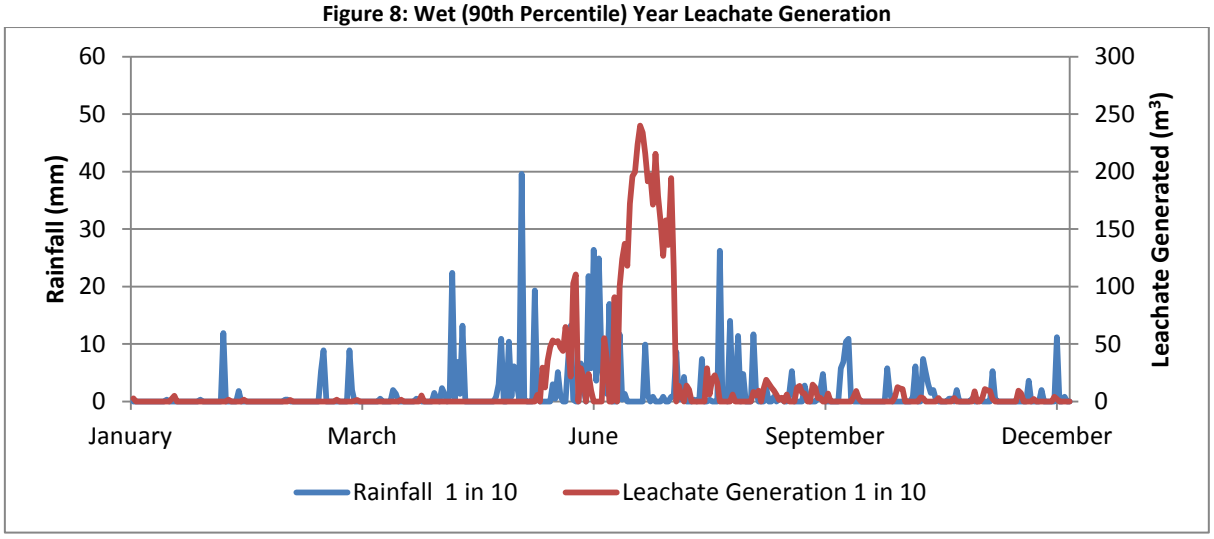
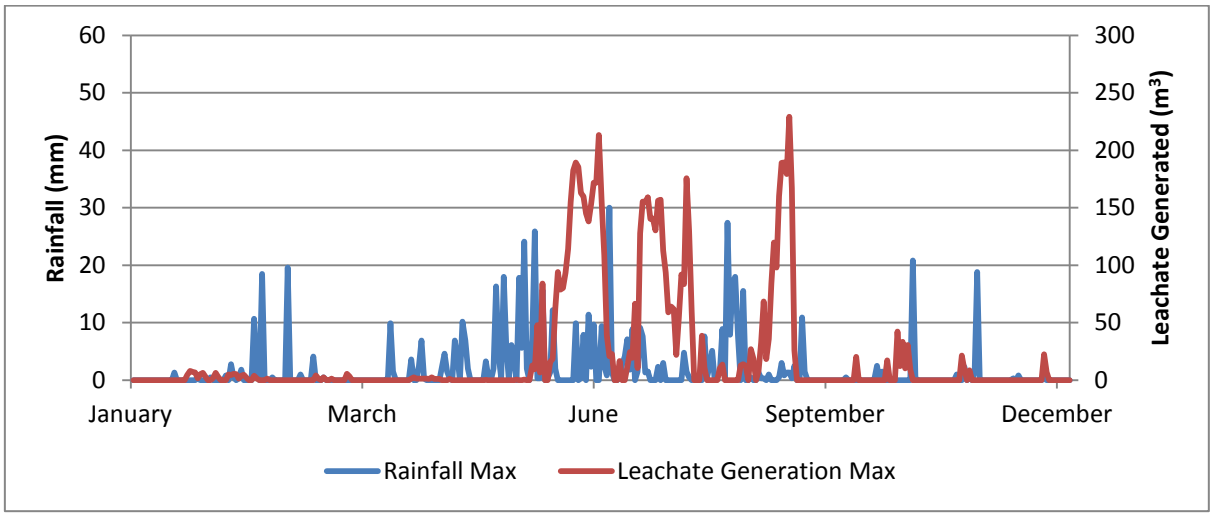


Figure 9: Maximum Leachate Generation



The total volumes of leachate generated across an annual cycle for each scenario are presented in **Table 10**.

Table 10: Annual Leachate Generation Volumes

Scenario	Total Leachate Generated (kL)
Typical	3,196
Wet Year	5,279
Maximum Year	7,706

6.9.2 LEACHATE COLLECTION SYSTEM

The leachate collection system will consist of a network of perforated HDPE pipes laid to direct the leachate from the aggregate drainage layer into a sump for removal. The leachate collection pipes will be appropriately sized to carry typical leachate flows and stress tested for performance during 1-in-100 year storm events.

6.9.3 LEACHATE DAM SIZE

The leachate dam surface area was initially sized using the VIC-BPEM guideline equation:

$$A = \frac{1{,}000\,V}{0.8E - R}$$

Where:

A = dam surface area (m^2)
V = annual volume of leachate (kL or m^3)
E = median annual evaporation (mm, class A pan)
R = median annual rainfall (mm).

Substituting for parameters at Allawuna Landfill yields a required dam surface area of 2,450 m^2.

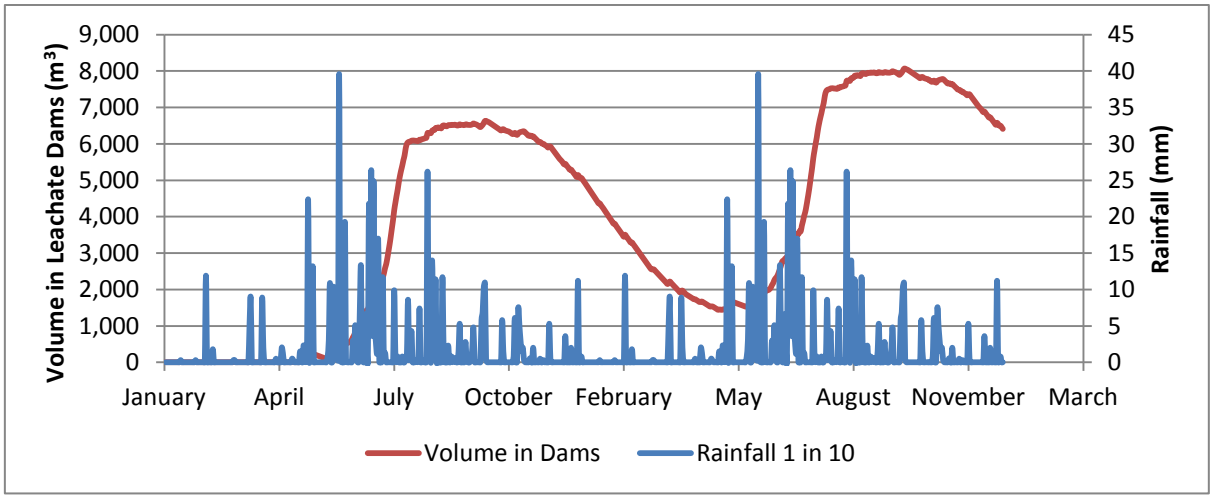
The leachate dam must be large enough to contain two consecutive wet (90^{th} percentile) years of rainfall generated leachate. A water balance model using the HELP model output and free water surface evaporation rates for the York area has been used to determine the leachate dam filling and emptying

cycle over two consecutive wet years. The dam surface area was initialised at 2,450 m^2, in line with the VIC-BPEM calculation.

The model output showed that in order to contain 2 years worth of wet year leachate output (and direct rain on the dam surface) the 2,450 m^2 dam would need to be 4 m deep. This depth is impractical for construction purposes, especially once design freeboard and storm surge capacity are incorporated.

The leachate dam design was modified to consist of two 3,000 m^2 leachate retention and evaporation dams. The construction of two dams enables one to be kept in reserve, filling with clean stormwater that can be brought online during wet periods, to increase summer evaporation or to empty the primary leachate dam for cleaning. The leachate dams will be constructed in a tiered arrangement where the primary dam may safely recharge the secondary dam. Total surface area was increased in size to 6,000 m^2 and the model run again for two consecutive wet (90th percentile) years of rainfall, yielding the filling and emptying cycle curve described in **Figure 10**.

Figure 10: Leachate Dam Filling and Emptying Cycle over Consecutive Wet Years



The required capacity of the two dams with a 6,000 m^2 surface area is 8,200 m^3. For a pair of identical trapezoidal dams of 3,000 m^2 surface area each, this is equivalent to an operational dam depth of approximately 1.37 m.

The freeboard capacity required in the dam was evaluated by determining the response of the leachate system to a 1-in-20 year storm in accordance with the VIC-BPEM. Using the BOM Intensity-Frequency-Duration (IFD) table for the Allawuna Site, the 24 hour duration rainfall volume for a 1-in-20 year event was 81.36 mm.

Assuming the waste mass is at saturation a 1-in-20 year, 24 hour duration storm event, a surge of 3,417 m^3 of leachate would be generated, equating to a 570 mm rise in the leachate dam levels. Adding the direct rainfall on the leachate dam yields a total increase of 651 mm. A minimum storm capacity freeboard of 651 mm will therefore be required for safe operation of the dams.

The dam capacity has been stress tested for failure during a 1 in 100 year extreme storm event of 24 hours duration. The stress test showed a leachate generation volume of 4,647 m^3 and a leachate dam filling of 774 mm.

In order to prevent the leachate dams overtopping, they will need to have the following dimensions:

Table 11: Leachate Dam Dimensions (Each Dam)

Parameter	Units	Value
Minimum Capacity	m^3	4,100
Minimum Operational Surface Area	m^2	3,000
Typical Operational Leachate Depth	m	1.37
Operational Freeboard	m	0.80

The modelling of the required dam capacity is considered to be extremely conservative as it does not include the leachate storage capacity in the unsaturated waste mass, or enhanced evaporation due to leachate trickle irrigation on the active cell surface.

6.9.4 LEACHATE DAM LOCATION AND CONSTRUCTION

The leachate dams will be sited a minimum of 230 m from 13 Mile Brook, as shown on **Drawing ALLA-EPA-02**.

The leachate dams will be constructed in a tiered fashion such that the primary dam will recharge the secondary dam. The secondary leachate dam if overfull will flow into the existing farm dam on the hill slope. This configuration creates two layers of redundancy below the primary leachate dam, limiting the risk of leachate release into the surrounding environment

The leachate dams will have a composite lining system of GCL and HDPE geomembrane above a low permeability subgrade of an equivalent specification to the liner under the landfill cells. Detail of the liner configuration is shown on **Drawing ALLA-EPA-09**. The installation of the leachate dam liner will be subjected to the same rigorous quality control process as the landfill cells.

The leachate dams will be surrounded with a 2.4 m high fence to prevent access by animals such as kangaroos and sheep to minimise the risk of liner damage.

6.9.5 LEACHATE RECIRCULATION

Leachate recirculation pipes will be laid connecting the leachate dam to the landfill. The recirculation of leachate back into the landfill can aid the efficient decomposition of the waste. Leachate may also be trickled onto the surface of the active cell area for evaporation.

6.10 LANDFILL GAS MANAGEMENT INFRASTRUCTURE

A landfill gas collection system is used to control the gas trapped in the landfill between the lining and capping layers. Collection of landfill gas minimises emissions, prevents gas migration off site, facilitates the use of the recovered gas and greatly increases landfill site safety. The main components of the landfill gas extraction system are:

- Vertical and horizontal gas extraction wells will be installed during the placement of wastes.
- A many layered, horizontally offset network of collection pipes will be installed as the placement of waste progresses to increase the effectiveness of gas extraction, and
- Condensate traps, gas well heads and associated pipe required for safe transfer of gas from the gas extraction wells will be installed after the completion of cells with landfill cap. This extracted gas will be conveyed to a flaring or an energy recovery facility.

During the initial phase of operation a flaring facility may be utilised to control the landfill gas extracted. Once the volume of landfill gas generated in the decomposing waste mass increases to a sufficient quality and quantity an energy recovery facility will be used to generate electricity.

6.10.1 LANDFILL GAS GENERATION ESTIMATION

The generation of methane and net annual carbon emissions are sensitive to the compositions of the wastes entering the landfill. The estimations provided here are based on default settings for Western Australia and are intended as a guide only.

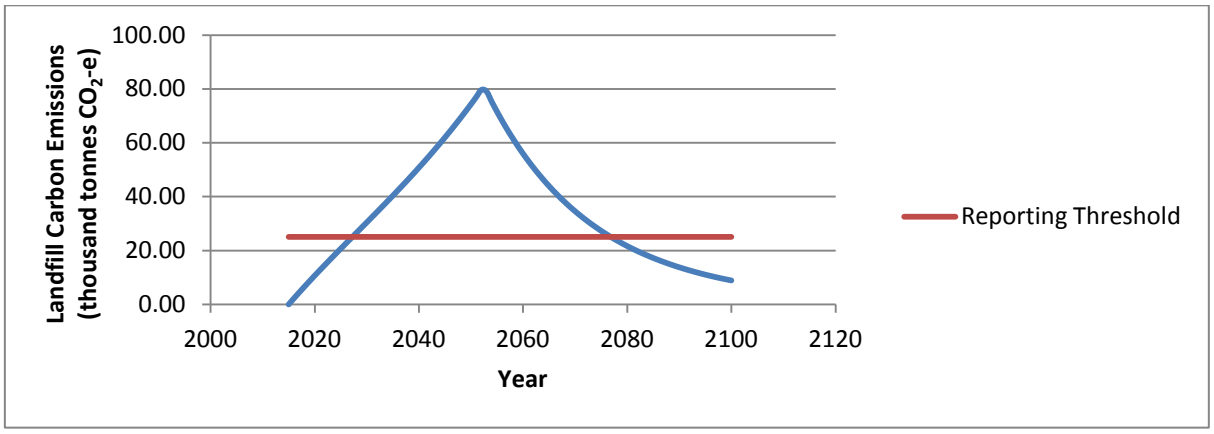
Over the design life of the landfill a projected 10.1 million tonnes of waste will be deposited. This waste is currently expected to be an even mix of 50% Municipal Solid Waste (MSW) and 50% Commercial and Industrial (C&I) waste.

Applying the National Greenhouse and Energy Reporting System (NGERS) standard material compositions and methane generation constants for MSW and C&I in Western Australia, the total lifetime methane generation of the landfill can be estimated. For the Allawuna Landfill a total of approximately 808 million m^3 of methane gas will be generated over the life of the landfill.

6.10.2 GAS CAPTURE EFFICIENCY AND CARBON EMISSIONS

The current technical guidelines for NGERS include two methods for calculating landfill gas emissions. The determination limits for the reportable gas capture efficiency of a landfill are 75% under Method 1 or 85% under Method 2. With the modern composite lining system designed for the Allawuna Landfill cells, methane capture efficiencies for completed cells are expected to easily achieve the 75% threshold for Method 1 reporting. **Figure 11** below describes the annual emissions generated over the life of the landfill development with 75% gas capture efficiency, the default Western Australian waste composition, methane generation constants and projected waste volumes.

Figure 11: Projected Reportable Landfill Carbon Emissions



The Allawuna Landfill is estimated under method 1 NGERS emissions determination to generate carbon emissions in excess of the reportable threshold in the 14th year of operation (2028).

This emissions estimation represents reportable emissions and not true emissions. The estimation is based on default values and a maximum 75% gas capture efficiency. The use of method 2 emissions measurement may allow reporting of up to 85% gas capture efficiency, which is likely to be much closer to the true performance of a well installed liner and capping system.

6.11 STORMWATER MANAGEMENT INFRASTRUCTURE

The surface water drainage is designed to prevent the interaction of stormwater and leachate. Clean runoff is diverted around the landfill footprint to minimise the total volume of leachate that requires management.

6.11.1 STORMWATER DAM

The stormwater dam is designed to capture surface runoff from the small catchment to the east of the landfill footprint, as depicted on **Drawing ALLA-EPA-11**. The total catchment area is 159 ha.

Runoff from the contributing catchment was estimated using the Rational Method for loamy and lateritic soil catchments in the Wheatbelt region of Western Australia, as described in the Engineers Australia (1998) *Australian Rainfall and Runoff* flood estimation guidelines.

The Stormwater dam will have an overflow channel capable of carrying a peak 1 in 50 year storm discharge of 7.30 m^3/s.

6.11.2 CREEK CROSSING

The creek crossing has been located at a relatively narrow and deep section of the 13 Mile Brook watercourse. The location is characterised by granitic outcropping and should facilitate easier construction than on the depositional materials along most of the creek.

A 2,038 ha catchment feeds into the 13 Mile Brook upstream of the proposed creek crossing location. The crossing will be appropriately constructed for a calculated 1 in 50 year storm flow of 23.98 m^3/s.

6.11.3 CULVERTS AND DRAINS

Appropriately sized culverts and drains will be used to control stormwater from the roads, embankments, hardstands, buildings and hill slopes at the site. Erosion protection measures such as check dams, rock pitching and sedimentation traps will be used to limit the flow of disturbed surface materials.

6.12 ANCILLARY INFRASTRUCTURE

Supporting infrastructure, necessary for the operation of the site will also be installed. This will include the weighbridge, sheds, offices, hardstands, fencing, traffic signage, storage areas and firebreaks.

6.13 EXPECTED LIFESPAN

The active waste placement period of the landfill is expected to be approximately 37 years. The progressive construction of cells is highly dependent on the volumes of waste received and the efficiency of airspace consumption. Cells will be constructed as required.

Once the final landfill cell is complete the post closure management period, during which leachate and landfill gas management continue, typically lasts a further 20-30 years.

6.14 CLOSURE, CAPPING AND REHABILITATION

As the cells of the landfill fill with waste to their final design levels, they will be progressively capped to seal in landfill gas and prevent the infiltration of stormwater. The final capping profile for the ultimate landform can be seen on **Drawing ALLA-EPA-05**.

The VIC-BPEM guideline sets the following design objectives for the final landfill cap:

- Minimising infiltration of water into the waste, ensuring that the infiltration rate does not exceed 75% of the seepage rate through the 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 landfill cap provides long-term protection of the groundwater environment. A cap that is designed so that the infiltration through the cap does not exceed 75% of the calculated seepage rate through the landfill basal liner avoids the so-called landfill 'bathtub' effect, in which leachate levels in the landfill build up. Even though waste in the landfill decomposes completely over time, becoming biologically inactive, hydration of the benign waste may remobilise non biological contaminants producing new leachate. The maintenance of an effective cap on the landfill is therefore critical to the long term aftercare of the site.

The required performance standards for landfill capping and indicative cap design are shown in **Table 12**.

Table 12: Landfill Cap Performance and Structure

Landfill Type	Cap Performance	Indicative Landfill Cap	
Class II and Class III Putrescible Landfill	75 percent of the anticipated seepage rate through the liner.	Topsoil / Mulch Soil Sub-base Geotextile	>1.0 m
		Drainage Layer (Optional)	0.3 m
		Geotextile and Geomembrane Low Permeability Clayey Material	> 0.6 m
		Gas Collection Layer (Optional)	
		Earthen Cover	0.3 m
		Waste	

Source: EPA Victoria (2010) *Best Practice Environmental Management: Siting, Design, Operation and Rehabilitation of Landfills.*

The final capped landform will be constructed at minimum gradient of 1:50 and a maximum gradient of 1:5 to facilitate drainage of stormwater while maintaining stability. The final capping will also include appropriate gas collection piping, leachate recirculation piping and survey monuments to monitor landfill settlement.

The finished and capped landfill surface will be progressively rehabilitated to become suitable for post closure land use. If planting of native species is required, the plants will be selected from the locally endemic species mix. Plants will be selected with root structures that do not pose a threat of penetrating the geomembrane and clay capping layers.

7 ENVIRONMENTAL INVESTIGATION AND IMPACT MANAGEMENT

7.1 FLORA AND VEGETATION

A comprehensive Level 2 flora investigation of the affected works areas was undertaken by ENV Australia (**Appendix A**). The key findings of the investigation were:

- The area is dominated by cleared cropland (87%) with low fauna habitat value,
- The remaining area (13%) is a seasonally dry minor creekline, also with low fauna habitat value,
- No declared weeds, threatened or priority flora were identified at the site, and
- The proposed development is likely to have minimal impact on the flora and fauna of the survey area and surrounds.

The landfill has been specifically located to avoid clearing of any remnant bushland on the site. The scattered isolated Marri and Wandoo trees on the area have been carefully assessed and show no evidence of Black Cockatoo roosting or breeding.

In a regional context, there is a total of 44,300 ha of conservation reserve bushland adjacent to the site (Wambyn Nature Reserve 215.2 ha, St Ronans Nature Reserve 118.2 ha and Wandoo National Park 44,000 ha). The scattered native vegetation making up a proposed composite clearing area (4.16 ha) represents 0.009% of the Black Cockatoo foraging habitat in the region. Discussions with the Federal EPA indicated that while referral may be recommended under the guidelines, given the small number of trees, and a self assessment of the activity as 'low risk', referral under the EBPC Act may not be necessary.

7.2 FAUNA

ENV Australia also completed a Level 1 fauna survey in the landfill development area (**Appendix A**). The key findings of the fauna investigation were:

- Both habitat types present in the study area are of low fauna habitat value,
- A comprehensive Black Cockatoo (*Calyptorhynchus latirostris* and *Calyptorhynchus baudinii*) species specific assessment found minor evidence of foraging under 10 of the 144 scattered Marri and Wandoo trees,
- No evidence of roosting or breeding in any trees; 13 trees have hollows suitable for breeding,
- Closest known Carnaby's Cockatoo roosting site is over 16 km away, and
- No evidence of Graceful Sun Moth (*Synemon gratiosa*) habitat in the area.

The clearing of the scattered Marri and Wandoo in the development area has been assessed as a 'low risk' activity. The mostly cleared cropland does not hold any significant habitat value. Given the proximity (less than 4 km) of large nature reserves and a National Park to the site, the maintenance of site remnant bushland areas and the lack of evidence of any roosting or breeding of Black Cockatoos on the site, it is considered that the development will have no discernible impact on foraging availability or fauna amenity in the region.

7.3 SURFACE WATER

A catchment map showing the flow of water resources in the vicinity of the landfill development can be seen on **Drawing ALLA-EPA-11**. The Allawuna site was selected in part because of its location in the water catchment, being very close to the headwaters and catchment divide.

The site is characterised by a dividing valley containing the 13 Mile Brook watercourse. The stream order and travel distances for the connection of 13 Mile Brook to the Avon River are summarised in **Table 13** below.

Table 13: Surface Water Stream Order

Watercourse	From	To	Length (km)	Total Length (km)
13 Mile Brook	Headwaters	Allawuna Creek Crossing	6.0	6.0
13 Mile Brook	Allawuna Creek Crossing	Property Boundary	3.4	9.4
13 Mile Brook	Property Boundary	Warranine Brook	1.7	11.1
Warranine Brook	13 Mile Brook	Clackline Brook	20.2	31.3
Clackline Brook	Warranine Brook	Spencers Brook	6.1	37.4
Spencers Brook	Clackline Brook	Avon River	10.5	47.9

The small portion of 13 Mile Brook catchment beyond the entrance road creek crossing is just 2,038 ha, or 5.7% of the total Spencers Brook catchment area of 35,694 ha (Water and Rivers Commission 2002). The landfill is located 41.9 km upstream from the Spencers Brook/Avon River intersection.

Upstream of the development, near the 13 Mile Brook headwaters a Rivercare project partnership between the 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 transport and improving water quality.

A small seasonally dry creekline will be realigned 180 m to the south to facilitate the construction of the landfill and stormwater dam. The realigned channel will act as an overflow drainage channel for the stormwater dam. Fauna investigations of the creekline found no endangered or threatened species in the current or realigned flow path. It is expected that the new stormwater dam will provide a similar and beneficial habitat for amphibious and reptilian fauna along the creekline.

The DoW was consulted regarding the project and conveyed the following requirements:

- Development of a Water Management Plan as part of EPA or Local Government Approvals processes to prevent any degradation of surface or ground water,
- Detail protection of 13 Mile Brook from landfill leachate, and
- Acquire a permit for the creek crossing under the *Rights in Water and Irrigation Act 1914*.

Surface water is protected through safe design of infrastructure, appropriate location of development features, effective leachate management strategies and contingency planning.

7.4 GEOLOGY

The geology of the site is typical of the western bounds of the Yilgarn Craton as it approaches the Darling Range. The site is classified as a dissected lateritic plateau, with elements of the Boyagin and Clackline subsystems. Granitic rock outcrops and fresh soils, with sandy and loamy gravel soils are prevalent across the site.

Mafic dolerite dykes form some of the ridgelines on the site. The Kokeby soil landscape unit is dominant in the valley features of the site, with alluvial deposition of sandy silts over clays (Sawkins 2010).

Many useful soil and geological resources are abundant on the site. Gravelly ridges and clayey depressions provide valuable construction materials for the future landfill. An outcropping of high quality hard granite has previously been identified on the site but was proven to be uneconomical to extract.

Borehole installation logs in **Appendix B** show the typical lithology below the site. Surface laterite gravels and deep white weathered granitic clays dominate the site.

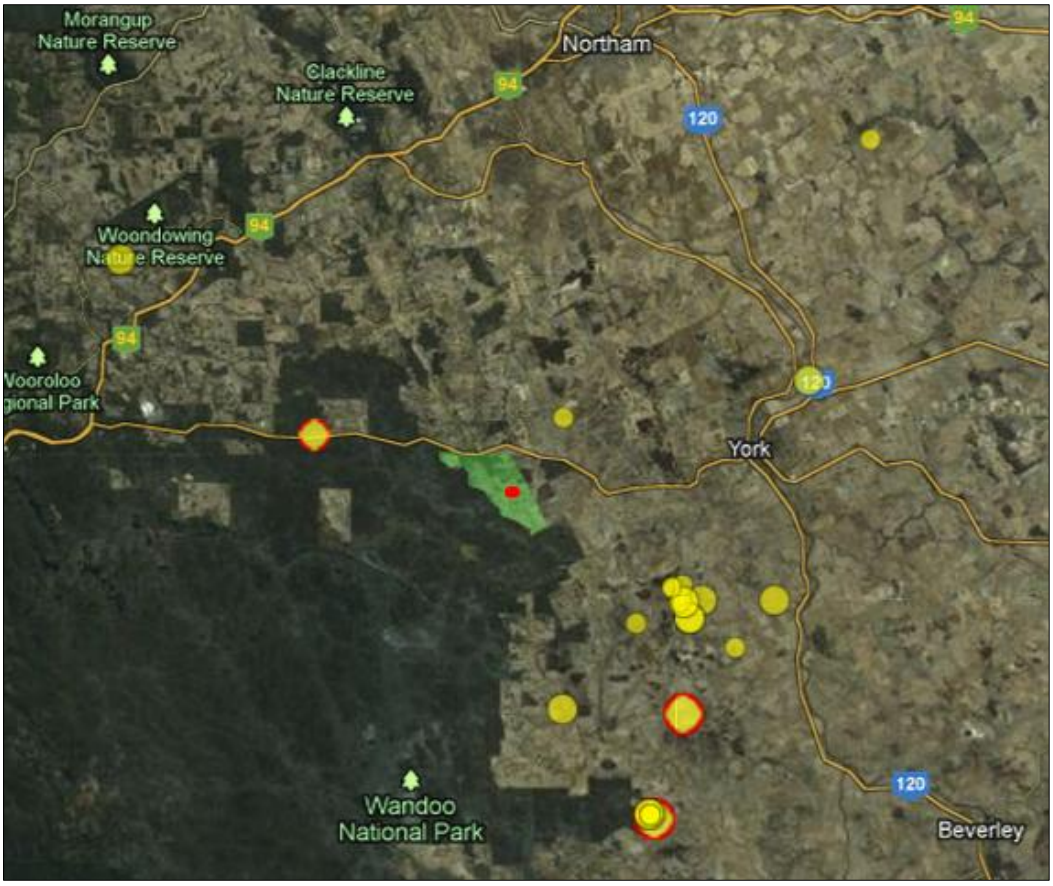
7.5 SEISMIC ACTIVITY

The area around Northam, from the Darling Scarp to Merredin is an area of notable seismic activity in Western Australia. The location of the landfill is to the south western edge of this zone of activity. The regional geology (Myers & Hocking 1998) shows only two minor features of interest in the Allawuna region. A dolerite dyke crosses Great Southern Highway and terminates in the neighbouring property on the eastern side of Allawuna. The dyke terminates approximately 1 km from the landfill footprint.

The other feature of interest is the Dumbleyung fault. The Dumbleyung fault is a Quaternary fault running in a south easterly direction approximately 11 km to the south west of the site boundary.

A search of the Geoscience Australia Earthquake Database (5/12/2012) showed no record of any earthquakes within 4 km of the site boundary, with the nearest being a magnitude 2.5 earthquake 4 km to the north east of the property. No earthquakes of magnitude greater than 3.8 have been detected within 20 km of the Allawuna site. The distribution of earthquakes in the area can be seen on **Figure 12**.

Figure 12: Earthquake Record in the Allawuna Region



Source: Geoscience Australia Earthquake Database 5/12/2012.

7.6 GROUNDWATER

The site is characterised by a confining clay layer 8 to 9 m thick underlying the landfill footprint. The confining layer generally follows the topography of the area, being marginally thinner in the valley (6.5 to 7.5 m).

7.6.1 GROUNDWATER INVESTIGATION

A network of seven functional boreholes was installed by ENV Australia in July 2012 to establish baseline groundwater flow and quality data. The complete report is attached as **Appendix B**.

7.6.1.1 Groundwater Flow

Slug testing estimated the hydraulic conductivity of the confined aquifer at 0.02 to 0.6 m per day. The groundwater under the site flows along the valleys and turns northward along 13 Mile Brook.

7.6.1.2 Groundwater Quality

Water samples from each bore were tested for a comprehensive suite of metals, nutrients, hydrocarbons and pesticides. The full laboratory results of the groundwater testing can be seen in **Appendix B**. In summary the results show:

- The groundwater is slightly acidic with a pH of 3.84 to 6.00,
- Most bores reported as saline,
- Some metals such as Cadmium, Iron and Nickel were detected at levels above Drinking Water Guidelines limits,
- Nutrient (nitrogen) loading coming from the property to the east, and
- No hydrocarbons, organophosphate or organochloride pesticides were detected.

7.6.2 SURFACE WATER AND GROUNDWATER INTERACTION

The surface water and groundwater systems in the vicinity of the proposed landfill footprint are disconnected by the thick layer of surface clay that covers the area. Laboratory testing shows the material to have clay content of over 50%, and a permeability of 2×10^{-10} m/s. The soil test results are attached as **Appendix C**.

The assessment of the surface clay permeability is considered to be conservative, as the sample was tested at 95% standard compaction. *In situ* compaction of undisturbed material is expected to be in the 98-100% range, with smaller pore spacing and therefore lower permeability.

The 3.0 m of this surface clay formation that is to be maintained under the landfill footprint will act as a tertiary barrier, further protecting the groundwater should any damage or defect occur in both the HDPE geomembrane and the GCL.

At 2×10^{-10} m/s, any water or leachate ponding on the surface of the clay would take far longer than the expected life of the landfill to reach the groundwater table. **Table 14** shows the rate of percolation of surface water through the low permeability surface clay under various static heads.

Table 14: Surface Water Travel Time to Groundwater under Various Standing Water Depths

Ponding Depth (m)	Infiltration Rate (m/year)	Time to Reach Groundwater (years)
0.3	0.0069	432
1	0.0084	356
5	0.0168	178
10	0.0273	110

It is evident that even in the event of the failure of both the HDPE geomembrane and the GCL, the leachate would still not reach the confined aquifer below the site. As **Table 14** assumes a constant standing water depth rather than the typical wetting and drying cycle experienced in the base of a landfill, the travel times are considered to be conservative estimates.

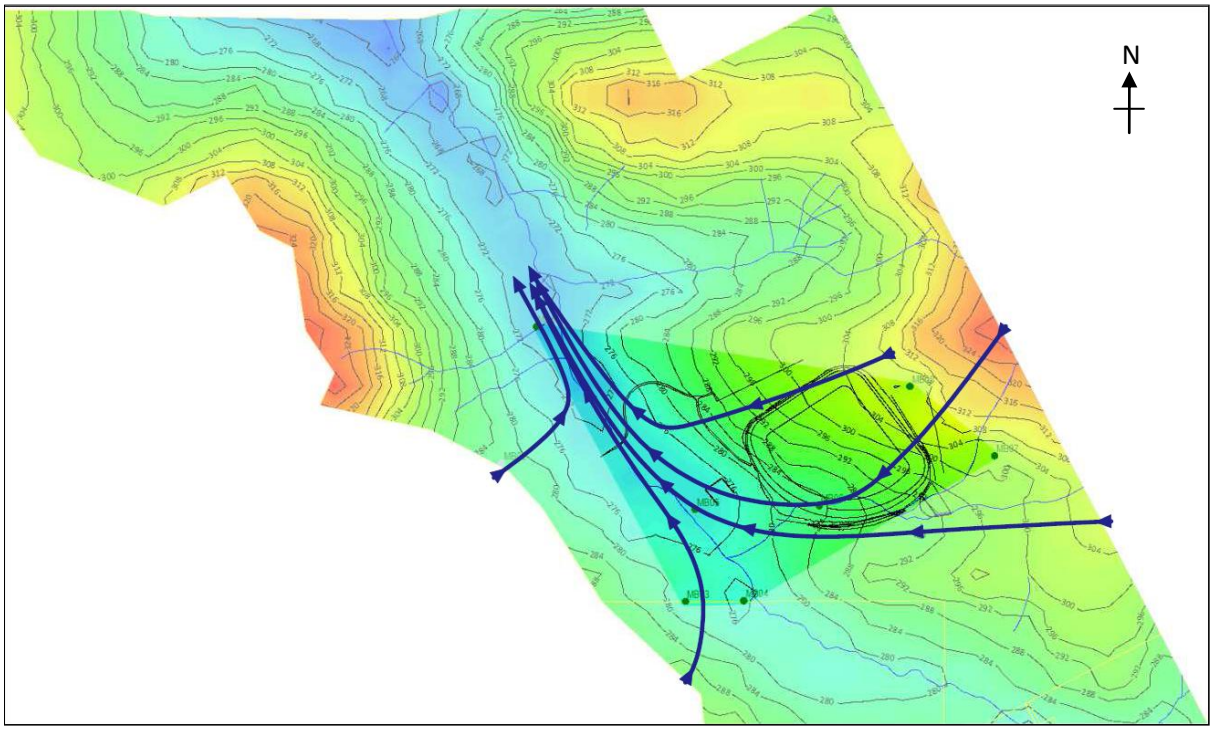
7.6.3 CONFINED AQUIFER FLOW

The flow direction of the confined aquifer has been established with two goals in mind:

- To establish the transport mechanics for any contaminants in the aquifer, and
- To determine optimal locations for future observation or pumping bores.

Figure 13 shows the hydraulic equipotentials and groundwater flow directions beneath the site. Flow within the bore field boundary has been determined by direct measurement of the standing water levels in the monitoring bores. Flow beyond the bore field boundaries has been inferred based on comparison between the measured bore heads and the surrounding topography.

Figure 13: Confined Aquifer Equipotentials and Flow Direction



Note: Bold colour equipotentials determined by observation, pale colour inferred from topography and bore results.

By applying the hydraulic gradient between bores MB06 (landfill sump) and MB05 (beyond the Leachate Dams, adjacent to 13 Mile Brook) of 10.484 m fall in head over 640 m of distance, and using the upper estimate of the aquifer hydraulic conductivity of 0.6 m/day, we find a groundwater velocity between the bores of less than 0.01 m/day. At this flow rate it would take 178 years for any liquid entering the aquifer at the lowest point of the landfill to be detected in MB05.

The low to very low permeability clays below the Allawuna site make it an ideal location for a landfill, or indeed any activity where the separation of surface and ground waters is of importance.

The extremely slow movement of groundwater beneath the site creates a strong argument for abandoning groundwater monitoring altogether. Any contamination of the groundwater by landfilling activities would not be detected in the monitoring bores for centuries.

7.7 WATER SUPPLY AND DRAINAGE CATCHMENTS

The site is not within a Prescribed Drinking Water Supply Area (PDWSA). The Mundaring Weir catchment divide is along the western boundary of the property. The investigations performed in the development of this proposal have shown that the surface runoff and groundwater flow from the site do not interact with the drinking water catchment.

The Manyuering Spring has been identified to the northwest of the site, 6 km from the landfill footprint. The spring is beyond the catchment divide, outside the zone of potential landfill influence.

7.8 POLLUTION

The surrounding environment is generally cleared cropland. No heavy industrial processes or extractive industries have been performed in the area. Other than minor point sources of nutrient loading from historical land uses, such as piggeries or household garbage, the site is pollution free.

7.9 GREENHOUSE GAS EMISSIONS

Construction and Operation phase carbon emissions have been estimated based on the expected plant requirements and the landfill gas generation modelling.

7.9.1 PLANT EMISSIONS

Plant used in the construction of the first cell and supporting site infrastructure will be diesel powered and each item will have an associated rate of carbon emission through vehicle exhaust. Approximate numbers of plant and their hourly emissions during construction are presented below in **Table 15**.

Each item of plant is assumed to operate eight hours per day, six days per week during the construction period. The construction period is estimated at 35 weeks.

Fuel consumption rates were estimated based on vehicle engine brake horsepower and average loading conditions. Consumption volumes were converted to CO_2 equivalent emissions using the diesel emissions constant of 2.7 kg CO_2-e per litre of diesel fuel consumed.

Table 15: Construction Plant Emissions

Plant	Number	Horsepower	Estimated Fuel Consumption (L/hr)	Emissions (kg CO2-e / hr)	Total Construction Phase Emissions (tonnes CO2-e)
Pad Foot Roller	1	130	22	60	101
Smooth Drum Roller	1	130	22	60	101
Grader	1	259	45	120	202
30 tonne excavator	2	204	35	95	318
Articulated Water Truck	1	439	75	204	342
Articulated Dump Truck	2	304	52	141	474
D9 Dozer	1	410	70	190	320
50 tonne Loader	1	501	86	233	391
Wheel Tractor Scraper	1	407	70	189	317
				Total	2,567

The operational plant carbon emissions have been estimated using a similar process. The results of the investigation are described in **Table 16**.

Table 16: Operational Plant Emissions

Plant	Number	Horsepower	Estimated Fuel Consumption (L/hr)	Emissions (kg CO2-e / hr)	Daily Operational Emissions (tonnes CO2-e)
30 tonne Compactor	1	354	61	164	1.31
50 tonne Compactor	1	523	90	243	1.94
D7 Dozer	1	240	41	111	0.89
Dump Truck 6x4	1	260	45	121	0.97
Excavator	1	204	35	95	0.76
Water Truck 6x4	1	260	45	121	0.97
Grader	1	259	45	120	0.96
				Total	7.80

Daily plant operations are expected to generate approximately 7.8 tonnes of CO_2-e greenhouse gas emissions. Over a 310 operating day year this equates to 2,418 tonnes of CO_2-e emissions per annum.

Plant will be maintained in good working condition and inspected daily as part of normal pre-start procedures. Inspections will include checking of mufflers, exhaust systems and fuel and oil lines and reservoirs.

7.9.2 LANDFILL EMISSIONS

Reportable landfill emissions may reach up to 95,000 tonnes per annum in the final years of waste placement, as determined by the preliminary NGERS modelling performed in **Section 6.10.1**, with default waste stream compositions and maximum 75% gas capture efficiency.

Collection of a sufficiently long term capped cell monitoring data set may enable an increase in reportable gas capture efficiency to 85% using the method 2 NGERS determination methodology.

The true gas capture efficiency of the site is likely to be much higher than 85% for completed and capped landfill cells. It is in the proponent's best interest to maximise the amount of landfill gas recovered for energy generation revenue and also to limit their emissions liability under the Clean Energy Future legislation.

7.10 CONTAMINATION

The site is not classified as contaminated land.

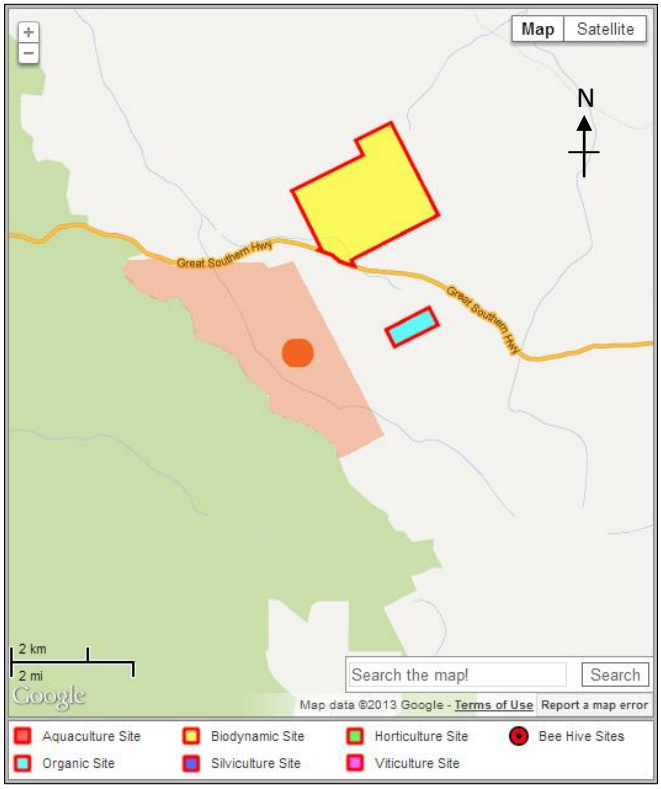
7.11 POTENTIALLY SENSITIVE AGRICULTURE

A search was undertaken to determine if any farming practices in the vicinity of the Allawuna site may be especially sensitive to the establishment of a landfill, or lose certification for their production process due to the development of the Allawuna site. A site may only be certified as organic or biodynamic by an approved certifying organisation, as regulated by the federal Department of Agriculture, Fisheries and Forestry (DAFF). A site is classified as 'organic' where practices emphasise the use of renewable resources, conservation of energy, soil and water, recognition of livestock welfare needs and sustainable crop yields without the application of synthetic chemicals or artificial fertiliser. A site is classified as 'bio-dynamic,' where, in addition to organic farming principles, preparations are applied in accordance with the work of Rudolph Steiner (OIECC 2009).

Properties may be identified as a 'sensitive site' on the Department of Agriculture and Food WA (DAFWA) sensitive sites database. Landholders may voluntarily register as a sensitive site with DAFWA if the site undertakes aquaculture, biodynamic, horticulture, bee hive, organic, silviculture or viticulture processes. Sensitive site registration with DAFWA does not require organic or bio-dynamic certification from an approved certifying organisation.

Two properties in the vicinity of Allawuna have been identified in the DAFWA sensitive sites database. One is listed as a Biodynamic site and the other as an organic site. The two sites are identified in Figure 14 below.

Figure 14: Organic and Biodynamic Farms Identified in the DAFWA Sensitive Sites Database



Source: DAFWA Sensitive Sites WA Database 27/2/2013.

The property boundary of the biodynamic site is 668 m from the Allawuna property boundary and 2,150 m from the proposed landfill footprint. The organic site is 1,280 m from the Allawuna property boundary and 1,975 m from the proposed landfill footprint.

Given the very large buffer distances and proposed management strategies for potential emissions at the landfill site, the Allawuna development is expected to have no impact on the organic or biodynamic sites identified.

7.12 SOCIAL SURROUNDINGS

SITA has undertaken a thorough and rigorous community consultation program during the preparation of this referral. The location of the site is such that there will be no impact on nearby public spaces. The landfill will not be visible from the Mount Observation picnic area.

8 PROPOSED MANAGEMENT

A suite of management procedures will regulate the daily operations of the landfill. Detailed management plans, based on the following summary descriptions will be developed for the site as part of the EP Act Part V Works Approval application.

8.1 WASTE ACCEPTANCE AND MANAGEMENT

This plan provides for the screening of waste, recording of waste volumes and types, dealing with non conforming wastes, dealing with hazardous wastes, preventing fires, managing litter and stockpiling of waste in an emergency.

8.2 WATER MANAGEMENT

Leachate generated by the decomposing waste is the most mobile form of pollution that may be generated by landfilling activities. Control of leachate on the site is considered to be of paramount importance to the daily operations of the landfill.

8.2.1 SURFACE WATER

Clean surface runoff from rainfall events is directed into either the stormwater dam or the existing 13 Mile Brook watercourse. By separating the clean stormwater and lined landfill cell water catchments, the volume of leachate generated will be minimised. The water management plan will describe the maintenance of the dam, drains and culverts on the site, prevention of erosion, response to extreme storm events and contingency plans for release of potential contaminants into the surrounding surface water environment.

8.2.2 GROUNDWATER

The groundwater on the site is protected by a thick confining clay layer. Surface water and groundwater interaction at the site is expected to be minimal. Regardless, a regular bore sampling and testing program, coupled with a detailed response plan for evidence of contamination will be included in the water management strategy for the site. The locations of the monitoring bores already established on site for baseline quality analysis are shown on **Drawing ALLA-EPA-10**.

8.2.3 LEACHATE

Leachate on the site is managed through a hierarchy of minimising generation, effective capture and storage and removal. Leachate head on the landfill liner is maintained at a maximum of 300 mm in accordance with the VIC-BPEM and typical landfill licensing conditions. The collected leachate is pumped into the leachate dams for storage and evaporation. Leachate is evaporated from the dam surfaces and the active cell surface via trickle irrigation.

The water management plan will describe the maintenance and operation of the leachate management infrastructure, the performance benchmarks for the evaporation dams and trickle irrigation and the appropriate escalation procedures for equipment malfunction, leachate release, dam overfilling and extreme weather events.

8.2.4 LEACHATE DAMS

The leachate dams have been designed to contain two consecutive wet (1 in 10) years of rain generated leachate and direct rainfall, while still maintaining a surge capacity for a 1 in 100 year 24 hour storm event. By enhancing leachate evaporation with active cell surface trickle irrigation, the dams should easily be emptied every summer, even in wet years. Typical operations are expected to make use of

only the primary leachate dam with the secondary leachate dam reserved as surge capacity or to empty the primary leachate dam for maintenance.

If the leachate dams are filling above the design operational freeboard, leachate will either be recirculated into the waste mass or transported off site in a tanker for disposal by an appropriately licensed contractor. The submersible pump used to control the leachate head in the liner system will be switched off during a high rainfall storm event if the site is to be left unattended. Turning off the pump will prevent uncontrolled flow of leachate into the leachate dams.

8.3 NOISE MANAGEMENT

A comprehensive noise assessment was performed for both the construction and operational phases of the site by Vipac Engineers & Scientists Ltd. The complete Noise Assessment report is attached as **Appendix D**.

Plant operations were modelled based on the expected numbers of plant and operational hours for the site with the results compared to the *Environmental Protection (Noise) Regulations 1997* (EP Noise). The noise investigation found that predicted noise levels at the nearest sensitive receivers were within the guideline limits for both construction and operational phases of the landfill development.

To ensure that there is no loss of amenity to the surrounding properties due to noise from the landfill site, noise management procedures and technologies will be employed at the site. The noise emission levels will comply with the *Environmental Protection Act 1986* and the *Environmental Protection (Noise) Regulations 1997* requirements.

The main sources of noise pollution during the development of the landfill would be:

- The vehicles entering and departing the site,
- Reversing beepers, and
- Operation of construction and earthmoving equipment.

The impact of noise emissions will be minimised by:

- Identifying and managing the operating hours of noise intensive machinery,
- Restricting construction working hours,
- Avoiding any requirement for blasting. If blasting proves necessary, communicating details to the surrounding neighbours and potential impact areas,
- Implementing buffer zones or bund walls to provide acoustic screening where predicted noise impact would be above the guideline thresholds,
- Ensuring staff are correctly trained in the effective operation of plant and equipment,
- Maintaining equipment and its noise control instruments as per manufacturer's recommendation to ensure lower noise levels during operation,
- Monitoring noise emissions, and
- Maintaining and updating a complaints register.

The large buffer distances to sensitive receptors and effective management of noise generation should create a minimal environmental impact from operations at the site.

8.4 DUST MANAGEMENT

Generation of dust will be minimised in order to maintain local amenity. Dust at the site is likely to be caused by:

- Wind blowing dust from the active tipping face,
- Progressive construction activities for new landfill cells,
- Truck movements bringing waste into the active tipping area and within the site,
- Spillage of waste or debris from trucks,
- Wind blowing on the stockpile of excavated material which is to be used for daily cover or landfill capping, and
- Disturbance such as vibration or waste displacement caused during waste placement operations.

In order to limit the potential for dust generation at the site, the following measures will be adopted:

- All vehicles carrying waste will be covered,
- Covers will only be removed on the active cell in the vicinity of the tipping face,
- Use of water for dust suppression on unsealed roads or exposed stockpiles when deemed necessary,
- Vehicles entering or leaving the site will pass over a cattle grid arrangement to knock off the dust from the tyres and underbody of the vehicle,
- Vehicles will stay on designated roads and tracks,
- The speed of vehicles accessing the site will be restricted to 50 km/hr on entry roads and 30 km/hr within the landfill facility,
- Exposed and disturbed areas will be monitored for dust emissions, with detailed records maintained,
- Leachate may be used on active landfill cell only for both dust suppression and evaporation, and,
- A complaints register will be maintained, detailing any dust emissions complaints and response action taken.

8.5 ODOUR MANAGEMENT

Detailed odour modelling for the proposed landfill was undertaken by Environmental Alliances Pty Ltd. The complete report is attached as **Appendix E**. Numerical model input data files may be supplied on request. The investigation found that for the proposed operational times, procedures and waste volumes, all odour generated would be maintained within the site boundary. Odour emissions were predicted based on observed data at a putrescible landfill with similar waste placement volumes and operational procedures.

Odour is typically generated by:

- Aerobic decomposition of freshly deposited wastes,
- Landfill gas generated by anaerobic decomposition of wastes, and
- Leachate treatment dams.

Odour at the Allawuna site will be limited by:

- Good operational practices and adequate buffer distances,

- 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, and
- Monitoring landfill gas at the gas extraction wells and the site boundary.

8.6 DISEASE VECTOR AND VERMIN MANAGEMENT

Disease vectors and vermin emanating from the landfill can pose a risk to public and environmental health. By denying pests food and shelter the risk of harm can be minimised. The disease vectors of interest for a landfill site include flies, mosquitoes, mice, rats, cats, foxes and birds.

Vermin and disease vectors can become an issue due to:

- Exposed food wastes on the active tipping area or windblown food waste from the placement of waste,
- Food waste littering from uncovered waste delivery trucks,
- Access to voids in the waste mass due to poor cover or compaction, and
- Still waters at the landfill.

In order to prevent the infestation of the site with disease vectors or vermin, the following management measures will be implemented:

- Cover material will be used to cover waste at the end of every day,
- Areas previously covered will be checked regularly and more cover applied if necessary,
- Waste delivery trucks will be covered,
- Trucks will be inspected for any waste on the truck before they depart the tipping face,
- Highly odorous or decayed waste will be buried promptly,
- Site fencing and waste transport routes will be monitored to remove any waste deposits,
- Sufficient gradient will be maintained for stormwater runoff to avoid any standing water accumulating on the site,
- Water bodies that are not required for fire, sedimentation and leachate control will be avoided,
- Appropriate fencing will be maintained to keep larger animals away from the site,
- Scare devices and traps will be utilised when need arises, subject to approvals,
- Pest exterminators will be employed to minimise infestations of vermin, subject to appropriate approvals,
- Bird control measures such as anti-perch strips on buildings, acoustic bird scaring devices and other techniques will be implemented, as required, and
- Nearby residents or land users will be informed of the process to register vermin or bird complaints. If any complaints arise, they will be investigated and measures will be adopted to respond appropriately.

8.7 DIEBACK AND WEED MANAGEMENT

Dieback is of concern on the Darling Plateau due to perched water sitting above the laterite caprock. Dieback is caused by the root rotting fungus *Phytophthora cinnamomi.* Keeping the area dieback free will be an important aspect of the operations at the facility.

Weeds are a potential threat to the ecological value of natural ecosystems and agriculture. Weeds can pose a potential fire risk especially when they dry out in summer. Weed management strategies will be developed and implemented at the site.

8.8 LANDFILL GAS MANAGEMENT

The decomposition of putrescible waste in an anaerobic environment produces landfill gas. The gas is a combination of methane and carbon dioxide. Both gasses pose an environmental risk as they contribute to the greenhouse effect. Methane is combustible and may explode with sufficient oxygen availability. Landfill gas will be collected and flared to convert the methane into the less harmful carbon dioxide. When a sufficient quantity and quality of landfill gas is being produced the gas will be used as fuel for electricity generation.

Landfill gas management has the goals of limiting the amount of gas escaping into the surrounding environment and maintaining the safety of landfill staff and visitors.

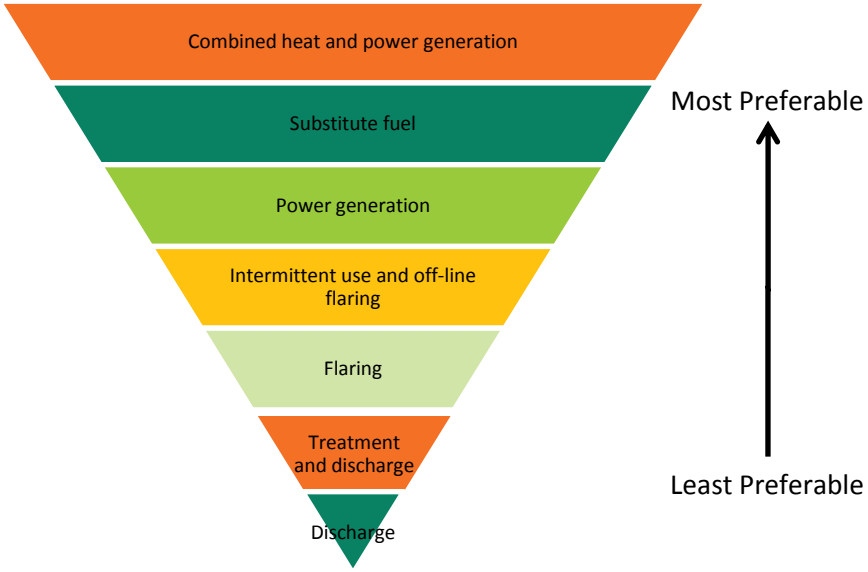
Landfill gas may escape the landfill through:

- The surface of uncapped or partially capped cells,
- The subsurface geology of the site,
- The leachate collection system, and
- A poorly maintained landfill gas management system.

In order to maximise the effectiveness of landfill gas capture and reuse at the Allawuna Landfill, the following measures will be implemented:

- Progressive installation of an appropriate landfill gas collection system,
- Progressive capping of cells to limit gas escape,
- The landfill gas management hierarchy illustrated in **Figure 15** will be regularly revisited and updated based on site capacity in line with the VIC-BPEM,

Figure 15: Landfill Gas Management Hierarchy



- The design of the landfill gas management system will be regularly reviewed as waste is placed to optimise the quality and volume of gas generated,
- Adequate condensate collection and drainage points will be provided in the landfill gas collection systems to avoid blockage by water vapour,
- Vertical and/or horizontal landfill gas extraction wells may be used,
- Vertical wells will be installed with care to avoid penetrating the basal landfill liner,
- The landfill gas management systems will be strategically located to minimise the potential for damage caused by settlement, vandalism, animals, natural processes or operational machinery,
- Scheduled monitoring and maintenance of gas extraction wells will be conducted, and
- Modifications to the gas collection system design after the construction phase will be recorded and maintained at the landfill site.

8.9 FIRE MANAGEMENT

A comprehensive plan will be developed in consultation with DFES and the local Fire Brigade to minimise the risk of fire. The plan will also aim to optimise fire response for public safety and minimisation of related damage to the facility. The Fire Management Plan will cover site fire fighting infrastructure, fire response procedures, fire fighting equipment, storage of flammable materials and maintenance of fire breaks.

Fire can also originate from the surrounding bush lands, tree plantations and farming areas, particularly during dry and hot weather conditions either naturally or due to deliberate lighting. The Fire Management Plan will also provide a framework for fire management and the protection of life and assets at the Allawuna Landfill and its surrounding environment during an event of fire within or outside the landfill area.

8.10 FUEL AND CHEMICAL MANAGEMENT

Chemicals and fuels used for landfill 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 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,
- Liquid storage areas will be located away from waterways,
- 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,
- Material Safety Data Sheets (MSDS) will be maintained for all chemicals and fuels on site, with MSDS made available to all staff,
- In 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.

8.11 SITE SECURITY

A security fence with barbed wire will be erected around the perimeter of the landfill operations area to prevent unauthorised site access, capture windblown litter and prevent access by stock animals or kangaroos.

The fence will have fire emergency access gates at appropriate locations along its perimeter. These gates will be locked securely, with a key provided to the local fire authority.

Contact details will be exchanged with neighbouring properties to maintain mutual vigilance for unauthorised access to the Allawuna site or neighbours.

8.12 CONTINGENCY PLANNING

A suite of contingency plans will be developed for the landfill to ensure all incidents that have the potential to harm human health or the surrounding environment are considered. Each contingency plan will address at a minimum:

- A summary of the likelihood of the risk occurring and severity of the risk effects,
- Emergency contact numbers,
- Escalation procedures for the first and subsequent responses to the incident, and
- Landfill site staff will be trained in the implementation of the contingency plan.

The contingency plans will include responses to at least the following incidents:

8.12.1 DETECTION OF CONTAMINATION IN GROUND AND/OR SURFACE WATER

In the very unlikely event of detection of contamination in ground or surface water during scheduled monitoring, site management will be notified immediately. The potentially contaminated bore or surface water body will be retested immediately to confirm the result. The source of the contamination will be identified by assessing the type of contamination and groundwater flow direction. The details of the confirmed contamination will be formally reported to the DEC and EPA. Should the contamination prove to be from SITA activities, site specific measures will be adopted to reduce the impact, assess the cause and limit the likelihood of any future similar incident.

8.12.2 DETECTION OF LANDFILL GAS

Landfill gas is contained within the landfill footprint by the HDPE geomembrane lining system. Subterranean gas migration from modern lined landfills is of significantly less concern than older unlined or clay lined landfills. In the unlikely event of a suspected leakage of landfill gas during operation of the landfill, the Site Manager will advise all personnel at the site to meet at a designated assembly area. Breathing apparatus will be available at the landfill to be used in case of emergencies. Landfill gas levels will be measured and compared to previously monitored levels to assess the situation and act accordingly. Responses may include temporary suspension of site activities, repairing of damaged collection infrastructure or upgrading of collection capacity.

8.12.3 BLOCKAGE OF LEACHATE AND/OR LANDFILL GAS COLLECTION PIPES

The Site Manager will be notified immediately to take appropriate action. A safe methodology for clearing the blockage or rerouting the flow of gas or liquid will be developed and implemented. Leachate in the storage dams may be recirculated into the landfill or transported offsite to create further surge capacity if the block lasts a significant amount of time.

8.12.4 OVERTOPPING OF LEACHATE DAMS

The design capacity, storm surge freeboard and effective management measures proposed mean overtopping of the leachate dam is statistically unlikely.

The leachate dams are designed such that the primary dam would discharge over a lined weir into the lined secondary leachate dam. If the secondary leachate dam should fill and over top, the water will be contained in an existing clay dam on the site.

In the unlikely event of overtopping of both lined leachate dams, the DEC would be notified and kept informed of any corrective measures undertaken to alleviate contamination of the local environment. These measures may include temporary bunding of the area down slope of the tertiary dam to collect the water, pumping the leachate into a tanker for safe disposal at an appropriately licensed liquid waste facility and excavation and appropriate disposal of any contaminated soil.

8.12.5 LANDFILL FIRE

Any personnel who identify a fire or a risk of fire will advise the Site Manager or other authorised staff member immediately. The information passed on may include the location of fire, type of fire, involvement of any personnel and the measures taken. An Emergency Response Plan will be followed and immediate action will be taken to avoid any risk to individuals. All site personnel will follow instruction from the Site Manager and may be required to meet in the assembly area. The Site Manager will perform an attendance check to verify presence of all site staff against the gate register to verify presence of people using the site at the time of the fire. A dedicated fire fighting water tank with appropriate Country Fire Authority (CFA) outlet fittings, a water truck outfitted for fire fighting and a store of flame retardant water additives will be maintained on site. If the fire may be managed using site resources it will be extinguished. If there is potential for the fire to become uncontrollable, the local fire authority will be contacted immediately for support.

8.12.6 DEPOSIT OF UNAUTHORISED WASTE

The facility's Operations Management Plan will describe the procedure for dealing with non-conforming wastes being delivered to the site. At the gate, the landfill attendant will inspect the incoming waste according to the waste acceptance criteria as described in the Operations Management plan. If non-conforming waste is identified at the gate, the vehicle will be turned away and directed to an appropriately licensed facility. If non conforming waste is identified at the tipping face, it will be stockpiled in a separate area and removed for disposal at an appropriate site.

8.12.7 OFFENSIVE ODOURS OR DUST BEYOND THE BOUNDARY OF THE PREMISES

Frequent inspections for odours or dust beyond the boundary will be conducted. The Site Manager will be informed of any reports of odour or dust emissions and record the details of the time, nature and severity of the complaint. Appropriate action will be taken to investigate and mitigate the impact, with a follow up debriefing of the person who made the complaint regarding the issue, solution and future prevention.

8.12.8 LITTER BEYOND THE BOUNDARY OF THE PREMISES

Inspections for litter beyond the boundary will be conducted frequently. The Site Manager will be informed of any wind borne litter or debris from trucks sighted beyond the premises, which will be recorded at the site office. A Complaint Register will be maintained for recording any incident reported

by the public or staff and appropriate action will be taken to remove the litter and mitigate the impact caused.

8.12.9 EQUIPMENT BREAKDOWN

Equipment or plant breakdown may lead to shutting down of operations. The cause of equipment breakdown will be investigated and remedied at the earliest possible opportunity. Equipment will be hired if necessary to continue operations without jeopardising landfill licence compliance or performance standards.

8.12.10 FLARE OR POWER OUTAGE

In the event of power failure, standby generators will be made available for use on site if required. The landfill gas flare will be fitted with a monitored warning device. Landfill gas management staff would reignite the flare if it were extinguished.

9 STAKEHOLDER AND COMMUNITY CONSULTATION

A comprehensive program of face to face meetings, public presentation, information mail out, website advertisement, public display, newspaper editorials and a site tour was conducted as part of the development of this referral. These activities were supported by a willingness by SITA staff to answer any queries from the community, neighbouring premises or other interested parties.

9.1 KEY STAKEHOLDERS

A brief summary of the consultation with the key project stakeholders is presented below.

9.1.1 THE DEPARTMENT OF ENVIRONMENT AND CONSERVATION

The DEC was approached as the first point of regulatory contact in the development of the site proposal. Following the submission of an application enquiry a scoping meeting with Cristina Angel of the Swan Region Industry Regulation branch held on the 2nd of July 2012 determined the scope of investigations and design detail that would be appropriate to satisfy the DEC's Works Approval requirements. The guidance of the DEC has been used to support the preparation of this referral document.

9.1.2 THE OFFICE OF THE ENVIRONMENTAL PROTECTION AUTHORITY

The EPA was approached after the Proponent was advised by the DEC that referral under Part IV of the EP Act would be appropriate for this project. A subsequent meeting was held with Richard Sutherland of the Mining and Industrial Assessment Branch on the 31st of July 2012 to establish the requirements and expectations of the EPA in the submission of a referral.

9.1.3 THE SHIRE OF YORK

The development of the landfill will be subject to Development Approval from the Shire of York. SITA has held frequent meetings with the Councillors and Shire Executive regarding the landfill development and the Shire's specific requirements.

9.1.4 MAIN ROADS WA

MRWA was contacted regarding the proposal and a proposed upgrade of the site entry intersection. At the request of MRWA a Traffic Impact Statement was prepared detailing the changes in traffic volume and potential issues affecting the site intersection. The Traffic Impact Statement is attached as **Appendix F**.

Further correspondence has developed the entrance road upgrade proposal to comprise of:

- An MRWA Type B standard rural left/right turn treatment,
- An entrance slip lane for vehicles approaching the site from the York direction, and
- An acceleration lane for vehicles departing towards Perth.

Figure 2 shows a concept drawing of the intersection upgrade.

9.1.5 DEPARTMENT OF WATER

The DoW was contacted for comment regarding the proposal. The advice of the department was that there would be no specific requirements relating to the Mundaring Weir PDWSA.

The DoW advised that incorporating an appropriate Water Management Plan in the EPA referral or Shire of York Development Application would be necessary. The DoW also advised that careful design of the leachate dam, given the proximity to 13 Mile Brook, would be appropriate.

Prior to construction of the creek crossing a permit will be required from the DoW under the *Rights in Water and Irrigation Act 1914*.

9.1.6 FIRE AND EMERGENCY SERVICES AUTHORITY

The Northam DFES office was contacted for comment regarding the proposal. The Northam District Area Manager advised that there would be no extra requirements placed on the development by DFES and that appropriate fire response should be coordinated with the Shire of York Community Emergency Services Manager.

9.1.7 INDIGENOUS ELDERS

Three Elders from the local York community were contacted and met regarding the proposal. The Elders indicated that the location of the landfill and the surrounding development area are not a place of significance for the local indigenous people.

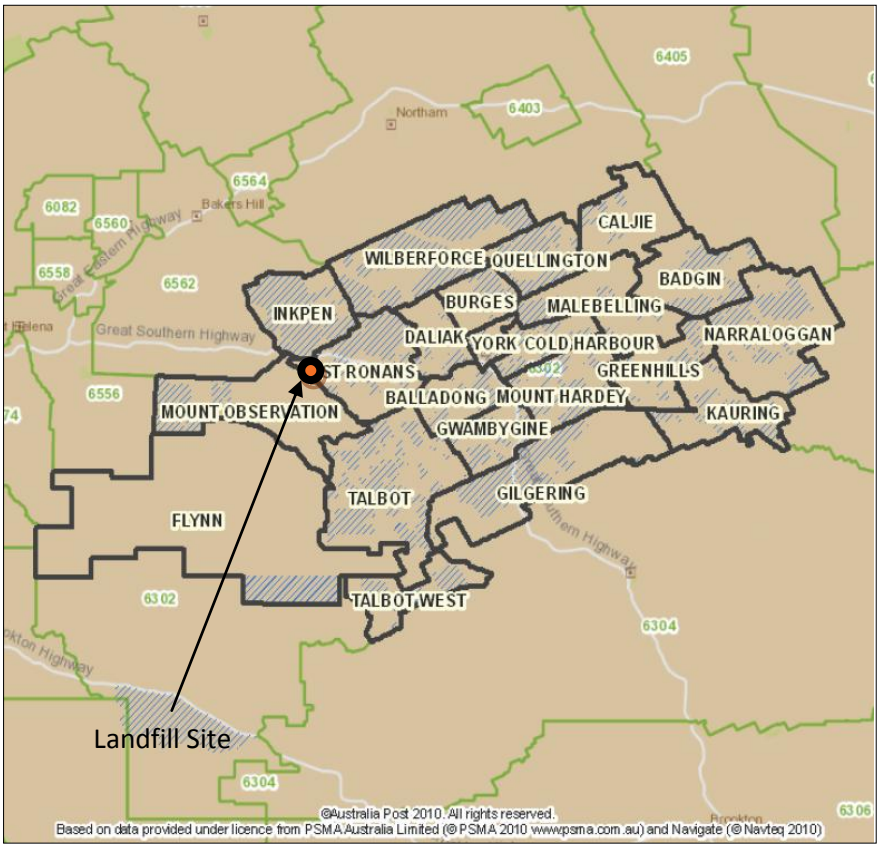
9.1.8 SWAN RIVER TRUST

Even though the proposed development is well outside the Swan River Trust development control area they have received some queries from interested members of the public. SITA has briefed the Swan River Trust on the project and continues to maintain open communication should they have any queries or concerns.

9.2 INFORMATION FLYER MAIL OUT

During the week of the 5th to the 9th November 2012 SITA sent a one page, double sided, unaddressed mail flyer to all residents in the Shire (**Appendix G**). The flyer contained a brief summary of the project, invitation to comment, contact details and an invitation to the public presentation on the 19th November. **Figure 16** below shows the properties encompassed by the 2,949 flyer mail out.

Figure 16: Information Flyer Mail Distribution



9.3 PUBLIC PRESENTATION

On the 19th November 2012 SITA gave a presentation at the York Town Hall before the monthly council meeting. The presentation focused on the preliminary concerns and frequently asked questions that had been raised as part of the community consultation process to that point, with an open question and answer session afterwards.

Over 300 community members attended, with a diverse range of viewpoints and concerns. The key issues of community interest were:

- The increase in traffic along Great Southern Highway,
- Protection of the Mundaring Weir drinking water catchment, and
- Benefit of the project to the local community.

Following a 30 minute presentation questions were taken from the floor for 90 minutes.

9.4 INFORMATION WEBSITE

A media release with further detail on the project was supplied on the SITA website. The media release covered the environmental investigations and design features of the landfill development in more detail.

The Website also hosts a Frequently Asked Questions (FAQ) document that is regularly updated as the project progresses to reflect the concerns of the community and the design features that will mitigate those concerns (**Appendix H**).

9.5 PUBLIC DISPLAY

SITA erected a static display at the York town hall with information on the company, their landfill management activities and the proposed landfill development. A model of the composite lining system with waste, drainage, HDPE geomembrane and GCL sections was also put on display to demonstrate the function of the liner system.

9.6 NEWSPAPER ARTICLES

During November 2012 the development appeared in both the Avon Valley Gazette and the Avon Valley Advocate to raise community awareness of the project and encourage contact with any concerns or comments. An article covering the York community response to the development was also published in the West Australian newspaper in December 2012.

9.7 SHALE ROAD SITE TOUR

On the 29th of November residents of the York community were invited to participate in a tour of the SITA Welshpool resource recovery centre and Shale Road Landfill sites, in order to gain a better understanding of the proposal and the activities that will be taking place at Allawuna should the landfill be approved.

Unfortunately, despite over 30 people expressing an interest in attending at the Public Presentation, only five were able to attend the site tour.

The tour consisted of a drive along Great Southern Highway past the site, with a description of the proposed entrance road upgrade along the way. The residents were then shown the resource recovery and waste transfer operations at Welshpool, and got to see firsthand the unloading of collection trucks,

removal of recoverable resources and consolidation of waste into transfer trailers to be carted to landfill. The tour finished up with a drive around the Shale Road landfill, highlighting the stormwater management infrastructure, capping and revegetation of completed cells, flaring of methane gas, activities on the tipping face, litter management systems, power generation from landfill gas and operation of the leachate evaporation ponds.

9.8 ALLAWUNA SITE TOUR

An Allawuna site visit was conducted on the 15th of February 2013. A morning session and an afternoon session were conducted with local residents collected from either the town hall or a road reserve near the site. Over the course of the day a total of 21 local community members were driven around the site in four wheel drives. The locations of the site infrastructure, weighbridge, leachate ponds, first landfill cell, stormwater dam and ultimate landfill footprint were marked out with colour coded survey pegs. Points of particular concern for the attendees were the management of leachate to prevent contamination of the downstream water catchment, the increased traffic associated with the site development, the impact of the site on the value of surrounding properties and alternative uses for the site other than as a landfill.

9.9 CONSULTATION RECORD

A compiled table of community and stakeholder consultation activities is attached as **Appendix I**. As there are personal details of individuals and organisations who have contacted SITA with queries or comments in the record it is not appropriate to release the record to the general public. A copy of the consultation record marked 'confidential' has been submitted to the EPA with this document. The consultation record will not be released to the general public.

9.10 CONSULTATION OUTCOMES

SITA has approached and engaged with a variety of government authorities, interest groups, members of the York community and members of the general public with concerns about the proposal.

SITA understands that landfills have a longstanding public perception of being 'dirty' and 'polluting.' Since opening Australia's very first engineered landfill, SITA has maintained its commitment to raising public awareness about the design and operation of modern landfills to prevent the environmental impacts uncontrolled waste dumping would otherwise create.

Specific community concerns relating to environmental impact assessment and EPA determination regarding this proposal have been comprehensively addressed in this referral document. Where a decision making authority has directed specific requirements for the development, SITA has followed their guidance and continues to keep them informed as the project progresses. SITA continues to be committed to the community and stakeholder consultation process and will maintain the established rapport through the lifetime of the project.

9.11 CONTINUING CONSULTATION

SITA has supplied two briefing updates to community members describing the developments in the project since the Town Hall Meeting. SITA will continue to maintain open communication with interested parties throughout the permitting and approvals process and into the operational life of the facility. SITA is currently developing a community reference group from a cross section of the local York population to represent the views, concerns and queries of the residents of the area.

10 REPORTING

SITA has committed to a transparent and accountable operation of the Allawuna Landfill site. Reporting on the environmental and licence compliance performance of the site will occur every year, with a summary of the results available to the public.

Reporting will include:

- Masses and types of waste received,
- Water quality monitoring results,
- Asbestos and/or Clinical waste disposal locations,
- Landfill gas extraction volumes,
- Spills and response,
- Odour complaints and response,
- Dust complaints and response,
- Noise complaints and response, and
- Any fires on site, response and debrief.

SITA has an excellent record of effective reporting at the existing Shale Road Landfill and plans to continue to build on this reputation at the Allawuna site.

11 SUMMARY AND CONCLUSION

Allawuna is an excellent location for a landfill. The geology, buffer distances, surrounding environment, landfill design features and proposed management procedures combine to create a low risk proposal.

The thick confining low permeability clay layer creates effective separation of ground and surface waters, even before the addition of the GCL and the HDPE Geomembrane. The very low permeability of the confined aquifer matrix and very long water travel times make any bore water quality monitoring superfluous.

The landfill is located in the upper reaches of the regional water catchment, well away from any major water bodies. Both surface water and groundwater from the site flows away from the Mundaring Weir drinking water catchment.

The landfill and supporting infrastructure is located exclusively on existing cleared cropland and will not require the clearing of any stands of remnant vegetation on the site. A thorough Flora and Fauna investigation has shown the clearing of scattered remnant trees to be of negligible impact.

Odour, Noise and baseline Groundwater Quality investigations have all been performed by expert consultants and shown that the design of the site is appropriate for the conditions in the area.

The preliminary design of the landfill has been carefully engineered to meet the requirements of the Victorian EPA's *Best Practice Environmental Management: Siting, Design, Operation and Rehabilitation of Landfills* document, in line with the current requirements of the DEC. The final and interim landforms have been assessed for geotechnical stability and found to have satisfactory factors of safety in both sliding block and circular slope failure modes. The leachate generation of a cell has been modelled for a worst case scenario to create appropriately sized leachate dams. Design of landfill gas management infrastructure and preliminary estimates of gas generation volumes and time scales has been performed.

Due consideration has been given to the progressive capping and rehabilitation of the site to limit leachate generation, minimise landfill gas escape and improve visual amenity.

Management plans have been outlined for waste acceptance, water, noise, dust, odour, vermin, landfill gas, fire, fuel and chemical storage and site security. A draft list of contingency plans incorporating responses to the most commonly experienced risks at landfill sites has been prepared.

Key stakeholders including the EPA, the DEC, the Shire of York, Main Roads WA, the DoW, DFES and the local Indigenous Elders have been consulted in the development of this referral.

A comprehensive community engagement plan has been conducted as part of this referral and presents a solid foundation to build upon future interactions with the local community. The community response has generally been focused on the dangers associated with increased truck movements on Great Southern Highway, the protection of the surrounding environment and the benefit to the York community. SITA believes all concerns have been adequately addressed in this referral document and that this development will bring substantial benefit to the local community. SITA continues to maintain its commitment to engagement with all project stakeholders.

SITA believes it has been appropriately thorough in the preparation of this referral, considering all the important siting, design, construction, operation, management and rehabilitation issues for a new landfill development. SITA believes that given the depth of investigation and level of engagement with the appropriate decision making authorities a ruling by the EPA of 'not assessed' would be appropriate for this proposal.

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