Government of Western Australia
Department of Environment Regulation

Decision Document

Environmental Protection Act 1986, Part V

Proponent: SITA Australia Pty Ltd

Works Approval: W5830/2015/1

Registered office: 3 Rider Boulevard
RHODES NSW 2138

ACN: 002 902 650

Premises address: Allawuna Farm Landfill
2556 Great Southern Highway
ST RONANS WA 6302
Being Part of Lot 4869 on Plan 224502 as depicted in Appendix C and defined between the following Global Positioning System positions:

Position No.	Latitude	Longitude
1	116° 36' 46.9" E	31° 54' 13.87" S
2	116° 35' 35.19" E	31° 54' 42.02" S
3	116° 36' 11.2" E	31° 55' 13.47" S
4	116° 37' 20.34" E	31° 55' 9.64" S

Issue date: Thursday, 17 March 2016

Commencement date: Monday, 21 March 2016

Expiry date: Monday, 20 March 2023

Decision

Based on the assessment detailed in this document the Department of Environment Regulation (DER) has decided to grant a works approval. DER considers that in reaching this decision, it has taken into account all relevant considerations.

Decision Document prepared by: Lauren Fox
Licensing Officer

Decision Document reviewed by: Alan Kietzmann
Manager Licensing (Waste Industries)

	Ruth Dowd Senior Manager – Industry Regulation (Waste Industries)
Decision Document authorised by:	Kerry Laszig A/Executive Director – Licensing and Approvals

Contents

1 Purpose of this Document

This decision document explains how DER has assessed and determined the application and provides a record of DER's decision-making process and how relevant factors have been taken into account. Stakeholders should note that this document is limited to DER's assessment and decision making under Part V of the *Environmental Protection Act 1986.* Other approvals may be required for the proposal, and it is the proponent's responsibility to ensure they have all relevant approvals for their Premises.

2 Administrative summary

Administrative details		
Application type	Works Approval ☒ New Licence ☐ Licence amendment ☐ Works Approval amendment ☐	
Activities that cause the premises to become prescribed premises	**Category number(s)** 64	**Assessed design capacity** 250,000 tonnes per year
Application verified Application fee paid	Date: 21/04/2015 Date: 09/04/2015	
Works Approval has been complied with Compliance Certificate received	Yes☐ No☐ N/A☒ Yes☐ No☐ N/A☒	
Commercial-in-confidence claim	Yes☒ No☐ The Vipac August 2015 Noise Assessment has been marked as 'commercially in confidence'.	
Commercial-in-confidence claim outcome	A representative of SITA Australia Pty Ltd (SITA) has confirmed that this 'commercial in confidence' claim was included on the Noise Assessment in error. SITA has not made a claim for this document to be kept confidential in any capacity.	
Is the proposal a Major Resource Project?	Yes☐ No☒	
Was the proposal referred to the Environmental Protection Authority (EPA) under Part IV of the *Environmental Protection Act 1986*?	Yes☒ No☐	Referral decision No: Application not assessed.
Is the proposal subject to Ministerial Conditions?	Yes☐ No☒	Ministerial statement No: EPA Report No:
Does the proposal involve a discharge of waste into a designated area (as defined in section 57 of the *Environmental Protection Act 1986*)?	Yes☐ No☒ Department of Water consulted Yes ☒ No ☐	
Is the Premises within an Environmental Protection Policy (EPP) Area Yes☐ No☒		
Is the Premises subject to any EPP requirements? Yes☐ No☒		

3 Executive summary of proposal and assessment

Works approval W5830/2015/1 has been granted for the construction of Cells 1 and 2 of a Class II putrescible landfill located at Lot 4869 Great Southern Highway in Saint Ronans. The landfill meets the description and design capacity of a Category 64 landfill as defined in Schedule 1 of the *Environmental Protection Regulations 1987*. The Premises is located on a portion of the Allawuna Farm, an area of approximately 1,500 hectares, which consists of approximately 75% of cleared land for sheep grazing and broad acre crop production with the remaining 25% consisting of remnant vegetation. The landfill footprint area is approximately 36 hectares with the remainder of the property proposed to remain under the current land use arrangements, which is incorporated into the specified prescribed premises boundary within Lot 4869.

Development approval (DA) for the landfill was granted by the State Administrative Tribunal (SAT) on 8 March 2016 subject to conditions.

Cells 1 and 2 will each be constructed in two parts (a and b) with approximately 1.75 million m^3 of airspace available. Based on a proposed input of between 150,000 and 250,000 tonnes of waste per year, Cells 1 and 2 would have a combined operational life expectancy of approximately 6 to 7 years. This application is for the proposed construction of Cells 1 and 2 only however the application addresses the design and investigations undertaken for the whole landfill area encompassing the construction and filling of 6 cells over a period of approximately 20 years with an estimated 5.6 million m^3 of waste being landfilled.

An assessment of the works approval application is presented in Section 4 (Decision Table and supporting Appendix A). This includes but is not limited to an assessment of the suitability of containment provided by the proposed engineered cell design in the context of the proposed waste types and the sensitivity of the environmental setting.

Potential emissions associated with landfilling of Class II waste include leachate, landfill gas, odour, dust and noise. All of these emissions have been considered in the assessment of the landfill siting and design and associated potential risk to sensitive receptors undertaken by the Chief Executive Officer's (CEO's) delegate.

Identified receptors include, but are not be limited to, residences in the surrounding area, groundwater and surface watercourse including the Thirteen Mile Brook located approximately 150m west of the retention pond.

The CEO's delegate considers that the landfill does not represent an unacceptable risk to human receptors. An assessment of odour, landfill gas, dust and noise emissions together with potential impacts associated with surface water management, litter and vermin are provided in Section A7 and A10 – A21 of Appendix A.

The CEO's delegate considers that the landfill does not represent an unacceptable risk to the environment based on the data and conceptual site model presented. An assessment of the environmental setting, liner design, landform stability, surface water management, cover availability and risk of leachate emissions to groundwater is presented in Sections A2 to A9 of Appendix A.

There is considerable community interest in the proposal. 69 individual submissions were received from the community following the application being advertised in *The West Australian* and *Hills Gazette* newspapers, with some of these submissions submitted by community groups or signed by multiple people. All representations have been considered by the CEO's delegate in her determination of the application. Further information relating to these representations and how they have been considered is included in Appendix B.

4 Decision table

All applications are assessed in line with the *Environmental Protection Act 1986*, the *Environmental Protection Regulations 1987*, DER's Corporate Policy Statement No.7 – Operational Risk Management, DER's Operational Procedure on Assessing Emissions and Discharges from Prescribed Premises, DER's Guidance Statement: Regulatory Principles (July 2015), Guidance Statement: Setting Conditions (October 2015), and DER's Policy Statement: Regulatory Decision Making Framework (2014). Where other references have been used in making the decision they are detailed in the decision document.

DECISION TABLE			
Works Approval / Licence section	**Condition number** **W = Works Approval** **L= Licence**	**Justification (including risk description & decision methodology where relevant)**	**Reference documents**
Prescribed premises boundary	N/A	Under section 54 of the EP Act the CEO has the power to grant a works approval over an area that includes a prescribed premises (the land on which activities within Schedule 1 of the EP Regs take place) and over an area that is wider than but connected with the prescribed premises. Under the EP Act a works approval is protective and can prevent an offence under section 53 or 56 of the EP Act arising. A works approval also provides a defence under section 74A(b)(iii) to offences under Division 1 of Part V of the EP Act. Lot 4869 on Plan 224502 encompasses an area of approximately 1150 hectares (ha). The CEO's delegate has determined that to include the whole of Lot 4869 within the prescribed premises boundary would result in the inclusions of areas of land that are not connected with the proposed prescribed premises. Furthermore the CEO's delegate has determined that it would be inappropriate to provide a defence under section 74A(b)(iii) for land that is not being used for or in connection with activities detailed in Schedule 1 of the EP Regs. The CEO's delegate has therefore determined to define the prescribed premises boundary as shown in Appendix C, being land that will be used for landfilling and in connection with the landfill including land on which leachate ponds, stormwater ponds and monitoring points subject to monitoring requirements in the works approval are located. This area equates to approximately 285 ha in size.	Application supporting documentation

DECISION TABLE			
Works Approval / Licence section	**Condition number** **W = Works Approval** **L= Licence**	**Justification (including risk description & decision methodology where relevant)**	**Reference documents**
General conditions	W1.2.1 – W1.2.6	Condition 1.2.1 for this works approval requires that all construction works are completed in accordance with the specified works approval application supporting documentation. This includes all amendments, addendums and clarifications submitted as documented in Table 1.2.1 of this condition. Condition 1.2.2 requires that a separation distance of 2m is achieved between the lowest elevation of waste in the landfill cell and the highest natural elevation of groundwater recorded in monitoring bores. This condition ensures that the landfill is to be constructed in accordance with the design proposal submitted in the application. Condition 1.2.3 requires that a separation distance of 2m is achieved between the lowest elevation for both the leachate pond and retention pond and the highest natural elevation of groundwater recorded in the monitoring bores. This condition ensures that the landfill is to be constructed in accordance with the design proposal submitted in the application. Condition 1.2.4 has been included on the works approval to require the installation of two landfill gas monitoring bores outside of the proposed landfill cell area to allow for monitoring of background gas levels. This requirement has been included in conjunction with the commitments made in the 'Landfill Gas Management Plan, Allawuna Farm Landfill" prepared by SITA (March 2015). Condition 3.1.2 requires certification to demonstrate that these bores have been installed as required. Condition 1.2.5 has been included on the works approval to require the installation of four dust monitors discussed under the "Allawuna Landfill – Dust Management Plan" prepared by Bowman & Associates Pty Ltd (April 2015), and to be installed in accordance with the Australia/New Zealand Standard 3580.1.1:2007 Methods for sampling and analysis of ambient air – Guide to siting	Application supporting documentation

DECISION TABLE			
Works Approval / Licence section	**Condition number** **W = Works Approval** **L= Licence**	**Justification (including risk description & decision methodology where relevant)**	**Reference documents**
General conditions continued		monitoring equipment. Condition 3.1.2 requires certification to demonstrate that these bores have been installed as required. Condition 1.2.6 requires that independent construction quality assurance (CQA) of the key aspects of the construction works is performed and recorded in accordance with the Australian Standard AS 3798–2007 Guidelines on earthworks for commercial and residential developments (Standards Australia Limited, 2007). Further detail is provided in Section A5 of Appendix A.	
Emissions general	N/A	**Point source emissions** Emissions to air resulting from the combustion of landfill gas: the volumes of gas generated are in part related to the landfill cell design together with waste types and volumes and in part related to how the landfill will be operated. An assessment of this emission is presented in Section A10 of Appendix A. There will be no point source emissions during the construction phase; therefore no conditions relating to point source emissions are required in the works approval. The CEO or his delegate will consider any requirement for conditions relating to the control and/or monitoring of point source emissions during the operational phase of the site when assessing the licence application for the premises. **Fugitive emissions** An assessment of fugitive emissions (dust, landfill gas, leachate, odour and noise) is presented in Sections A11 to A14 of Appendix A. Potential impacts associated with surface water management, litter and vermin are provided in Sections A15 and A18 to A20 of Appendix A.	Application supporting documentation *Environmental Protection Act 1986*

DECISION TABLE			
Works Approval / Licence section	**Condition number W = Works Approval L= Licence**	**Justification (including risk description & decision methodology where relevant)**	**Reference documents**
Emissions general continued		The CEO's delegate considers that fugitive emissions during the construction phase can be sufficiently regulated under section 49 of the *Environmental Protection Act 1986.* No specified fugitive emissions have therefore been included on this works approval. The CEO's delegate will consider any requirement for conditions relating to the control and/or monitoring of fugitive emissions during the operational phase of the site when assessing the licence application for the premises.	
Monitoring	W2.1.1 – W2.1.7	Conditions 2.1.1 and 2.1.2 include specific requirements, such as methodology and time between sampling rounds, to be implemented when undertaking the monitoring specified in this section of the Works Approval. These conditions assist in providing greater accuracy and consistency of monitoring data. 2.1.3 of the works approval requires surface water monitoring to establish the baseline surface water quality of Thirteen Mile Brook prior to any construction works commencing, including monitoring during construction works. Condition 3.1.2 requires this data to be provided in the Construction Quality Assurance Validation Report. The baseline surface water data will assist in demonstrating the effectiveness of stormwater and sediment controls during construction. The proposal has stated that surface water will be monitored as detailed in section 7.5 of the "Allawuna Farm Landfill Surface water and Sediment Management Plan" prepared by Bowman & Associates Pty Ltd (August 2015). The baseline surface water data will be used as a comparison for any surface water monitoring that may be required under the operational licence to demonstrate that any discharges from the site, including runoff, sediment and stormwater, are being managed as required.	Application supporting documentation

DECISION TABLE			
Works Approval / Licence section	**Condition number W = Works Approval L= Licence**	**Justification (including risk description & decision methodology where relevant)**	**Reference documents**
Monitoring continued		The landfill design specified in the application includes a minimum 2m separation between the lowest elevation of the waste in the landfill cell and the maximum elevation of groundwater, as required in condition 1.2.2, with an additional 0.5m as a contingency buffer. Condition 1.2.3 requires a minimum separation distance of 2m between the lowest elevation of the leachate and retention ponds and the highest natural elevation of groundwater. The pond design includes an additional 0.5m contingency buffer. Condition 2.1.4 has been included to require quarterly monitoring of groundwater quality surrounding the proposed landfill footprint area. This condition assists in providing further data for background levels and seasonal fluctuations, as well as being used to confirm the minimum 2m separation distance between the base of waste in the proposed cells and the 2m separation distance for the ponds, and the natural highest groundwater elevation. Condition 3.1.2 requires the monitoring data to be included in the Construction Quality Assurance Validation Report to be submitted following cell construction to demonstrate the separation distance was achieved. Condition 2.1.5 has been included on the works approval to require monthly monitoring of background gas levels to be commenced when the bores have been installed as required by condition 1.2.4. This condition will assist in detecting if landfill gas, generated during the operational phase, is being released into the environment. Condition 2.1.6 (and Table 2.1.3) has been included on the Works Approval to require noise monitoring to be undertaken during the construction of each cell and assessed against the *Environmental Protection (Noise) Regulations 1997.* This condition has been included to reflect the proponent's commitment to undertaken noise monitoring as detailed in section 4.4 of the "Allawuna Farm Landfill – Noise Management Plan" prepared by Bowman & Associated Pty Ltd	

DECISION TABLE			
Works Approval / Licence section	**Condition number W = Works Approval L= Licence**	**Justification (including risk description & decision methodology where relevant)**	**Reference documents**
Monitoring continued		(July 2015) and assists in verifying whether noise emissions can be managed to meet specified regulatory noise limits under the *Environmental Protection (Noise) Regulations 1997*. This condition also requires the proponent to propose noise mitigation measures if improvements are required to meet the prescribed standard. Condition 2.1.7 requires the cessation of all construction works until such a time that any of the proposed noise mitigation measures, identified from the report in condition 2.1.6, have been implemented.	
Information	W3.1.1 - W3.1.5	Conditions 3.1.1 and 3.1.2 require the works approval holder to submit compliance documentation following the completion of each landfill cell prior to the deposit of waste in that cell. The documentation must certify that the works were completed in accordance with the conditions of the works approval and include a Construction Quality Assurance Validation Report, demonstrating each cell has been constructed to the approved standard. Conditions 3.1.3 and 3.1.4 include the specific requirements to provide monitoring data required by the works approval to the CEO of DER as specified on a six-monthly or quarterly basis.	
Works Approval Duration	N/A	The works approval is being granted for a period of 7 years. The application indicates that the landfill cells will be completed in stages with the first two cells, Cell 1a and 1b, expected to be completed within 1 - 2 years, and Cell 2a and 2b to also be completed within the period of 1 - 2 years with construction works on Cell 2a and 2b anticipated to commence in 2021.	Application supporting documentation
Financial Assurance	NA	The CEO's delegate has considered the risks to the environment and is satisfied that the proposed landfill design and construction will provide adequate protection of the environment and a financial assurance under Section 86C(2) of the Act is therefore not required for this works approval. Any requirement for	*Environmental Protection Act 1986*

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Financial Assurance continued		financial assurance at the operational stage will be considered at the licensing application stage.	

5 Advertisement and consultation table

Date	Event	Comments received/Notes	How comments were taken into consideration
22/04/2015	Application referred to other decision making authorities listed: • Department of Health; • Department of Parks and Wildlife; • Department of Water; • Environmental Protection Authority; • Shire of York	Summary of comments is detailed in Appendix A, Section A21	As detailed in Appendix A, Section A21
23/04/2015	Application referred to 65 interest parties identified during the community consultation process of the previous application.	Summary of comments in Appendix B	As detailed in Appendix B
24/05/2015	Application advertised in *Hills Gazette*		
27/04/2015	Application advertised in *The West Australian*		
6/10/2015	Application referred to other decision making authority: • Department of Agriculture and Food (Commissioner of Soil and Land Conservation, Biosecurity and Regulation)	Summary of comments is detailed in Appendix A, Section A21	As detailed in Appendix A, Section A21
23/12/2015	Proponent sent a copy of draft instrument	Initial comments on draft documents were provided to DER on 9/02/2016. The main comments on the Works Approval conditions included minor changes to wording of conditions and changes to proposed completion dates.	

Date	Event	Comments received/Notes	How comments were taken into consideration
		The main comments on the Decision Document included rewording to provide further clarification, or to correct information where required.	
24/12/2015	Application referred to other decision making authority: Department of Agriculture and Food (Biosecurity)	Summary of comments is detailed in Appendix A, Section A21	As detailed in Appendix A, Section A21

6 Risk Assessment

Note: This matrix is taken from the DER Corporate Policy Statement No. 07 - Operational Risk Management

Table 1: Emissions Risk Matrix

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

Appendix A

A1 Storage of Environmentally Hazardous Materials

The application has identified that a diesel powered generator will be installed at the premises and will be located on a concrete bunded hardstand. The proponent has advised that they intend to store up to 35,000 litres of diesel, 1,000 litres of oil and approximately 400 litres of lubricants and grease, which will be used for equipment at the premises. An aboveground fuel tank for diesel storage will be constructed at the premises adjacent to the workshop area. The application indicates that chemicals and fuels will be stored in accordance with the Australian Standard AS 1940 *The storage and handling of flammable and combustible liquids* and the *Dangerous Goods Safety (Storage and Handling of Non-explosives) Regulations 2007* (Dangerous Goods Regulations).The proponent has also developed a spill management plan which includes the following controls:

- Oil, grease and lubricants will be stored on bunded pallets within the workshop area;
- Diesel tank to meet industry standard storage requirements;
- Spills kits located around the premises;
- The Material Safety Data Sheet (MSDS) will be maintained for any fuels and chemicals that are stored at the premises and materials will be stored as per manufactures specifications;
- Fire extinguishers available on-site;
- Quantity of environmentally hazardous materials kept to a minimum; and
- Mobile pumps will be located within spill trays.

The CEO's delegate considers that sufficient information has been provided on storage infrastructure. Condition 1.2.1 of the works approval requires works to be completed in accordance with the documentation submitted.

A2 Environmental Setting/Conceptual Model

A2.1 Human Populations

The proposed site is located within a rural area. There are 21 properties within 2.5km of the site boundary. The nearest town centre is York, situated approximately 20km east of the site. There are no residential premises within 1 km from the landfill footprint. The closest two houses identified during the assessment belong to the Allawuna farm land owner, and are located approximately 1.1km south and 1.9km north-west of the landfill footprint respectively.

On 27 November 2015, DER received a declaration from the landowners to advise that of the two houses located within Lot 4869, one is uninhabited and, for the one that is occupied, the landowners have declared that they are aware of SITA's intent to construct and operate a landfill within Lot 4869 and that they consent to this and also consent to their residence being disregarded as a receptor. It has been identified that a partially demolished and uninhabited house is located 1.1.km south of the Premises. Regardless of the landowner's declaration, the impacts of emissions and discharges from the Premises have been assessed by the CEO's delegate in consideration of the onsite residence (1.9km) and this assessment has been incorporated into the delegate's decision making process.

The Environmental Protection Authority's Guidance Statement 3: *Separation Distances Between Industrial and Sensitive Land Uses* (2005; hereafter referred to as EPA GS3) recommends a 500m separation distance for sensitive uses (subdivisions), 150m for single residences and an internal buffer of 35m from the boundary of class II landfills. This landfill proposal meets the recommended separation distances in GS3.

A2.2 Surface Water

The proposed landfill footprint area lies within the Avon River Sub-catchment within the Swan Avon – Main Avon Catchment of the Avon River Management Area (*Waterways Conservation Act 1976)*. It is also within a proclaimed water area under the *Rights in Water and Irrigation Act 1914* (RIWI Act). The Mundaring Weir Catchment is a Public Drinking Water Source Protection Area

(PDWSPA) which is afforded Priority 1 (P1) management status and is located approximately 1km west of the landfill footprint. The P1 PDWSA is within the Helena River Catchment Area. The Helena River is located approximately 4km south of the proposed landfill.

The following surface water bodies are located within 1km of the premises:

- Thirteen Mile Brook is located approximately 310m southwest and west of the landfill cells and 150m from the retention pond. The brook flows northwest before discharging to the Avon River located 16km east of the premises;
- A seasonal unnamed tributary of Thirteen Mile Brook is located approximately 80m south and 30m east of the proposed landfill cells. The tributary flows southwest (seasonally) before discharging to Thirteen Mile Brook. The proponent is required to obtain a permit under the RIWI Act from the Department of Water to construct a crossing over this creek as well as obtaining approval to construct the storm water dam on the seasonal creek line.

The premises is not within or surrounded by a protected wetland area. The closest wetland of significance is the Koojedda Swamp, located approximately 21 km north-west of the premises. This has not been considered as a sensitive receptor given its distance from the proposed landfill.

A2.3 Groundwater

A2.3.1 Regional Geology

The “Allawuna Farm Landfill Hydrogeological Site Characterisation Studies” report prepared by Golder Associates Pty Ltd (Golder), March 2015 (the Golder Report or Golder) provides a description of the regional geological setting based on the Perth 1:250,000 Geological Series map. In summary, the site is located on the Darling Plateau, east of the Darling Fault and is underlain by Archaean granitic and gneissic rocks that comprise part of the Yilgarn Craton. These basement rocks have been extensively weathered and fresh bedrock is generally overlain by a lateritic weathered profile (regolith) that may be up to 30 metres thick. The weathered profile is mostly comprised of sandy clays that are overlain at shallow depth by ferruginous pisolitic gravels and duricrusts (commonly known as “laterites”).

In some areas, the laterites are overlain by deposits of grey, white or yellow sand of variable thickness. Quaternary colluvium, including valley filled deposits, variably laterised and podsolized are found either overlying laterite or directly overlying granitic rocks where laterite is absent.

Quartz dolerite dykes intrude the Archanean rocks in the region. The dykes are typically between 2 and 10 m thick but have been identified at up to 200 metres thick. The closest dyke to the landfill mapped in the “Perth” 250,000 Geological Series map is located approximately 3.4 km north-east. No faults, according to the mapping, are indicated in the vicinity of the landfill site.

A2.3.2 Field Investigations

A series of field investigations were completed within the vicinity of the site, which provide data on the local geology and hydrogeology, as documented in:

- “Baseline Groundwater Monitoring Report, Proposed Allawuna Landfill, Shire of York” prepared by ENV Australia Pty Ltd (ENV), 19 October 2012 (the ENV Report);
- “Groundwater Monitoring report, Allawuna Farm – February 2015” prepared by Bowman & Associates Pty Ltd (B&A), 11 March 2015 (the B&A Report);
- “Allawuna Farm Landfill, Hydrogeological Site Characterisation Studies” prepared by Golder Associates Pty Ltd (Golder), March 2015 (the Golder Report); and
- Updated geological information provided by Golder in August 2015 (Golder August data).

Field investigations included but were not limited to:

- 114 test pits undertaken across the site with 69 located within the vicinity of the landfill footprint and 45 as part of an investigation of potential borrow areas. Test pitting was undertaken in a staged approach in August, September and November 2014 and February 2015 to depths ranging from 0.5m to 6m below ground level (m bgl);

- Installation of 23 groundwater monitoring bores (MB01, MB03 – MB14 and GMB01 – GBM10: locations depicted in Appendix E) between August 2012 and March 2015 to depths of between 8 and 33m bgl.
- Geophysical surveys (using electrical and magnetic imaging techniques) of the landfill site location and larger surrounding area were completed over four days during 13 to 16 January 2015. The surveys were primarily undertaken to assist in identifying dykes but also provide information on subsurface conditions to support the test pitting and bore installation programs.
- Cone penetrometer tests (CPTs) undertaken in May 2013 (8 CPTs) and February 2015 (25 CPTs). The scope and objective of these tests is discussed further in the local geology section below.
- Particle size distribution (PSD) analysis on four regolith samples collected during the drilling of GMB05. The samples were taken at depths of between 2.5 and 15.5m bgl with the intent of verifying field observations recorded during drilling.
- Geotechnical testing of regolith samples which included but was not limited to tests for compaction characteristics, hydraulic conductivity and dispersive potential.

Additional monitoring bores (GMB1–GMB10) were installed by Golder to further investigate apparent geological anomalies that were identified in bores MB01-MB14 that were previously drilled and constructed at the site. Some bore logs from the 'MB range' suggested that fluvial sediments associated with palaeochannels occurred in regolith at the site. To further investigate Golder used air-core drilling techniques so that the underlying lithology could be identified with a higher degree of accuracy. The Golder findings confirmed the site-specific geology is consistent with the "Perth" 1:250,000 Geological Series map and does not contain palaeochannel deposits, although sand was found in the weathered profile at monitoring bore site GMB06. This is discussed in the next section.

A2.3.3 Local Geology and Hydrogeology

A2.3.3.1 Local Geology

Logs of test pits, CPTs and monitoring bores indicate the site and immediate surrounding area is generally underlain by a lateritic weathered profile containing clayey sand, sandy clay, and clay with layers of quartz sand and gravel. A high dominance of quartz grains was recorded, typically described as sub-angular to angular, with some described as sub-rounded. Partially weathered granite bedrock was recorded at depths of approximately 9m to 22m bgl during drilling. PSD results from GMB05 were generally consistent with field observations recorded during drilling (clayey/silty sand, sand and gravel).

The presence of granitic bedrock and a lateritic weathered profile is generally consistent with the description of the geology of the area provided in the Explanatory Notes for the Perth 1:250,000 Geological Series map. Investigations at the proposed landfill site indicated that granitic bedrock was cross-cut by four dolerite dykes, a feature that is also commonly seen in granitic bedrock in the region.

Drilling investigations at monitoring bore site GMB06 intersected an anomalously thick sequence of sand in the regolith (to 22 m bgl). This raised concerns about the potential presence of a palaeochannel beneath the landfill footprint. However, additional investigations near the site indicated that the sand body was a localised feature, and the characteristics of the sand grains (angular shaped sand grains) were not consistent with fluvial transport associated with palaeochannel deposits in the region. Golder indicated that the most likely cause of the localised sand accumulation in the location was local transport of sandy materials from upslope of the area. The additional investigations that were undertaken for Golder to reach this conclusion are outlined below:

- Four dykes were identified to intersect the premises including landfill cells 1a, 2a, and 2b, and proposed cells 4, 5 and 6, with one dyke close to the retention pond. Golder used the information to identify suitable borrow areas as indicated in Appendix F.

- A magnetic imaging survey depicted a low-intensity magnetic geological feature intercepting the proposed landfill area. Golder indicates the feature may be the result of mineralogical differences in the basement rock, whereby there is a relatively depleted magnetic mineral content in rocks in the location of the anomaly compared to surrounding rocks. However, as they recognised that it could potentially be the result of a palaeodrainage feature, Golder completed a desktop remote sensing study and a program of CPTs to investigate further.
- A remote sensing study was completed to assist in identifying the extent of the sand feature in GMB06 and Test Pit (TP) 94. However none of the datasets examined enabled surface geological features at a local scale to be identified.
- CPTs were completed at 33 locations within the landfill cells footprint and to the northwest, south, southeast and southwest of the site (refer to Appendix G for CPT locations). The objective of the CPT program was to determine if the deep sand found in GMB06 is laterally extensive across the landfill footprint and if it represents a potential preferential pathway between the landfill and sensitive groundwater and surface water receptors, including the Mundaring Weir Catchment P1 PDWSPA, and the Helena River surface water catchment area. The results indicate the majority of areas investigated are underlain by stiff clays and laterite duricrust. CPT refusal was met at shallow depths of between 0.5m and 3.6m bgl. The exception was CPT6 located in close proximity to GMB06 which was progressed to 14.5m bgl.
- The results of the CPT program is supported by test pit logs which met refusal at depths of 0.7 to 2.8 m at the northern surveyed extent of the linear geological feature, and also met refusal at depths of 1.4 to 1.8 m at the southern surveyed extent of feature. The results of both test pitting and CPTs indicate refusal close to ground surface, indicating that the deep sand in GMB06 is localised, not laterally extensive and is not expected to extend west of GMB06 towards the Helena Catchment and the P1 PDWSA. The estimated extent of the deeper sandy material is depicted in a cross section by Golder (Appendix H of this document).
- Golder also indicate that cores from GMB06 depict that the bore was drilled into massive granite at 21.5m bgl without encountering sediments indicative of high energy fluvial environments, which are typically at the base of palaeovalley systems. The angularity of the quartz sand and gravels recovered during drilling in combination with angular feldspathic grains are indicative of material that has not travelled far from the source.
- Material described as silt to a depth of 20m bgl in the log for MB02 was further investigated by drilling a new bore (GMB08) next to it. The lithology encountered in GMB08 indicated that the material logged as silt was in fact typical regolith over granite and was not sedimentary in origin. Whilst no groundwater was recorded during the drilling of MB02, groundwater was encountered at 18m bgl in the new bore.

A2.3.3.2 Geotechnical and Geochemical Properties

Geotechnical tests of in-situ soil were completed by Golder to determine its suitability as an *in-situ* compacted clay.

Golder tested 14 samples from 9 test pit locations around the site for cation exchange capacity (CEC), pH, electrical conductivity, exchangeable sodium percentage (ESP), sodium absorption ratio (SAR), field moisture content, material plasticity and particle size distribution (PSD). Golder concludes that although ESP and SAR results indicate a sodic, dispersive soil with results of 6% and 3 respectively, the low CEC (average of 3) indicates a low propensity for the material to swell and become mobile.

The results of laboratory hydraulic testing of soil samples indicate a hydraulic conductivity of 1 x 10^{-9} m/s using water and 1 x 10^{-8} m/s using a salty solution. Effective porosity of the compacted in-situ clay was calculated to be 0.25.

Golder concluded that the geotechnical tests indicated that they clayey material is not a suitable liner material if used on its own. However, Golder considered that a suitable landfill liner could be established if local clay was used in conjunction with a geosynthetic clay liner (GCL) to form a

compacted clay liner system. An assessment of the proposed landfill engineering design is provided in Section A6.

A2.3.3.3 Hydrogeology

Key objectives of DER assessment

The CEO's delegate has assessed the hydrogeological data provided with the application to determine whether the operation of a landfill at the site would pose an unacceptable risk to groundwater and surface water receptors. As part of that assessment the following key elements were considered and are discussed below:

- The suitability of the scope of field investigations and assessments undertaken;
- The suitability of the hydrogeological conceptual site model in identifying all potential groundwater bodies and pathways between groundwater and surface water receptors;
- The suitability of the assessment of risk to groundwater and surface water receptors, including if there is a sufficient separation between the designed landfill base and the saturated aquifer and sufficient capacity for attenuation along the groundwater flow path between the base of the landfill and any surface water receptors to which groundwater discharges.

Hydrogeological Investigations

A summary of the field investigations including bore installations, CPTs, test pits and electrical magnetic imaging surveys completed at the site is presented in Section A2.3.2. In addition a number of groundwater monitoring events and hydraulic tests were completed as follows:

- Groundwater levels were monitored between 2012 and 2015 as follows:
  - MB01 – MB08: between 9 and 10 occasions from August 2012 to February 2015, including winter;
  - MB09 to MB14: between 7 and 8 occasions between August 2013 and February 2015, including winter;
  - GMB02 to GMB06: three occasions during 2014 and 2015.
- Rising head slug tests were completed for 9 bores (MB01, MB03, MB06, MB07, and GBM02 – GMB06) to investigate the hydraulic conductivity of the aquifer.

It is considered that the groundwater monitoring network extent and number of monitoring events provide sufficient coverage across the site to afford an understanding of aquifer conditions, seasonal groundwater fluctuations and flow directions. There is limited monitoring data provided for the GMB02 – GMB06 bores and the monitoring data for GMB07 – GMB10 was not provided with the application, however MB01 - MB14 provide an adequate network for the purpose of assessing groundwater level fluctuations and groundwater flow. As discussed in Section 2.3.2, the 'GMB range' of bores were installed to further investigate the underlying geology/hydrogeology using coring drilling techniques and replace MB02.

The hydraulic testing is considered to be sufficient to estimate the hydraulic conductivity of the underlying aquifer. The results are discussed below.

Hydrogeological Conceptual Model

Appendix H includes Golder's conceptualisation of groundwater occurrence and flow direction beneath the site and surrounding area.

Groundwater inflows were encountered during the installation of 16 bores at depths of between 5 and 28.5 mbgl. No inflows were recorded during the drilling of the remaining 8 bores (MB02, GMB01 – GM06 and GMB10). Following well development, groundwater levels rose by between 3.5m and 10.5m above the depth of the inflow.

Standing groundwater levels across the measured bores ranged between 0.04 and 21.8 m bgl (299.44 to 304.11 m AHD). Based on the groundwater monitoring record (2012 – 2015), groundwater levels beneath the site vary seasonally by up to approximately 1.2m.

The application states that a minimum separation distance of 2m, with an additional 0.5m contingency, will be maintained between the base of the landfill waste level, and the highest recorded groundwater level. In order to achieve this separation distance, the cells will be constructed via a cut and fill process. Material will be cut from Cells 2a and 2b (up gradient of the slope) and will be placed into the areas for Cells 1a and 1b, raising the existing ground level in areas where groundwater level is highest. The highest recorded groundwater elevation within the proposed landfill cell area is 0.71m bgl recorded in bore MB14. As depicted in Figures D103, D105, D106 and D205 (included in Appendix D, Figures D3 to D6), the area where MB14 is located will be filled with cut material to raise the ground elevation by at least 2m. This will similarly be undertaken throughout the cell area to allow a minimum 2.5m separation distance, including the 0.5 m contingency, to be met. This also applies to the proposed areas where the leachate and retention ponds will be constructed.

Golder concluded that groundwater is present within an unconfined aquifer within the lateritic and weathered granite profile, which is locally perched in some areas and locally semi-confined in other areas. These variations in groundwater occurrence are likely due to lateral and vertical variations in lithology. Where sandier regolith exists over less permeable regolith, perching of groundwater may occur seasonally following rainfall events. Where lower permeability regolith overlies the water bearing units in the aquifer, semi-confined conditions can occur. Artesian flow was recorded in two bores (GMB05 and MB11) close to the seasonal creek. Golder notes that groundwater observed to be flowing outside of the steel surface casing of MB06 was due to a damaged annular seal and is not indicative of artesian conditions.

Groundwater flow in the immediate vicinity of the site is inferred to be to the west/southwest towards Thirteen Mile Brook, which is assumed to be a seasonal groundwater discharge location when groundwater levels are high (winter). Groundwater flow on the western side of Thirteen Mile Brook is expected to be easterly towards the brook. Visual indications of groundwater seepage were recorded in a flat area close to the stream bed approximately 80m south-east of the extent of cell 1a, which supports this. The hydraulic conductivity of the aquifer was estimated using the results of slug tests completed for 9 bores. The results were between 0.2 to 3.0 m/day (2.31×10^{-6} and 3.47×10^{-5} m/s).

Golder state the following **conclusions** in relation to the local geology and hydrogeology:

- *'The proposed landfill is set in an Archean granitic geological setting, with a classical saprolitic regolith profile developed from the weathering process.*
- *The landfill site is located over variably weathered material developed over granitic rocks and not transported far from their source.*
- *The magnetic anomaly that transects the landfill footprint is not a palaeochannel feature, but rather reflects the magnetic properties of the underlying porphyritic granite in a zone of deeper in-situ weathering.*
- *CPT test work to establish whether the anomalous feature extended laterally showed the sandy materials did not extend beyond the site to the west.*
- *The area of deep sand is expected to be discontinuous within the landfill footprint.*
- *The areas of deep and shallow sand are contained by low permeability granite and clayey material and is not a palaeochannel.*
- *There is no evidence of the presence of extensive palaeochannel systems that might hydraulically link the landfill site to other catchments.*
- *There are no expected potential pathways to sensitive receptors (including Thirteen Mile Creek or any other water catchments).*
- *Groundwater beneath the site is present in an unconfined aquifer that is locally perched or semi-confined.*

- *Inferred groundwater flow across the proposed landfill area is a west to south to south-westerly direction towards Thirteen Mile Brook with groundwater gradients on the western side of the Brook likely to flow easterly during winter into the Brook.*
- *During winter, groundwater flow direction is generally towards the seepage area which feeds into the unnamed seasonal creek located south of the landfill footprint.*
- *Artesian flowing bores were located along the seasonal creek line indicating that the groundwater potentiometric level is higher than the ground level'.*

A2.3.4 Assessment of Risk to Groundwater and Surface Water Receptors

Golder has indicated that the risk to groundwater from leachate leaking through the landfill liner is expected to be low. This is due to:

- An engineered lining system and leachate collection system designed to limit leachate head build up to 0.3m at any one time;
- Management systems designed to identify and resolve any leachate management system performance problems;
- Groundwater is expected to be protected by a clayey soil layer as identified during field investigations; and
- Surface water controls to limit storm water coming into contact with the landfill cells.

The Golder Report specifies that the liner system for both the landfill and leachate pond have been designed to *"contain the leachate for a period of up to 100 years"* with any breach of the liner systems not anticipated to occur within that period. Golder used Darcy's law constitutive equation using the following inputs to calculate the estimated time of seepage. Golder estimated that it would take an average of 350 years for leachate to migrate to the Thirteen Mile Brook.

DER checked this calculation using data provided by Golder. The data suggested that the hydraulic gradient for the water table in the area was about 0.0167. Using this value and assuming a hydraulic conductivity value of 0.2 m/day and a porosity of 0.3 for aquifer materials gives a groundwater flow rate of about 4 metres per year. This means that the travel time for groundwater from the toe of the landfill to Thirteen Mile Brook would be about 125 years, and from the rear of the landfill footprint the same journey would take about 350 years. It is anticipated that the eventual discharge of leachate into Thirteen Mile Brook would have no significant impact on the quality of the Brook as the significant retention time of leachate within the groundwater will assist in decomposition of the leachate through microorganisms. It is anticipated that any leachate discharging into the Brook would not pose a significant risk to the environment or public health.

A2.3.5 Groundwater Quality

The Golder Report contains the results of groundwater testing for GMB02 – GBM06 up and down gradient of the proposed landfill footprint. The groundwater quality was characterised by sampling these bores on 3 occasions in December 2014, January 2015 and February 2015. Samples were analysed for a range of parameters including metals, hydrocarbons, chloride, nitrogen, nitrite and nitrate, pH, total dissolved solids and major ions.

Baseline groundwater sampling was undertaken for bores MB01, MB03 to MB08 in August 2012 (MB07 was not sampled during this round) and February 2013. Bores MB01, MB03 to MB14 were also sampled in August 2013, February 2014, August 2014, November 2014, December 2014, January 2015 and February 2015.

Based on the sampling events, the Golder Report identified that total dissolved solids in bores MB02 and GMB05 were higher (average 13,133 mg/L) than the other bores (average 3,340 mg/L). When considered in relation to the common ions in water, all of the Golder bores displayed sodium chloride water types. The Golder Report considers that differences in sampling data are attributed to longer residence times within the ground.

Groundwater quality has elevated acidity (pH 3.2 to 5.6) and salinity (4,000 to 30,000 µS/cm).

The CEO's delegate considers that ongoing baseline monitoring should be undertaken during construction to determine the natural variability of groundwater quality near the proposed landfill site. The works approval includes groundwater monitoring conditions.

A2.4 DER Assessment of Geology and Hydrogeology

An assessment of the information on geology and hydrogeology submitted with the application has been completed and the CEO's delegate is satisfied that the investigations completed are sufficient to:

- Characterise the geology and hydrogeology beneath and surrounding the site;
- Develop a hydrogeological conceptual site model for the site identifying all potential groundwater bodies and pathways between groundwater and surface water receptors; and
- Assess the risk to groundwater and surface water receptors.

A2.4.1 Characterisation

The assessments and conclusions by Golder using data from the investigations by ENV, Bowman & Associates Pty Ltd and Golder are also considered to be sufficient and robust.

A2.4.2 Hydrogeological Conceptual Site Model

The CEO's delegate considers that the Golder Hydrogeological Conceptual Site Model provided a suitable representation of the underlying geology and hydrogeology. In summary the CEO's delegate concurs that the site is underlain by a lateritic weathered profile developed on granitic bedrock. The regolith that comprises the weathered profile generally has a low hydraulic conductivity that impedes groundwater flow. However, the properties of the regolith vary considerably across the site, and consequently the nature of the regolith aquifer varies too. In some areas the aquifer is unconfined and is recharged directly by rainfall, but is semi-confined by clayey materials in lower parts of the site.

The key receptors are considered to be groundwater in the underlying regolith and granite and Thirteen Mile Brook to which groundwater beneath the site discharges.

The application includes sufficient information to indicate the absence of a palaeochannel or other groundwater preferential pathways between the site and the Helena River or Mundaring Weir catchments. Following the identification of the low intensity magnetic anomaly, Golder undertook a substantial amount of sub-surface investigations to determine if this was a palaeochannel. The CEO's delegate acknowledges the following data which indicates a palaeochannel is absent:

- The direction of the magnetic anomaly is of a northwest to southeast direction which is consistent with the trend shown by other shear zones and dolerite dykes identified in the regional bedrock.
- The sands recovered from GMB06 displayed angular characteristics, typical of uneven weathering of granitic features and of grains not being transported far from their source. Sands from palaeochannels typically display rounded grains as a result of water erosion and further migration from the source, which were not identified in this area.
- CPT and test pit data indicate that bedrock is close to the surface and close to the catchment divide between the site and the Helena River surface water and Mundaring Weir P1 PDWSA catchments. The deeper sandy regolith in GMB06 and TP94 appears to be restricted in lateral extent;
- The northwest to southeast orientation of the anomaly suggests that it is not connected to the regional groundwater, as groundwater level data indicates that water flows in a west to south-westerly direction towards the Thirteen Mile Brook, and not along this linear feature as would be expected if it were a significant groundwater conduit such as a palaeochannel.
- The investigations into this linear feature indicate that the sandy profiles only occur sporadically along the feature, indicating limited hydraulic connectivity and therefore limited potential for groundwater flow in the direction of the feature.

The conclusions of the CEO's delegate are supported by comments received from the Department of Water (DoW) on 22 May 2015 in regards to the landfill proposal. DoW has stated the following in regards to the site hydrogeology:

- *The additional studies undertaken by Golder Associates are generally sufficient to indicate that there is no evidence of the presence of extensive palaeochannel systems that might link the landfill site to other catchments.*

A2.4.3 Risk to Groundwater and Surface Water Receptors

As outlined above, groundwater and Thirteen Mile Brook have been identified as receptors (locations depicted in Appendix E). The following summarises the key features and risk associated with those receptors:

- Groundwater monitoring data provided in the application indicates that the quality beneath the site is acidic and brackish, likely as a result of the rising water table intercepting soluble salts and iron deposited in the soil profile as land was cleared for farming. As a result of these factors, drainage of salts and soluble metals from the site are already likely to be contributing to environmental impacts on aquatic ecosystems downstream of the site.
- The proponent has committed to engineering the base of the each landfill cell so that a separation distance of at least 2m is maintained between the lowest elevation of waste in the cell and the highest recorded groundwater elevation with a contingency of an additional 0.5m to account for any additional variability.
- The sandy material identified in GMB06 and TP94 has been sufficiently delineated to conclude the absence of a palaeochannel or other preferential pathway leading from the site to the Mundaring Weir P1 area and the Helena River catchment. Golder have stated that in the event that sandy deposits are present, sand will be removed to a depth of 1.5 metres and replaced with 1.5 metres of clay for the liner system. Further discussion on the landfill liner design is provided in Section A3.
- DoW directly advised DER during the stakeholder consultation period that the water quality at the site '*has no beneficial use as a human drinking water supply.'*
- The DoW borehole database (completed 7/10/2015) indicates there are no recorded groundwater wells within 1km of the Lot boundary, and approximately 2km from the proposed landfill cells and surrounding areas.
- Thirteen Mile Brook is located approximately 310m southwest and west of the landfill cells and 150m to the south-west of the retention pond. A seasonal creek is located directly south of the proposed landfill area which flows into the Thirteen Mile Brook and is subject to groundwater seepage during winter months. The Brook and creek are assumed to be in hydraulic connectivity with the aquifer. Based on the groundwater contour plan in the Golder Report (included in Appendix J), the hydraulic gradient is approximately 0.0167. Assuming an effective porosity of 0.3 and a hydraulic conductivity of 0.2 m/d, it is estimated that the groundwater flow velocity to be approximately 4 metres per year.

DER's Principal Hydrogeologist completed numerical modelling to investigate the effects of topography and aquifer properties on the pattern of groundwater flow near the Allawuna landfill site and to determine whether it would be feasible for groundwater to flow beneath Thirteen Mile Brook and the surface drainage divide that separates this catchment from the Helena River catchment.

A steady-state cross-sectional model was developed using the US Geological Survey finite-element model TopoDrive (Hsieh, 2001[1]) to investigate whether the presence of palaeochannel sediments to the west of Thirteen Mile Brook would provide a conduit for groundwater flow beneath the surface water divide. Geological information in the model near the proposed landfill site to the east of Thirteen Mile Brook was based on the investigations undertaken by Golder Associates, whereas a variety of geological settings were tested for the area to the west of the Brook.

[1] Hsieh, P.A. *TopoDrive and ParticleFlow – two computer models for simulation and visualization of groundwater flow and transport of fluid particles in two dimensions*. US Geological Survey Open File Report 01-286.

The main outcome of the modelling was that geological factors to the west of Thirteen Mile Brook had no influence on groundwater flow near the landfill site. The modelling indicated that groundwater flow from the vicinity of the proposed landfill site always discharged to Thirteen Mile Brook no matter what changes were made to the geology to the west of the Brook. This behaviour was caused by the shallow depth to bedrock near Thirteen Mile Brook and is in line with groundwater flow behaviour observed in previous studies of the effects of geology and topography on groundwater flow within catchments (Toth, 1963[2]; Winter *et al*., 2003[3]). The modelling indicated that it would not be feasible for groundwater flow from the vicinity of the landfill site to cross the catchment divide and enter the Helena River catchment.

The CEO's delegate has concluded that the risk to groundwater and surface water is acceptable in the context of the landfill engineering design (discussed further in Sections A11 and A15 of Appendix A). This includes a an engineered liner and a leachate management system designed to maintain a maximum 0.3m head of leachate on the liner at any one time.

The CEO's delegate has concluded that the landfill design is acceptable with regard to the hydrogeological setting. Conditions have been included in the Works Approval related to the standard of landfill construction and includes a requirement for a 2m separation to groundwater (also refer to the Decision Table in Section 4 for additional detail and justification of conditions).

A2.5 Other Sensitive Receptors

A2.5.1 Native vegetation:

ENV Australia Pty Ltd prepared the *Allawuna Landfill Vegetation and Fauna Assessment* in September 2012 on behalf of Bowman & Associates Pty Ltd in support of the application. A summary is provided below:

Approximately 87% of the area is cleared cropland with low fauna habitat. No declared weeds, threatened or priority flora species were found. The premises boundary is adjacent to the 44,000 hectare Wandoo National Park which was gazetted in 1995 under the State Government's *Protecting Our Old Growth Forests Policy* and is managed by the Department of Parks and Wildlife.

An area of bushland at the northern end of the premises (within the premises boundary) has been issued with a Soil Conservation Notice (dated 3 April 2003) (SCN) by the Commissioner of Soil and Land Conservation under the provisions of the *Soil and Land Conservation Act 1945*. The Notice restricts any destruction or clearing of this area, including undertaking any activities that may hinder the regeneration of native vegetation. The proponent has proposed to clear 0.2 hectares of bushland within the area subject to the SCN, as well as remnant vegetation within the landfill footprint. While the SCN remains in force the proponent is not authorised to clear any of the vegetation subject to the SCN.

Approvals for clearing native vegetation:
The proponent stated in the application that clearing of this bushland does not require a native vegetation clearing permit under the *Environmental Protection Act 1986* (EP Act) as the activities are permitted under regulation 5 of the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004* under items 12 and 19:

- Item 12, clearing for vehicular tracks, does not require clearing authorisation if the area to be cleared is for the construction of a track for vehicles, the owner of the land undertakes the clearing, and that no more than 5 hectares are cleared within the financial year.

[2] Toth, J., 1963. A theoretical analysis of groundwater flow in small drainage basins. *Journal of Geophysical Research*, **68(16)**, 4795-4812.
[3] Winter, T.C., Rosenberry, D.O. and LaBaugh, J.W., 2003. Where does the ground water in small watersheds come from? *Ground Water*, **41(7)**, 989-1000

- Item 19, clearing of isolated trees, does not require authorisation if the clearing consists of removing trees that are in an otherwise cleared area, are located more than 50m from other native vegetation and that no more than 5 hectares are cleared by the owner in the financial year.

In order for the above exemptions to be applied, the clearing is required to be of a prescribed kind and not undertaken in an Environmentally Sensitive Area (ESA), as described in section 51C of the EP Act. The proposed removal of the isolated trees in this application is of a prescribed kind (as listed in regulation 19) and is not within an ESA. This clearing is exempt and not subject to the Works Approval. The clearing for a vehicle track (regulation 5) is proposed to be undertaken in an area subject to the SCN and is therefore not exempt unless authorisation has been granted from the Commissioner of Soil and Land Conservation, Biosecurity and Regulation (Commissioner).

The proponent referred the proposal to clear native vegetation within the area subject to the SCN to the former Department of Sustainability, Environment, Water, Population and Communities (DSEWPAC) to determine if it would be classified as a controlled action under the *Environmental Protection and Biodiversity Conservation Act 1999* (Cth). On 5 August 2013 the former DSEWPAC determined that the tree clearing for the development of the Allawuna Farm Landfill was not a controlled action however this does not authorise any clearing.

The proponent then specifically requested authorisation from the Commissioner, Department of Agriculture and Food, in October 2015 to remove scattered trees for the purpose of upgrading the access road to the premises. The Commissioner advised the proponent that he had *"no objections to the removal of scattered trees to facilitate the upgrading of the access road to the proposed Landfill site."*

The commissioner provided comments to DER on 5 November 2015 which stated *"the Commissioner has informed the proponent that he has no objection to the removal of the scattered trees adjacent to the existing access track into Allawuna farm."* Based on the advice DER received from the Commissioner, the removal of the vegetation as described to the Commissioner and within the application supporting documentation, is exempt and is therefore not subject to the requirements of this Works Approval

SITA applied for a clearing permit on 16 June 2015 to clear 0.7 hectares of native vegetation and seven trees in areas adjacent to, but not within, the Premises boundary. This assessment has been considered under a separate process and is not discussed within this document.

A2.5.2 Aboriginal Heritage Sites:

The Department of Aboriginal Affairs online Aboriginal Heritage Inquiry System has a record of a registered Aboriginal site, being the Helena River (Site ID 3758) located approximately 700 metres east of the premises. In 2012 the proponent met with Elders of the Local Aboriginal Community as part of the stakeholder consultation process. The proponent has stated that *"the Elders indicated that the location of the landfill and surrounding development are not a place of significance for the local Aboriginal people."*

A2.5.3 Rivercare project – Thirteen Mile Brook riparian revegetation

A Rivercare project between the Department of Water and the Talbot Brook Land Management Association has been established for the revegetation of riparian vegetation along the upper reaches of Thirteen Mile Brook as a means of improving water quality and reducing sediment/erosion.

The proponent is required under the planning approval to submit a Revegetation Plan for the Thirteen Mile Brook prior to commencement of the landfill. It is recommended that a copy of this plan be included with the licence application.

A3 Landfill Liner and Leachate Management System Design

A3.1 Liner Design Components and Separation to Groundwater

An assessment of the proposed liner design provided in the Golder Report has been undertaken and the CEO's delegate considers it appropriate. The following summarises the main components as depicted in Figure A3.1:

- 0.3m of leachate drainage aggregate;
- Cushion geotextile;
- 2.0mm High Density Polyethylene (HDPE) geomembrane;
- 0.01m Geosynthetic Clay Liner (GCL) with a hydraulic conductivity of at least 1 x10^{-11} m/s;
- 0.5m of engineered clayey material, increased to a 1.5 m layer where sandy areas are identified.

Geotechnical testing of in-situ soils demonstrated that the clayey material was not suitable however, if used in conjunction with a geosynthetic clay liner (GCL), the existing material can still be used to form a compacted clay liner system which is detailed in the section A3 for liner design. The CEO's delegate agrees that the clayey material used together with a GCL is suitable for use in the liner system.

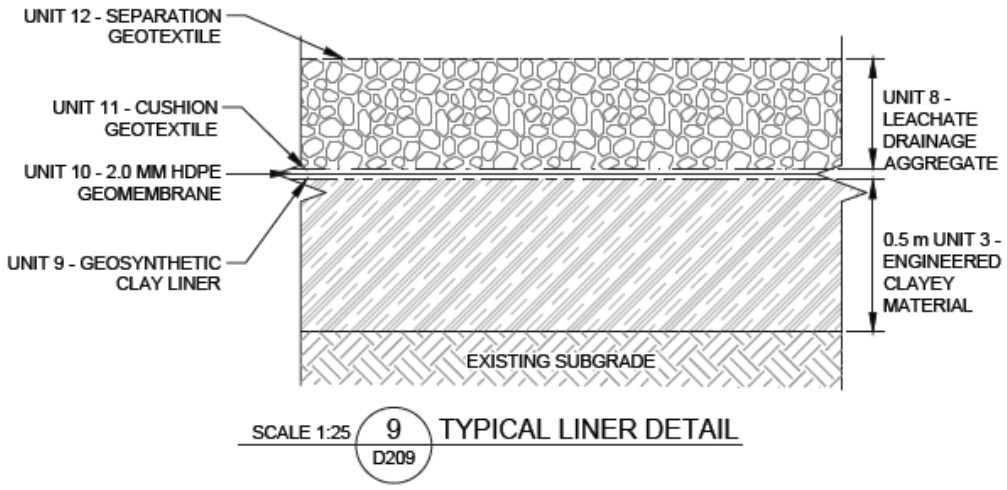
Prior to installing the liner, any geotechnically unsuitable or sandy regolith identified during the excavation for cell construction is to be removed and replaced with compacted clayey soil material sourced from the locally cut material during cell construction. The estimated extent of the deeper sandy material is depicted in Appendix H and is expected to be localised.

The Golder Report indicates that the material is likely to achieve compaction to a permeability of 1 x 10^{-8} m/s. The CEO's delegate notes that the permeability of this material has not been considered in the assessment of risk to groundwater. The liner, as designed provides adequate containment.

The sub base geology beneath the compacted geotechnically approved fill layer typically comprises sandy clay and clayey sand regolith overlying granite bedrock (also refer to the geological description in section A2.3.3).

Condition 1.2.2 in the Works Approval requires that there is at least 2m separation to groundwater below waste at the base of the landfill. (The designed base of the landfill, as illustrated in Figures D7 and D8 of Appendix D (Figures D207 and D208 of the Golder Report), includes a minimum 2.5m separation from the base of waste to the highest predicted groundwater level (including groundwater levels which are indicative of an unconfined water table and those indicative of a semi-confined potentiometric head).

Figure A3.1: Proposed Landfill Liner Design *(Source: Golder Report, Appendix B)*



A3.2 Assessed Liner Performance

The Golder Report indicates that the designed liner system for both the landfill and leachate pond have been designed to *"contain the leachate for a period of up to 100 years"* with any breach of the liner systems not anticipated to occur within that period.

Golder discussed the risk of liner failure in the document *Allawuna - Response to DER Queries dated 20 July 2015 - Leachate Management,* dated 14 September 2015. Golder used Darcy's law constitutive equation using the following inputs to calculate the estimated time it would take for any leachate as the result of liner failure to reach Thirteen Mile Brook:

- Distance to nearest receptor (Thirteen Mile Brook is located 310m from landfill cells);
- Distance to groundwater of 2.5 m (with the top 0.5m being compacted clayey material);
- Permeability of compacted clayey material of 1 x 10^{-8} m/s when saturated with leachate;
- In-situ clay permeability of between 2.3 x 10^{-7} and 6.9 x 10^{-6} m/s; and
- Effective porosity of compacted clayey materials and in-situ clay of 0.25.

The influence of the HDPE and GCL layers has not been considered for the purposes of Golder's assessment. Golder has estimated that it would take an average of 350 years for any leachate to reach the Thirteen Mile Brook in the event of liner fail. DER has assessed the travel time for groundwater from the toe of the landfill to Thirteen Mile Brook would be about 125 years, and from the rear of the landfill footprint the same journey would take about 350 years.

The CEO's delegate considers that the assessed liner performance is considered to be reasonable for this site, given the environmental risk setting (refer to Sections A2.3.3 and 2.4).

A4 Leachate Collection Systems Design

A4.1 Leachate Production Rates

A water balance assessment has been provided in the Golder Report. Golder used the United States of America Environmental Protection Agency (USEPA) Hydrogeological Evaluation of Landfill Performance (HELP) computer program to simulate the water balance for the landfill under a range of scenarios. The HELP model is considered as a suitable model for this site. It is noted that the HELP model may underestimate the volume of leachate generated and this uncertainty has been addressed by using 90th percentile monthly rainfall data as an input of the HELP model.

A level of conservatism was factored into the model by assuming that leachate production takes place after two successive wet years (over years 4 and 5). This was determined to be approximately 1,630 m^3 and was considered to be the maximum rate of leachate production that

was likely to take place in the landfill. A review of this modelling by DER officers has identified a high level of conservatism considered in the leachate management system with a high level of confidence. The application states that site-specific climatic data will be used as an input during the operational phase of the landfill to allow for ongoing management of leachate being generated.

A4.2 Leachate Pond Storage Capacity

The leachate production rate calculated through the HELP model was used as an input to an additional water balance modelling exercise to determine the required capacity of the leachate storage pond using the GoldSim water balance model (version 11).

Simulated rainfall events were run using the model for a predicted operational period for the two consecutive wet years using HELP modelled data for years 4 and 5. Simulations considered the requirement to maintain a freeboard of at least 0.5 meters and the capacity to contain leachate during a 1 in 20 year storm event of 72 hours duration. The HELP model considered the input of contaminated stormwater being pumped into the leachate pond in the event of an emergency. Recirculation of leachate has not been considered the modelling data and will only occur in emergency situations. The modelling indicated that for this time period, one leachate pond would be sufficient to contain leachate at the premises.

The leachate pond is designed to have a surface area of 2,000 m^2 (40m x 50m) and a storage volume of 2,700 m^3, while maintaining a 0.5 m freeboard. The total storage capacity of the designed leachate pond is 3,600 m^3.

On the basis of the information provided and climatic information for the site, the CEO's delegate considers that the designed capacity of the leachate pond will be adequate to manage leachate from landfilling operations at the site at the predicted rate of growth of the landfill footprint for Cells 1 and 2.

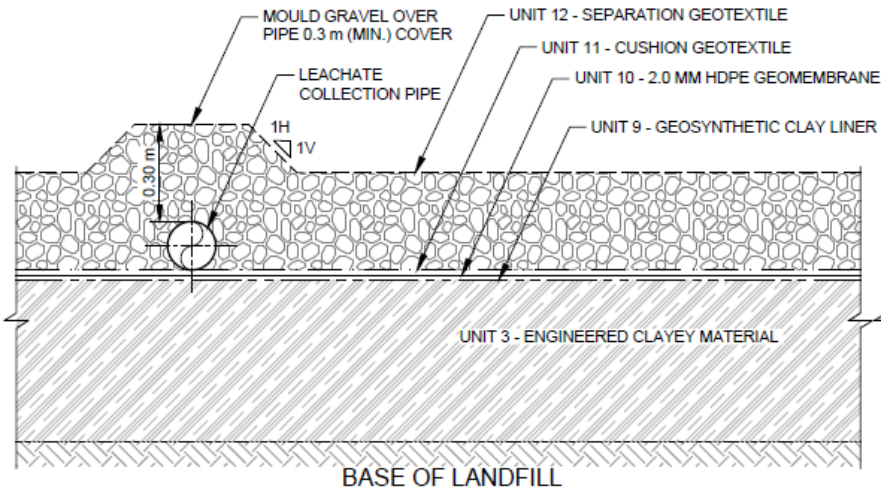
A4.3 Leachate Collection System Components and Operation

A leachate collection system will be installed as part of the landfill development and includes the following design and operational components as detailed in the Golder Report and additional information on leachate management provided by Golder on 14 September 2015:,

- The collection system is comprised of collection pipes, a collection sump and 300 mm drainage layer comprised of aggregate.
- The cells and aggregate drainage layers are designed in a manner that allows an approximate 3% slope towards the leachate collection sump to control the build-up of leachate head on the liner to a maximum 0.3m.
- The leachate collection system is incorporated into the liner system within the leachate drainage aggregate layer. Perforated pipes are installed within this drainage layer to capture leachate generated within the cell (as depicted in Figure A4.3).
- The collection pipes are proposed to be installed on a gradient of approximately 2.5 - 3% and header pipes installed on a gradient of 1%, which allow for leachate to gravity feed towards the leachate collection sump.
- The collection pipes will have a diameter of 150 mm with perforated holes every 300 mm along the pipe and header pipes to be designed with a diameter of 250 mm with perforated holes every 300 mm along the pipe. These pipes are to be installed within the 300 mm leachate drainage layer and will be covered with the drainage aggregate once installed. The drainage layer is overlain by a separation geotextile to assist in the prevention of clogging.
- The collection sump is proposed to be constructed over the liner system and will be include 0.2m of reinforced concrete at the base of the sump, and an additional 2.0mm HDPE geomembrane.
- The collection sump is designed with an extraction sump outlet which allows leachate to be pumped out of the sump. A pressure transducer will continuously monitor levels of leachate and an automatic pump system will be installed in the sump to allow for continuous pumping towards the leachate pond.

- The proponent has committed to managing a maximum level of 300mm for the hydraulic head of leachate above the liner. This will be achieved by pumping the leachate from the collection sump into the leachate storage pond for evaporation. Based on calculations of the leachate volumes, the leachate pond is required to have a capacity of 2,700 m^3 whilst maintaining a freeboard of 0.5m.
- The leachate storage pond includes the following design components:
    - 0.5m clayey engineered material;
    - 0.01m Geosynthetic Clay Liner (GCL) with a hydraulic conductivity of at least 1 $x10^{-11}$ m/s;
    - 2.0 mm smooth HDPE liner; and
    - Minimum separation distance of 9.55 m between the base of leachate pond and highest estimated groundwater level at that location.
- In the event that leachate production exceeds the volume of the leachate pond, the proponent proposes to have leachate transferred offsite to an appropriate disposal facility or for diversion to the retention pond for short term storage (up to 14 days).
- The retention pond includes the following design components:
    - 0.5 m clayey engineered material;
    - 2.0 mm smooth HDPE liner; and
    - Minimum separation distance of 2.58 m between base of retention pond and highest estimated groundwater level at that location.
- Golder has provided a risk assessment (in addition to supporting documentation for the retention pond provided to DER on 14 September 2015) for leachate being stored in the retention pond. The CEO's delegate considers that the containment infrastructure of the retention pond is sufficient to contain any leachate on an interim basis in the event that the leachate pond exceeds capacity.
- Leachate is proposed to be recirculated through the landfill in the event of an emergency, however the Leachate Management Plan states that the option of leachate irrigation will be undertaken prior to offsite disposal. The assessments undertaken in the HELP and GoldSim models have been based on the assumption that *"no leachate is recirculated onto the landfill"*. DER's assessment has only considered recirculation in an emergency event where evaporation and offsite disposal are not available.

Figure A4.3: Leachate collection system within liner drainage layer *(Source: Golder Report, Appendix B)*



A4.5 Leachate Level Monitoring

A pressure transducer and continuous depth monitor will continuously monitor levels of leachate within the sump to assist in maintaining a maximum head of leachate of 0.3 m on the liner.
A leakage detection system has not been proposed, however the sub-surface drainage system discussed below in section A7.1 is designed to capture any leachate in the event of liner failure and divert it to the retention pond where the water quality will be tested for consideration of disposal options.

A5 Construction Quality Control

The works approval application includes specifications for Quality Assurance and Quality Control (QAQC) within the document *Allawuna Farm Landfill Technical Specification for the Construction of Cell 1, Cell 2 and Ancillary Works,* prepared by Golder Associates Pty Ltd, March 2015. For this purpose, an independent third party Quality Assurance Inspector (QAI) with experience in landfill construction and geosynthetic lining systems will be appointed to verify that the works have been carried out to the agreed standards. The duties of the third-party QAI will include:

- Inspections;
- Testing;
- Verification;
- Audits and evaluation of materials and workmanship;
- Provision of advice on installation, testing, repair and covering of the critical aspects of construction; and,
- Issuing a final QAQC report documenting the quality of the constructed facility.

The QAQC document will verify that:

- Materials used comply with Specifications; and,
- Method of construction/installation is appropriate and, as a result the design requirements have been met.

The QAQC document will contain the material/construction specifications, testing methods, testing frequency, corrective action and provides for appropriate documentation procedures.

Condition 1.2.5 of the Works Approval requires that independent construction quality assurance (CQA) of the key aspects of the construction works is performed and recorded in accordance with the Australian Standard AS 3798–2007 Guidelines on earthworks for commercial and residential developments (Standards Australia Limited, 2007). Condition 3.1.2 requires the submission of a Construction Quality Assurance Validation Report, demonstrating each cell has been constructed to the approved standard.

A6 Landfill Liner Integrity and Stability Assessments

A6.1 Seismicity

The Golder Report sourced information on the seismicity of the site location based on the Leonard et al (2013) Atlas of Seismic Hazard Maps of Australia. The Atlas indicates that the peak ground acceleration for the 1 in 500 year return period is approximately 0.075g.

The proposed landfill location is situated within an area of notable seismicity according to *The 2012 Australia Earthquake Hazard Map (Geoscience Australia, 2012).*

The site is considered to be approximately 11 km south west of Dumbleyung fault line. The nearest earthquake is reported to have been a 2.5 magnitude earthquake approximately 4 km from the premises boundary. The seismicity risk in the area was incorporated into the Golder stability assessment (refer to section A6.2 below). The seismicity at the site was simulated using a pseudo-static slope stability analysis to consider the impacts of seismicity on the landfill stability. The stability assessment considered the following seismic events:

- Operating basis earthquake;
- Maximum design earthquake; and
- Maximum credible earthquake.

The results of the assessment are discussed in the section below.

A6.2 Stability Assessment

The application contained a stability assessment undertaken by Golder (March, 2015) titled *Allawuna Farm Landfill, Stability Analysis and Liner System Integrity Assessment for Landfill Development.* The stability assessment included assessment of the following:

- Veneer stability assessment;
- Analyses of the basal liner system interface stability;
- Basal liner system integrity assessment;
- Waste stability; and
- Embankment and foundation stability.

DER engaged GHD Pty Ltd (GHD) to critically review the stability assessment received for this application. GHD's review in May 2015 identified the following:

- Geotechnical models used for the stability analysis did not seem to consider the variability of soil and rock depth at the site;
- Calculated minimum factors of safety were above the required minimum in all situations except for maximum credible earthquake conditions; and
- The proposed capping system is considered stable.

Additional information was sought from the proponent to address GHD's above findings. This additional information was provided in July 2015 and was assessed by GHD in August 2015. The supplementary information included:

- Reassessment of the stratigraphic models for global stability to identify and consider the varying soil and rock depths at the site;
- Re-analysis of the critical stability analyses with reduced effective cohesion to consider granular soils; and
- Sensitivity analysis of the strength parameters assigned to waste under credible earthquake conditions.

GHD's assessment of the supplementary information identified the following:

- The reassessment of critical stability analysis considered the impact of granular soils which were calculated to have reduced factors of safety (when compared to the results of the initial stability report) however these were still above the required minimum values; and
- The reassessment on strength parameters of waste material, including increased cohesion, was considered to be acceptable.

GHD concluded that the operational landfill design is considered to be stable and that no additional stability monitoring is required, provided that the landfill is constructed in accordance with the landfill design specifications. (GHD assessments are included in Appendix K).

Based on the GHD review, Golder's findings and recommendations regarding stability appear to be appropriate. Condition 1.2.1 requires the Works Approval Holder to construct the works in accordance with the application supporting documentation.

A6.3 Liner Integrity

Golder has undertaken an assessment of potential stresses in the lining system to inform the selection of appropriate geosynthetic materials to be used in the liner. This included both pre-waste placement and operational landfilling scenarios. Golder's liner integrity assessment determined the following:

- *The integrity of the lining system during waste placement is satisfactory;*
- *The settlement of the subgrade and embankment fill due to the loading imposed by the waste will not detrimentally impact the integrity of the lining system; and*
- *The post-waste deposition settlement will not affect the integrity of the lining system.*

A7 Surface Water Management

The proposed landfill design includes plans for the establishment of diversion bunds (0.5m high) and drains (0.5m deep by 3m wide) to divert any surface water and stormwater away from waste storage and landfill areas. The stormwater drain is proposed to be installed on the eastern side of the proposed landfill, with the diversion bunds constructed around the perimeter of the landfill. All surface water and stormwater will be diverted to a stormwater dam located on the creek line to the south-east of the landfill cells. An overview of the surface water diversion design is provided in Appendix L.

Stormwater management for the site was considered using predicted long-term rainfall events incorporating Bureau of Meteorology (BoM) and SILO data for York region. BoM data was used in the rainfall intensity-frequency-duration studies to calculate the rainfall intensity over varying storm events (i.e. 1 in 100 year Annual Recurrence Intervals (ARI) events over 24 hours). The SILO climatic data has been used by Golder for long-term daily evaporation estimates.

A water balance model was developed using GoldSim to calculate the capacity of the proposed stormwater dam and incorporated the estimated evaporation rates and rainfall data from the BoM and SILO data sets. The Golder Report has determined that the proposal will require a stormwater dam with a storage capacity of 36,000 m^3. This dam will be used to address the water requirements during construction and operations, including dust suppression and fire water supply. The dam embankment is proposed be constructed of compacted engineered clayey material.

Golder's simulation was undertaken for a 25 year period, with only one of these years failing to provide sufficient operational water. Golder has undertaken an Options Study to assess the availability of water during construction activities. The Options Study determined that an average rainfall year should provide sufficient water for use at the site and that the existing groundwater bores are able to be used as a source for additional water supply. A licence to take water is required to be obtained from DoW.

The application includes the *Allawuna Farm Landfill Surface Water and Sediment Management Plan,* August 2015, prepared by Golder Associates Pty Ltd (SWMP). The SWMP includes consideration of the environmental risks, mitigation and management options for surface water and stormwater. The CEO's delegate considers the assessment and risks to be acceptable. Section A15 includes a risk assessment for this component.

Flood events have also been considered by Golder as part of the application. Golder provided data on the simulation of a 1 in 100 year ARI event using the hydraulic modelling software, XPSWMM (XP Solutions, 2014). As a contingency for flooding, a dam spillway is proposed to be constructed as part of the stormwater dam which assists in directing stormwater towards Thirteen Mile Brook and away from the landfill cells. Based on 100 year ARI rainfall event, the peak design flood discharge has been modelled at 6.2 m^3/s from the dam spillway. In the event that flooding occurs, the modelling has demonstrated that the stormwater will not come into contact with the landfill cells.

A7.1 Sub-surface drainage

The application includes a subsoil drainage system under the landfill footprint which is designed as a short-term management system to assist in diverting groundwater seepage during construction of the embankment within the groundwater seepage area close to the creek.

The pipework is designed such that all groundwater seepage is diverted away from the embankment construction area towards the retention pond. The retention pond is designed with a capacity of 2,690m^3 and a freeboard of 0.5m. The total capacity of the pond is 3,900 m^3. The retention pond is to be constructed from 500 mm compacted engineered clayey fill material with a 2 mm HDPE liner. The design of the pond allows a separation distance of 2.58m from the base of the pond to the highest estimated groundwater level at that location.

Water collected in the subsurface drainage system will be stored within the retention pond and tested within 7 days of entering the pond. If the water tests determine that the water is not contaminated, it will be discharged to the stormwater dam for use around the premises or release through the sediment management structure.

The subsoil drainage system is not intended as a leachate detection or collection system, however if there are any liner failures, leachate will be captured within this system and diverted to the retention pond where water quality will be tested for consideration of disposal options. Although this system is intended as a temporary measure, it has been identified by the CEO's delegate that water and leachate may continue to be collected within this system during operations and post closure. Licence conditions will be included to require a minimum freeboard of 0.5m to be maintained on the retention pond at all times which will assist in containing any leachate collected in the system during operations and post closure. Licence conditions for discharge criteria from the retention pond may also be included.

A7.2 Sediment management

A Sediment Management Structure (SMS) is to be implemented on the creek line down-gradient from the stormwater dam. The SMS is proposed to be constructed of aggregate (between 250 – 500mm in size) to allow for the passage of water while reducing the passage of suspended solid particles. Sediment that has been contained behind the SMS or within the stormwater dam will be removed using excavating machinery and transported for disposal in the landfill.

In the event of heavy rainfall or localised flooding, the proponent has committed to additional temporary sediment controls such as sand bags or silt fences, which can installed further down the creek line to assist in the prevention of sediment migration towards Thirteen Mile Brook.

SITA has committed to meeting with members of the Rivercare project for the establishment and implementation of a rehabilitation and revegetation plan for Thirteen Mile Brook. This plan is required under the conditions of the planning approval.

The SWMP includes consideration of the environmental risks, mitigation and management options for sediment. The CEO's delegate considers the assessment and risks to be acceptable. Section A15 includes a risk assessment for this component.

A8 Landfill Cover

The application identified that 1,418,000 m^3 of material will be required during the lifetime of the landfill (all 6 cells operating over approximately 20 years). Of this required material, 561,000 m^3 is available within the landfill footprint as excavated material during construction and will be retained on-site.

An additional 857,000m^3 of material is required for the construction of the landfill, capping, and daily cover throughout the life of the landfill. The proponent has identified three borrow areas where additional material will be sourced for use. The borrow areas cover a total area of 20 hectares (depicted in Appendix F).

The borrow areas will be cut at a maximum depth of approximately 5m, progressively removing less material as the excavation progresses down gradient. Topsoil (200mm) will be retained for use in rehabilitation of land suitable for farming. It is anticipated that material will not be sourced from the borrow areas until year 10 onwards. Borrow material is not required for the construction or operations of Cells 1 and 2. Any potential emissions and discharges from these areas and any clearing of vegetation required have not been assessed under this application and will be assessed under any subsequent applications.

Waste that meets the definition of Clean fill in the *Landfill Waste Classification and Waste Definitions 1996* (As amended December 2009), published by the Department of Environment and Conservation, will also be used as cover material. Cover material will be subject to a payable

levy, as prescribed under the provisions of the *Waste Avoidance and Resource Recovery Levy Act 2007*, unless an exemption is sought from and approved by DER.

Waste will be covered daily with 300mm of material. A condition will be included on the licence which addresses the cover requirements and frequency for each waste type accepted at the premises. The licence may include conditions which specify cover requirements for controlled wastes such as tyres and asbestos. The requirement for waste to be covered will assist in the reduction of odours, vermin and dust.

A9 Landfill Capping

Landfill capping is used to minimise infiltration into the waste mass and therefore leachate generation rates, prevent human and animal access to the waste, assist in controlling releases of landfill gas and to aid a beneficial after use of the site.

The application states that the Victorian document *Best Practice Environmental Management, Siting, design, operation and rehabilitation of landfills* (August 2015) (BPEM), will be used to set design objectives for the final landfill with the rate of infiltration not exceeding 75% of the seepage rate. The capping layer will contain appropriate gas collection piping, leachate recirculation piping and survey markers to monitor landfill settlement. The landform of the proposed final capping will be constructed at a minimum gradient of 1:50 and a maximum gradient of 1:5 to facilitate drainage of stormwater away from the surface.

The capping system will consist of the following components in order of bottom to top and as depicted below):

- 300 mm soil cover over final layer of waste;
- Geosynthetic Clay Liner (GCL);
- Linear Low Density Polyethylene (LLDPE) geomembrane liner;
- If required, cushion geotextile layer;
- Geocomposite drainage layer;
- 700 mm sub-soil layer; and
- 300 mm topsoil/mulch layer

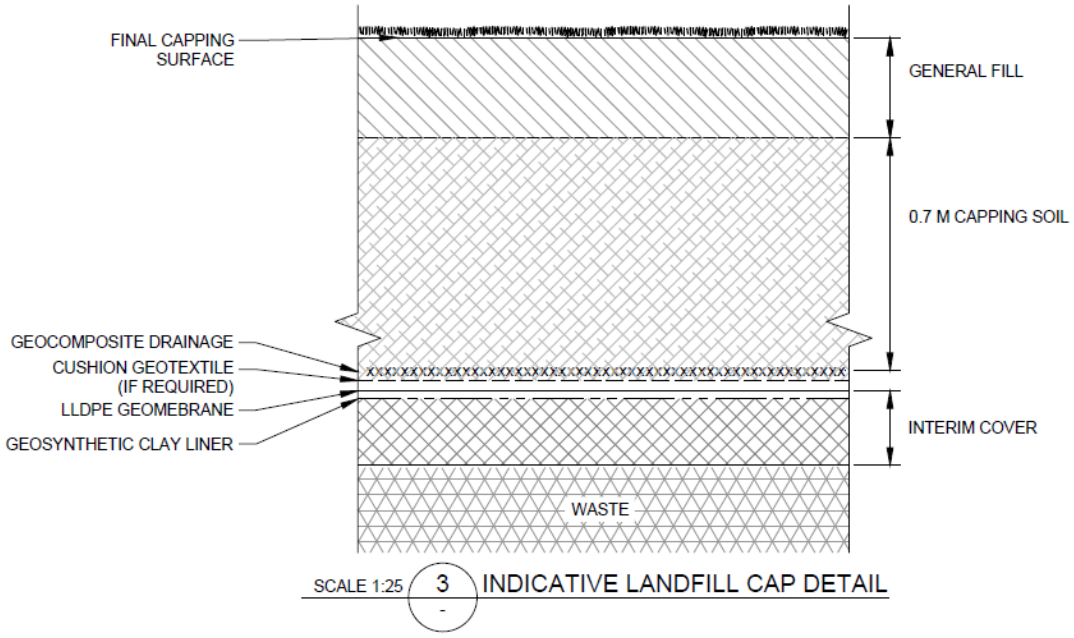


Figure A9: Capping components (Image provided by Golder Associates Pty Ltd)

The finished capped surface will be progressively rehabilitated for suitable post closure land use, and if planting is required, the plants will be selected from locally endemic species with shallow root structures to maintain the integrity of the capping system. Given that the capping system will

be developed in accordance with the above specification and that the GHD stability review considers this capping to be stable, the CEO's delegate is satisfied that the proposed capping is acceptable.

Emissions and Monitoring

A10 Emissions of Landfill Gas (LFG)

Landfill Construction

The proposal has stated that two subsurface monitoring points will be installed to monitor background gas levels. The installation of these bores has been included on the Works Approval as condition 1.2.4 with certification of installation required under condition 3.1.3.

The background gas level monitoring has been included on the Works Approval as condition 2.1.5 which requires monthly monitoring commencing within 28 days of the bores being installed. These conditions have been included to reflect the commitments made in the occupier's application and will assist in the management of landfill gas during operations.

No emissions of landfill gas are expected at the construction stage.

Landfill Operation

A LFG assessment has been undertaken by Golder Associates Pty Ltd (Golder) using the GasSim model. Modelling has been based on an annual waste throughput of 250,000 tonnes per year with approximately 50% of waste being municipal solid waste and the other 50% being commercial and industrial waste, with a dry to average moisture content. Golder has advised that the waste degradation rates (k values) in Western Australia generally range from 0.02 to 0.06 which does not fit with the default rates of GasSim. The waste degradation rates used for the modelling are somewhat greater than the WA rates so Golder has considered the results as being conservative.

Rates were calculated using 50th and 90th percentiles (50% and 90%) which outline the probability that the LFG production rate will not be exceeded. Rates after 1 year of landfilling are estimated at 32 m^3/hr (50%) and 36 m^3/hr (90%) meaning that there is a 50% chance that the LFG production rate will be less than or equal to 32 m^3/hr and 90% chance that the rate will not exceed 36 m^3/hr. The peak LFG production rate is estimated at approximately 21 years of landfilling; associated predicted production rates are anticipated to be 1548 m^3/hr (50%) and 1661 m^3/hr (90%) respectively. The Proponent intends to update the GasSim model throughout the course of waste disposal at the premises.

A review of the LFG modelling and LFGMP provided in the application identified a need for further information to justify relevant conclusions and controls. For example, Golder has stated that lateral LFG migration is considered to be low risk (due to the presence of a liner and cap) however the risk assessment that has been undertaken to demonstrate how this risk rating was identified has not been provided. Additionally, a risk assessment has not been included to assess the impact on environmental receptors in the event of liner failure.

The potential for landfill fire to occur has not been considered in the LFGMP and LFG trigger levels for required actions have not been included. Proposed methods for detecting landfill fire and consideration of emergency management procedures under abnormal operating conditions and malfunction of the LFG management infrastructure will also need to be addressed in the LFGMP. The LFGMP will require updating at the licence application stage to address the above issues. A detailed risk assessment should also be provided as part of the LFGMP to identify all potential sources, pathways, receptors and controls relating to LFG.

<u>Emission Description</u>

Emission: Significant generation of LFG resulting from the decomposition of putrescible waste within the landfill which will be extracted through a LFG extraction system for treatment via

combustion through a modular flare or gas turbine engine for power generation. LFG can also be passively vented to the atmosphere through the surface of the landfill during filling and where a barrier and/or active collection system has not been applied. LFG has been considered as both a point source and fugitive emission.

The typical components of LFG are methane, carbon dioxide, nitrogen, oxygen and hydrogen and many trace gases such as hydrogen sulphide, carbon monoxide, halogenated organics and aromatic hydrocarbons.

Impact

When not managed appropriately, LFG will migrate through paths of least resistance including subsurface geological and man-made features such as pipelines and service ducts. LFG emissions can result in odour, asphyxia and can create an explosion risk in certain situations. Carbon Monoxide is formed where there is incomplete combustion of LFG due to ineffective combustion control, which is highly toxic.

The nearest residents are located 1.9 km from the premises. The distance to the nearest house and the rural setting indicates a low risk of potential impact from LFG management measures (including flaring and combustion). This is based on current proximity to housing.

Controls

The proposal includes installation of a LFG extraction system to capture the LFG for treatment via combustion through a modular flare or gas turbine engine for power generation. The flaring also assists in odour reduction as methane is converted into carbon dioxide.

The initial extraction and flare are anticipated to be installed within the first five years of operation with the flare being able to treat LFG production rates of around 100-500 m^3/hr. The flare will be upgraded as required to treat higher LFG production rates. When LFG production rates have reached optimum levels (approximate generation of 600 – 800 m^3/hr to power a 1MW engine), an LFG engine will be considered for installation to convert LFG into energy for use on-site or to be put back into the power grid. Applications will be submitted to relevant authorities for approval prior to installation of flares and the LFG engine.

Flares will be fitted with alerts (SMS texting and flash back arrestors) for flame fails so that relevant persons are notified immediately in the event of a malfunction.

The proposal includes extraction wells allowing condensate to be collected in barometric condensate drop out traps or in pumped condensate collection vessels, with pipework constructed to allow long term settlement of condensate. Condensate collected in the system is proposed to be treated and disposed in the same manner as leachate, as discussed under A4.

The landfill is designed with a lining system (discussed under section A3.1) to assist in containment of LFG within the landfill cell and prevent lateral migration of LFG.

The final capping of each cell has been proposed in accordance with the VIC BPEM and assists as a barrier between LFG and the environment. The proponent will be installing vertical and horizontal wells (where required) to capture LFG within the active and capped landfill areas. The wells will maintain negative pressure to ensure that each well maintains similar LFG production rates. The extraction system and wells will be installed within at least six months of an area being filled. The LFG extraction and treatment system is proposed to be designed and installed by suitably qualified professionals.

The proponent has submitted a “Landfill Gas Management Plan, Allawuna Farm Landfill” prepared by SITA (March 2015) (LFGMP) which entails:

- Each LFG extraction well to be monitored on a fortnightly basis;
    - Monitored using a hand held sampler;
    - Ensuring LFG is extracted at the ideal rate; and

  - LFG balancing to be conducted by an appropriate professional.
- LFG extraction system will be inspected visually each day;
  - Checking system is working at capacity;
  - Checking for pipe blockages;
  - Checking for any damage to pipes;
  - Checking that condensate collection systems are in working order; and
  - Checking for detection of any odours
- Surface monitoring of LFG across the landfill including final capped and working areas
  - Conducted bi-annually using an Inspectra Laser Methane Gas analyser (or equivalent); and
  - Identification of surface LFG will involve remedial action such as the addition of suction to extraction wells in the area, applying additional cover material, repairs if there is any damage in the area (including the cap), installation of additional LFG extraction wells and infrastructure.
- Subsurface monitoring
  - Two monitoring points will be installed under the Works Approval between the site office and landfill footprint area to monitor for background gas levels.
  - Additional monitoring points will later be installed on either side of the landfill footprint area;
  - Monitoring points will initially be tested on a monthly basis;
  - Monitoring will commence prior to any waste being placed in the landfill; and
  - If LFG is detected, additional monitoring stations will be installed and monitoring frequency increased to be able to more accurately assess the situation and determine what remediation action is required.

Risk Assessment
Consequence: Major
Likelihood: Unlikely
Risk Rating: Moderate

Regulatory Controls
Conditions for LFG monitoring will be considered for inclusion on the licence as well as the inclusion of a licence condition to maintain a 0.3 metre maximum head of leachate on the liner to assist in the prevention of LFG extraction wells becoming blocked with leachate.

It is recommended that a new (updated) LFGMP and associated risk assessment be submitted as part of the licence application which addresses the gaps identified in DER's review as detailed at the start of this section. DER may consider that a condition be included on the licence to require compliance with the LFGMP. Conditions for the installation and monitoring of background gas levels have been included on the Works Approval as discussed in the 'Construction' section above.

Residual Risk
Consequence: Major
Likelihood: Unlikely
Risk Rating: Moderate

A11 Fugitive Emissions to Groundwater

Landfill Construction and Operation
Emission Description
Although this emission is generated during site operations (during and following waste placement), the risks are considered as part of landfill design and prior to construction. The main emission from landfills that poses a risk to groundwater is leachate. Leachate seepage to groundwater from landfilling operations may arise if liner defects occur during placement and/or over time in the liner or leachate management system, including leachate storage pond.

Landfill liner systems cannot be made completely impermeable and all liners will therefore experience a certain level of leachate seepage. Landfill leachate from a putrescible landfill mainly consists of dissolved organic matter and inorganic compounds such as sulphates, chlorides and ammonium salts. Leachate may also contain some metals including lead, nickel and copper, hydrocarbons and synthetic organic compounds.

Impact
Potential contamination of groundwater and surface water receptors. This includes Thirteen Mile Brook located 350 m west of the site as discussed under sections A2.2 and A2.3.

Controls
The liner and leachate management design are detailed in Sections A3 and A4. The landfill has been designed to limit leachate movement through the liner and is appropriately designed for the environmental setting.

The existing groundwater monitoring network installed at the site is appropriately located and installed to monitor both background groundwater quality and potential movement of leachate though any liner defects.

Risk Assessment
Consequence: Moderate
Likelihood: Unlikely
Risk Rating: Moderate

Regulatory Controls
The primary controls limiting leachate emissions to groundwater (and indirectly to surface water) are the correct design and construction of the landfill cells. This is required through conditions 1.2.1, 1.2.3 to 1.2.5 and 3.1.1 to 3.1.3 of the Works Approval.

Operational conditions will be considered as part of the licence assessment however it is likely that conditions will be included on the leachate to require a limit of 300mm of leachate head within the leachate sump and ensuring a freeboard of 0.5 m of the leachate dam. The licence may also include specific management conditions to be undertaken in the event that leachate head in the sump is exceeded or when freeboard in the leachate dam is exceeded. Management actions will likely include the requirement to remove leachate offsite, or undertake maintenance if blockages in the system are identified. Monitoring conditions may be included on the licence to verify the leachate head in the sump and to monitor the leachate extracted from the sump.

Residual Risk
Consequence: Moderate
Likelihood: Unlikely
Risk Rating: Moderate

A12 Fugitive Dust Emissions

Landfill construction

Emission Description
Dust can be generated during the construction of the landfill cells by vehicle movements, and earthworks.

Impact
Fugitive dust emissions can impact on local air quality and cause nuisance to residents although these are located some distance from the premises (1.9 km). Fugitive dust emissions can also adversely impact on adjacent vegetation including any agricultural crops grown on land adjacent to the premises, including crops grown within the existing farming areas of the Allawuna Farm.

Controls
The proponent has proposed a number of preventative measures to manage fugitive dust from construction. These include wetting down/sealing all trafficked roads, restricting on-site traffic speeds, and using water trucks to suppress dust from stockpiles.

The CEO's delegate considers that the assessment of fugitive dust emissions has been undertaken appropriately in the application. The environmental risks associated with fugitive dust emissions under the construction phase of the premises are therefore considered acceptable.

Risk Assessment
Consequence: Minor
Likelihood: Unlikely
Risk Rating: Moderate

Regulatory Controls
Condition 1.2.1 of the works approval requires the construction work and emissions and discharges during construction to be managed and monitored in accordance with the documentation submitted in support of the application. This requires the proponent to implement the dust preventative measures set out above during construction of the landfill.

Condition 1.2.5 has been included to install four dust monitors at the Premises in accordance with the Australian/New Zealand Standard AS/NZS 3580.1.1:2007 Methods for sampling and analysis of ambient air – Guide to siting monitoring equipment. Condition 3.1.3 requires certification that the installation of these dust monitors has been complied with.

No specific conditions for dust emissions monitoring have been included on the works approval as the emission risk has been identified as 'moderate' which is considered acceptable given the 1.9km separation distance to sensitive receptors.

Residual Risk
Consequence: Minor
Likelihood: Unlikely
Risk Rating: Moderate

Landfill operation
A review of the following documents in regards to managing dust emissions at the premises has been undertaken:

- *Allawuna Landfill – Dust Management Plan* prepared by Bowman & Associates Pty Ltd, 28 April 2015 (April DMP); and
- *Allawuna Landfill – Dust Management Plan* prepared by Bowman & Associates Pty Ltd, 14 July 2015 (updated DMP).

An assessment of the April DMP submitted by the proponent identified the following deficiencies:

- Further information was required on the types of dust monitors proposed;
- Siting of dust monitors in accordance with *AS/NZS 3580.1.1:2007 Methods for sampling and analysis of ambient air – Guide to siting monitoring equipment* (AS/NZS 3580) was not considered*;*
- Clarification on monitoring frequency was required;
- Nature and potential characteristics of any contaminated dust and the potential impacts of this type of dust was not addressed;
- Details on prevailing wind directions was not provided; and
- Comparison of the April DMP against the document *A guideline for managing the impacts of dust and associated contaminants from land development sites, contaminated sites remediation and other related activities* (March 2011), published by the Department of Environment and Conservation (DEC Dust Guidelines) was not evident**.**

An updated DMP (updated 16 July 2015) was submitted to DER. An assessment of the updated DMP identified the following:

- The morning prevailing wind direction is south-easterly changing to a westerly in the afternoon;
- Met One Instruments' E-Sampler light scatter aerosol monitors (or similar) would be used for monitoring;
- Details on the siting of dust monitor locations had been selected in consideration of the AS/NZS 3580 and has referred to 'peak sites' and 'background sites' for the choice of locations;
- It was unclear if the siting of the dust monitor locations complied with locations specified in section 7, Selection of Monitoring Sites, of AS/NZS 3580;
- Contaminated dust had still not been considered;
- A comparison of the updated DMP against the DEC Dust Guidelines had not been provided;
- Periodic monitoring of asbestos had not been considered; and
- The Total Suspended Particulate Matter annual level of 90 µg/m^3 referenced in Table 2 (Standards and Goal for Particulates) of the updated DMP is not an annual level and is a 24 hour standard as referenced by the National Health and Medical Research Council. This document was also rescinded on 19 March 2002. This may have an impact on the DMP.

Following the review of the updated DMP the following aspects should be considered for inclusion in an updated DMP which should be addressed at the licence application stage:

- Depositional dust gauges should be used around the boundary of the landfill footprint to assist in determining the levels of dust deposition and consideration of any contaminated dust also being deposited;
- Periodic monitoring of asbestos dust should be included in the DMP;
- Dust should be characterised to identify any potential contaminants and a risk assessment should be undertaken to determine controls to address the associated risks; and
- The impact of dust emissions on the nearby surface waters should be considered.

Emission Description

- Dust generated by vehicle movements including the delivery, deposition and compaction of waste; and
- The deposit of dusty loads at the site including potential asbestos fibres from asbestos loads and dust generated by wind blowing across open and restored landfill faces.

Impact

Fugitive dust emissions can impact on local air quality and cause nuisance to residences although these are located some distance from the premises (1.9km). Fugitive dust emissions can also adversely impact on adjacent vegetation including any agricultural crops grown on land adjacent to the premises, including the organic and biodynamic farms located approximately 2km and 2.5km respectively, from the landfill footprint area.

Dust containing asbestos fibres represents a risk to the health of anyone in the vicinity of the site. The proponent has provided a Standard Operational Procedure and two Work Instructions which have been addressed above in section 2.1 'Waste Acceptance and Processing'. Asbestos wastes are required to be sufficiently wrapped and contained within thick plastic and if identified in the waste stream, to be wet down as required to prevent the release of fibres.
Dust can also impact on nearby surface water within the Thirteen Mile Brook (approximately 310m from landfill cells).

Controls

The DMP (Bowman & Associates Pty Ltd, July 2015) outlines the following controls:

- Wetting down all unsealed trafficked areas at the start of each day;
- Wetting down dust generating activities;
- Reducing on-site speed;
- Wetting down access roads throughout the day as required;

- Dust generating loads to be wet down during delivery;
- Trucks to pass through a wheel wash prior to leaving the premises;
- All trucks entering and leaving the premises will be covered;
- Undertaking regular visual observations;
    - Continuously for dust leaving premises boundary;
    - Twice daily for dust at site access on Great Eastern Highway; and
    - Continuously for dust generation on internal roads.
- Dust generating stockpiles and storage areas to be covered or wetted down;
- Dust generating activities will cease during unfavourable weather conditions (wind speeds around 26 – 33 knots);
- Maintaining a supply of water for dust suppression;
- Recording and investigating any complaints; and
- Consideration of utilising additional dust suppression methods including use of water trucks or sprays, hydro seeding or mulching, or chemicals that assist in forming a crust over surfaces.

The DMP also specifies that monthly monitoring of PM_{10}, wind direction, wind speed and ambient temperature will be undertaken at four locations on the property, three at the premises boundary in direct line with the three closest sensitive receptors, and one adjacent to the landfill area as shown in the Figure A12 below. These monitoring locations have selected based on location of sensitive receptors, prevailing wind direction, and consideration of AS/NZS 3580. It has not been confirmed if these locations comply with the siting requirements of AS/NZS 3580.

The types of monitoring equipment proposed are Met One Instruments' E-Sampler monitors, or similar light scatter aerosol monitors. A windsock will also be placed at the premises to given an indication of wind strength and direction and equipment will be on-site to record temperature. DER requested that the proponent provide an Asbestos Management Plan (AMP) to be developed in accordance with *Guidelines for managing asbestos at construction and demolition waste recycling facilities*, published by the former Department of Environment and Conservation (December 2012) (Asbestos Guidelines).

The proponent has also provided two Work Instructions titled 'Asbestos Waste Management – Allawuna' (29 July 2015), and 'Asbestos Waste – Identification, Isolation and Containment – Western Australia' (9 September 2014) to manage the acceptance, handling and burial of Special Waste Type 1 (asbestos).

The first Work Instruction contains the following controls:

- Personal protective equipment specifications for on-site workers to be worn when handling asbestos wastes;
- All staff to be trained when handling asbestos;
- Asbestos to be correctly wrapped and labelled;
- Recording of asbestos burial locations;
- SITA personnel to attend each load of asbestos being buried; and
- Covering of asbestos with 300mm of cover material as soon as feasible and before waste has been compacted, with final cover of 1m.

The proponent has also provided a Standard Operating Procedure (SOP) 'Asbestos Waste' (30 November 2014).

Although a specific AMP has not been provided, the SOP and Work Instructions address the basic requirements of the Asbestos Guidelines as they apply to landfill operations and DER considers that these are sufficient for the management of handling and landfilling asbestos waste at the premises. The WAM also makes specific reference to implementing the SOP and Work Instructions for asbestos wastes.

Risk Assessment (Dust)
Consequence: Moderate
Likelihood: Unlikely
Risk Rating: Moderate

Given the considerable distance (1.9 km) of sensitive receptors it is unlikely that the adjacent residences will be impacted to a moderate degree by dust emissions. The resulting moderate level of risk to the environment and public health associated with dust emissions is considered to be acceptable.

In the event that the above dust controls measures fail, it is considered that dust emissions will increase and it is considered possible that dust will impact on the surrounding residences.

Risk assessment (Dust containing asbestos)
Consequence: Severe
Likelihood: Rare
Risk Rating: High

The controls proposed by the proponent (implementation of the SOP and Work Instructions) should control asbestos such that it is rare that asbestos fibres will be released from the activities. However, due to the severe consequences of asbestos fibres reaching a receptor the risk rating is high.

Regulatory Controls
The installation of the abovementioned dust monitors is required as specified in the 'construction' section, with monthly dust monitoring to occur during construction.

The proponent has committed to undertake monthly monitoring of total suspended particulate matter during operations, as documented in the DMP. It is recommended that a condition be included on the licence to maintain the risk level rating and commitments made by the proponent. Additional monitoring for asbestos fines is also likely to be included on the licence.

Operational conditions related to covering of waste will assist in reducing dust emissions and a condition may also be included to require sufficient liquid to be maintained within the leachate pond to reduce the risk of dust emissions from this area.

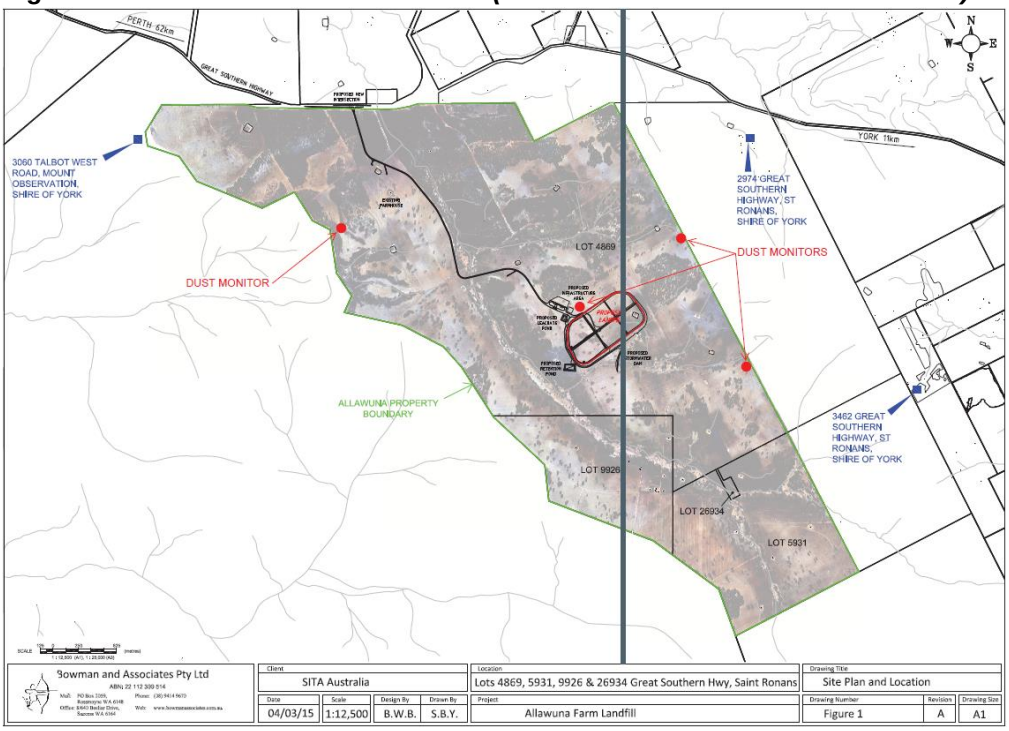
A condition will likely be included on the licence to require a complaints management system to be maintained which will record any complaints received for dust and require an investigation to be undertaken in response to the complaints received.

It is recommended that a new DMP be submitted as part of the licence application which addresses the gaps identified in DER's review as detailed at the start of this section. DER may consider that a condition be included on the licence to require compliance with the DMP.

Conditions relating to the acceptance, handling and covering of asbestos waste will likely be imposed through the licence which will assist in the regulation and reduction of asbestos containing dust emissions.

Residual Risk
Consequence: Severe
Likelihood: Unlikely
Risk Rating: High

Figure A12: Location of dust monitors *(Source: Bowman & Associates DMP)*



A13 Odour Emissions

Landfill construction

No waste will be accepted at the premises during construction therefore no fugitive odour emissions are expected at the construction stage. Specific conditions for odour emissions are not required in the works approval.

Landfill Operation

Odour modelling was prepared by the proponent and reviewed by a DER Air Quality Officer. In general, the estimated emission rates used in the modelling appear to be conservative however it is difficult to substantiate given the difficulty in characterising odour emissions from these sources. It is noted that the cell modelled for this proposal is not the cell that is closest to the nearest residence however the modelled cell is representative of operations for Cells 1 and 2.

The proponent has provided the *Allawuna Farm landfill – Odour Management Plan* (16 July 2015) prepared by Bowman & Associates Pty Ltd (OMP) for assessment as part of this application. DER's Air Quality Officer identified that while the OMP provides a general approach to odour management, contingencies for odours have not been adequately addressed.

DER's Air Quality Officer identified that odours from the leachate storage dam may pond in the valley under light and stable wind conditions, causing this odour to travel substantial distances offsite in the presence of stronger wind conditions. The OMP will be required to be updated at the licence application stage to address the leachate pond as an emission source for ponding.

<u>Emission Description</u>

Odours generated from decomposing nature of putrescible waste including the generation of landfill gases. Fugitive odour from leachate pond can also be generated.

<u>Impact</u>

The key impact from odour is nuisance and detriment to the local amenity. The nearest odour sensitive receptor, a residential property, is located 1.9 km from the proposed landfill area.

Odour has the potential to accumulate in the valley under light and stable wind conditions which could migrate offsite and impact on other residences located several kilometres from the landfill.

Controls: The OMP specifies the following controls for general site activities:

- Use of daily cover on waste;
- Covering all loads of waste arriving and leaving premises;
- Daily odour audits using the SUEZ Facility Odour Audit Tool;
- Complaints management and investigation;
- Landfill gas extraction system (as detailed in point source emissions to air); and
- Management of leachate pond (as discussed under A4).

No specific controls have been proposed for odours from the leachate pond other than the use of aerators to ensure the pond remains aerobic.

Risk Assessment
Consequence: Minor
Likelihood: Unlikely
Risk Rating: Moderate

Regulatory Controls
The CEO's delegate considers that regulatory controls are likely to be imposed at the licensing stage to ensure the timely covering of waste with appropriate material to minimise odour from deposited waste, appropriate management of leachate, passive venting of landfill gas and the setting of emission limits on landfill gas combustion processes to reduce the risk of odorous gases being emitted.

Other conditions that will be considered for inclusion on the licence may require the occupier to complete an annual review on landfill gas generation rates including flow rates and concentrations, and the consideration of treatment measures such as the installation of a flare or active extraction.

Residual Risk
Consequence: Minor
Likelihood: Unlikely
Risk Rating: Moderate

A14 Noise Emissions

The proponent provided a Noise Assessment for the construction and operational aspects of the proposal. The following technical reports have been assessed by a DER Noise Officer:

- *Environmental Noise Assessment, Allawuna Landfill Environmental Noise*, prepared by Vipac Engineers & Scientists Ltd (31 March 2015); and
- *Environmental Noise Assessment, Allawuna Landfill Environmental Noise*, prepared by Vipac Engineers & Scientists Ltd (19 August 2015)

The acoustic survey, as documented in both Vipac reports, was undertaken during 23 – 31 August 2012 and was based on the following noise sources during operations:

- 30t and 50t compacter;
- Dozer;
- dump truck;,
- water cart;
- grader; and a
- Semi-trailer road train.

The following aspects were detailed in the March 2015 report:

- Proposed operating hours between 0700 to 1700 hours Monday to Friday during both construction and operation phases;
- Based on the results in the noise assessment, operations can comply with the assigned levels for daytime but not with the assigned levels for night-time hours.

DER's Noise Officer's assessment of the March 2015 report noted the following:

- The methodology and assumptions used in the noise modelling of the March 2015 Vipac report are acceptable and sufficiently robust for conducting assessment of noise impact from this proposal; and
- The results and conclusions provided in the assessment seem reasonable and in consideration that construction will be undertaken during day-time hours, and that there is large buffer distance between the landfill and nearest noise sensitive receptors, the proposal is predicted to comply with the *Environmental Protection (Noise) Regulations 1997* (Noise Regulations) for day-time hours. This report was prepared in consideration of operations occurring during day-time hours.

The following aspects were added in the August 2015 report:

- Night-time work with reduced operation was proposed, namely operations between 0600 to 0700 Monday to Saturday;
- Assessment of noise emissions from the proposed night-time operation was conducted; and
- Based on the results in the noise assessment, SITA believes the proposed night-time work can comply with the assigned noise levels for night.

DER's Noise Officer's assessment of the August 2015 report has noted the following:

- Road train sound power levels have been reduced in accordance with the "Vehicle Standard (Australian Design Rule 28/01 - External Noise of Motor Vehicles) 2006", Australian Government, however this reduction needs to be justified and demonstrated in the report;
- A detailed assessment of night-time operations has not been undertaken; for example:
    - Ambient night-time noise analysis has not been provided;
    - Consideration of strong temperature inversions at night; and
    - Consideration of tonality at night when ambient noise levels are low.
- The August 2015 report has not satisfactorily demonstrated that the proposed night-time operations. Unless further information is provided, any licence granted by the CEO may seek to prevent operations commencing prior to 0700 hours.

The planning approval authorises the hours of operation of 0600 to 1700 Monday to Friday and 0600 to 1600 on Saturdays (excluding New Year's Day, Good Friday and Christmas day). These gaps will need to be addressed as part of the licence application to demonstrate that the operations can comply within the specified operational hours.

Landfill construction

Noise emissions during landfill construction typically arise from vehicles on the premises undertaking earthworks. Noise from vehicles can include reversing beepers.

Condition 1.2.1 of the Works Approval requires the works to be constructed and emissions and discharges from the construction works to be managed and monitored in accordance with the documentation submitted as part of the application. This documentation includes the NMP prepared by Bowman & Associates Pty Ltd.

The proponent has proposed to undertake noise monitoring during the construction phase of the premises to validate compliance with the Noise Regulations.

Condition 2.1.6 (and Table 2.1.3) has been included on the Works Approval to require noise monitoring to be undertaken during the construction of each cell assessed against the *Environmental Protection (Noise) Regulations 1997.* This condition has been included to meet the proponent's commitment to undertaken noise monitoring as detailed in section 4.4 of the Noise Management Plan discussed below, as well as verifying compliance with assigned regulatory

levels specified in the Noise Regulations. This condition also requires the proponent to propose noise mitigation measures if improvements are required to meet the prescribed standard. Condition 2.1.7 has been included on the Works Approval to require all construction activities to cease until any proposed noise mitigation measures identified in any reports submitted in accordance with Table 2.1.3, have been implemented at the Premises.

Landfill operation
The following risk assessment has been completed as per the March 2015 report with operations commencing at 0700 hours.

Noise emissions during landfill operation typically arise from vehicles on the premises, including dozers, delivery trucks, compactors and graders. Noise from vehicles can include reversing beepers. Other potential noise sources include landfill gas extraction systems and pumps associated with the leachate and landfill gas management systems.

Impact
Nuisance impacts on residential community may result in amenities being impacted. Impacts are expected to be minimal, localised and short-term, if the operation can be limited to daytime only.

The nearest noise sensitive receptors, being residences, have been identified as being located approximately 1.9km to the north-east of the landfill and 2.4km south-east of the landfill. A third noise sensitive area, the Mount Observation Picnic Area, has also been considered which is located approximately 2.5km north-west of the landfill. Modelling has not been undertaken at the two residences located on the Allawuna Farm property, owned by the landholder.

Reversal tonal alarms can carry long distance and can cause nuisance impacts.

Controls
The proponent has identified the following noise emission controls which are documented in the Allawuna Farm Landfill – Noise Management Plan (16 July 2015), prepared by Bowman & Associates Pty Ltd (NMP):

- Enforcing speed limits of on-site vehicles and machinery;
- All of the heavy machinery and mechanical plant used on-site will be fitted with acoustic panels and mufflers; and
- Construction of noise bunds around area of the landfill as a contingency if noise emissions become unreasonable.

The proponent has also proposed to undertake noise monitoring during the operational phase of the proposal.

Risk Assessment
Consequence: Insignificant
Likelihood: Unlikely
Risk Rating: Low

Regulatory Controls
The requirement to undertake a noise assessment once operations have commenced will be included on the licence as per the proponent's commitments outlined in section 4.4 of the NMP.

Based on information provided in the March 2015 Vipac report, the CEO's delegate believes that in consideration of the large separation distances (1.9 km), noise characteristics are unlikely to be an issue for this site during day-time hours. Noise emissions during night-time hours are required to be addressed under an updated acoustic assessment to be provided as part of the licence application.

DER's Noise Officer's experience with the tonal reversing beepers has identified that noise emissions from vehicles may travel several kilometres from the source and may cause nuisance impacts. It is recommended that non-tonal reversing beepers are fitted to all vehicles and mobile

equipment. If nuisance noise emissions are identified during construction or operations, the CEO's delegate will consider the inclusion of conditions to manage impacts of the emission.

Residual Risk
Consequence: Insignificant
Likelihood: Unlikely
Risk Rating: Low

A15 Emissions to Surface Water

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

Landfill Construction

The surface water management drainage and associated systems will be installed during construction of the landfill to restrict surface water entry into the landfill footprint during construction and to assist in the prevention of emissions during the operational stage.

Emission Description

Stormwater contaminated from waste storage, processing and fill areas. Surface water may become contaminated from the addition of sediment, heavy metals and nutrients.

Impact

Uncontaminated surface water diverted away from the landfill footprint area:

Large-scale disturbance associated with landfill operations and associated surface water and stormwater diversion has the potential to impact on the surrounding environment through the potential erosion or sedimentation of local drainage lines and surface water receptors. This includes Thirteen Mile Brook located 350m west of the landfill cells and the seasonal creek line south of the site, which feeds into the Thirteen Mile Brook during winter.

The site is located on the slope of a hill which receives upstream surface water run-off. The stormwater dam is proposed to be constructed on the seasonal creek line which may result in changes to downstream flows and migration of sediment as well as potential impacts on the ecology of surface water and riparian vegetation.

Potentially contaminated surface water within the landfill footprint:

Rainfall and surface water entering the landfill will be considered as leachate and will be managed accordingly. Refer to section A4 for DERs assessment on leachate management at the premises.

Controls

Uncontaminated surface water:

The proposed landfill design includes plans for the establishment of diversion bunds (0.5m high) and drains (0.5m high by 3m wide) to divert any surface water and stormwater away from waste storage and landfill areas. The stormwater drain is proposed to be installed on the eastern side of the proposed landfill with the diversion bunds constructed around the permitter of the landfill. All surface water and stormwater will be diverted to the stormwater dam located on the creek line to the south-east of the landfill footprint. The drainage system is depicted in Appendix L.

The stormwater dam will be constructed of compacted engineered clayey material and will have a capacity of 36,000 m^3. A Sediment Management Structure (SMS) is proposed to be constructed on the creek line down gradient from the stormwater dam. The SMS is proposed to be constructed of aggregate (between 250 – 500mm in size) to allow for the passage of water while reducing the passage of suspended solid particles.

The proponent has provided the *Allawuna Landfill Surface Water and Sediment Management Plan,* August 2015, prepared by Golder Associates Pty Ltd (SWMP) for assessment as part of this application. The SWMP outlines the following controls:

Surface water

- All relevant employees to be trained to understand the SWMP and systems in place;
- Stormwater diversion drains and bunds to be regularly inspected and maintained;
- Stormwater dam and spill integrity to be inspected and maintained regularly;
- Water levels in the stormwater dam will be monitored during a major rainfall event;
- Surface water will be monitored at the stormwater dam and/or downstream discharge point; and
- In the event of heavy rainfall or localised flooding, temporary interception drains or containment bunds can be implemented around the site to divert the additional inflow of surface water away from storage and waste disposal areas.

Sediment

- Temporary sediment measures to be implemented (i.e. sand bags) as required during construction to prevent excessive sediment entering stormwater drains;
- Erosion control measures and sediment traps to be inspected and maintained to design capacity prior to winter periods;
- In the event of heavy rainfall or localised flooding, additional sediment controls such as sand bags or silt fences can be temporarily installed further down the creek line to assist in the prevention of sediment migration towards Thirteen Mile Brook;
- Erosion remediation controls such as rock lining, protection mats or vegetation/mulch covers, will be implemented if erosion is identified;
- Sediment that has been contained behind the SMS or within the stormwater dam will be removed using a type of excavating machinery and will be transported for disposal in the landfill; and
- All relevant employees to be trained to understand the surface water management plan and systems in place.

Potentially contaminated surface water

The proponents have committed to implementing a number control measures to minimise the potential for potentially contaminated surface water leaving the landfill footprint and potentially impacting on adjacent watercourses. These measures include:

- Diversion drains and bunds to prevent uncontaminated stormwater from entering the waste storage and landfilling areas;
- Lined landfill with active leachate collection system to contain and manage (evaporate) leachate;
- Large portion of the landfill is below ground; hence, improved control of surface water runoff;
- Use of daily cover material over waste with a final capping system designed with a rate of infiltration not exceeding 75% of the seepage rate; and
- The landform of the proposed final capping will be constructed at a minimum gradient of 1:50 and a maximum gradient of 1:5 to facilitate drainage of stormwater away from the surface.

The lined retention pond and leachate pond are available for containment of any contaminated or potentially contaminated stormwater, if required.

Risk Assessment

Consequence: Moderate
Likelihood: Unlikely
Risk Rating: Moderate

Regulatory Controls

Condition 1.2.1 of the Works Approval requires the construction works to be undertaken in accordance with the landfill design in the application. This includes the construction of surface water diversion bunds and drains to divert all surface water around the proposed cell prior to cell construction.

Condition 2.1.5 has been included on the works approval to require baseline surface water monitoring to be undertaken prior to the commencement of construction and operation activities.

The need for regulatory controls relating to the management of surface water and stormwater, and the monitoring of water on the premises during landfill operation, will be considered at the licensing stage. However, conditions will likely include the requirement to prevent stormwater becoming contaminated and to treat any contaminated or potentially contaminated stormwater as required before being discharged off the premises, as well as requirements for monitoring of surface water. Conditions will also be considered to require adequate freeboard to be maintained on the retention pond and leachate pond to minimise the risk of overtopping.

Residual Risk
Consequence: Moderate
Likelihood: Unlikely
Risk Rating: Moderate

A16 Premises Security

The proponent has committed to the following security measures at the premises:

- Landfilling area to be enclosed within a meshed security fence 1.8m high with barbed wire;
- Access gates will be installed which will be locked outside the hours of operation; and
- All vehicles entering the premises are required to stop at the weighbridge before proceeding to the landfill area.

The CEO's delegate considers these security measures suitable and licence conditions relating to the ongoing management of site security will likely be applied for site operations.

The conditional planning approval does not authorise public access to the landfill.

A17 Waste Acceptance and Processing

Landfill Construction

No waste will be accepted on-site during the construction stage; therefore no conditions are required in the works approval.

Landfill Operation

The proponent is expected to apply for a licence to accept up to 250,000 tonnes per year of waste types that are consistent with the acceptance criteria for Class II landfills as specified in the *Landfill Waste Classification and Waste Definitions 1996 (as amended 2009)* published by the former Department of Environment and Conservation (Waste Definitions).

The proponent has provided a procedure manual titled *Waste Acceptance Manual, Allawuna Farm Landfill, Version 1* (July 2015) (WAM) for assessment as part of this application. The manual specifies the types of wastes to be accepted at the premises, provides details on burial requirements, sampling and analysis requirements, and rejection procedures for non-conforming wastes.

Special Waste Type 2 (biomedical waste) is addressed under the WAM and includes the following controls:

- Waste burial location to be marked with GPS and a record maintained on-site;
- Waste to be immediately covered with at least 1m of cover material;
- SITA personnel to be present when each load of biomedical waste is buried.

The WAM has specified that hazardous or dangerous wastes such as liquid wastes, flammables, corrosive, radioactive or infectious wastes, will not be accepted at the premises.

Waste is predominantly sorted at SITA's licensed Welshpool and Landsdale transfer stations which will reduce the requirement for sorting of wastes at the landfill. Pre-sorted waste has a lower risk of containing non-conforming waste. Any non-conforming waste identified at the landfill will be removed and stored in an isolated area before it is removed from the site and taken to an appropriately licensed disposal facility.

The majority of waste will be received from SITA's Landsdale and Welshpool transfer stations however, Class II waste from other commercial waste collectors for local governments and within the region may also be accepted for disposal. The proponent has committed to including signage to specify the waste types that are authorised to be accepted at the premises. Members of the public will not be permitted to bring waste to the site.

A18 Vermin Management

Typical vermin that can be found on landfill sites include rats, mice, flies, mosquitoes, feral cats, foxes, birds and cockroaches. If uncontrolled, these vermin can be a nuisance and affect public health and surrounding ecosystems.

Landfill Construction

Vermin are not expected to be an issue during the construction stage; therefore no conditions are required in the works approval.

Landfill Operation

The putrescible nature of the waste proposed for disposal at the premises has the potential to attract flies, vermin and other pests such as feral animals and pest bird species.

Impact: Feral animals, such as foxes and cats, have the potential to kill native fauna and compete with native fauna for natural resources including food and habitat.

Potential alteration and destruction of local ecosystems resulting from the threat of vermin from the landfill site. The premises boundary is adjacent to the 44,000 hectare Wandoo National Park and the proposed landfill cells are located 350 metres east of the Thirteen Mile Brook.

Potential nuisance to local residents from the presence of flies and vermin. The nearest residences located outside of the proposed premises boundary are located approximately 1.9km north-east and 2.4km south-east of the landfill cells and surrounding area.

Controls: The proponent has provided the *Allawuna Landfill – Vermin Management Plan,* 16 July 2015, prepared by Bowman & Associates Pty Ltd (VMP), for assessment as part of this application.

The VMP outlines the following controls:

- Rodents
  - Installation of bait boxes around the premises;
  - Ongoing inspection and servicing of bait boxes;
  - Dead rodents to be removed when identified; and
  - All rodenticides to be stored in accordance with the *Guidelines for the safe use of pesticides in non-agricultural workplaces (2007)* and *AS 2507-1998 The storage and handling of agricultural and veterinary chemicals.*
- Birds
  - Visual checks of pest bird species will be undertaken daily; and
  - If required, a bird control specialist will be contracted to implement bird control measures at the premises.
- Flies
  - Daily waste covering will assist in reducing flies at the premises; and

    - If required, spraying of flies will be undertaken by adequately trained personnel in a manner that does not impact on the surrounding environment.
- Feral cats
    - Boundary fencing to prevent access to the premises;
    - Use of 1080 baits;
    - Trapping; and
    - Culling if required.

Risk Assessment
Consequence: Moderate
Likelihood: Possible
Risk Rating: Moderate

Regulatory Controls
It is proposed that a condition be included on the licence to require the proponent to implement controls to prevent pests and vermin. Additional conditions, such as the requirement for cover material, will also assist in reducing the risk of pests and vermin at the premises.

This Works Approval does not authorise the culling of any native fauna species. If native fauna become nuisance species at the landfill, the proponent is required to engage with the Department of Parks and Wildlife to develop a management strategy.

Residual Risk
Consequence: Moderate
Likelihood: Unlikely
Risk Rating: Moderate

A19 Litter Management

Landfill Construction
Litter is not expected to be an issue during the construction stage; therefore no conditions are required in the works approval.

Landfill Operation
Emission Description
Emission: Windblown waste and litter from landfilling municipal waste, especially light waste items such as paper, plastic film and plastic bags, can be spread over a wide area by wind movement. The rate of litter borne from landfilling activities will be dependent on the waste type, ambient weather and efficiency of litter prevention activities on-site.

Impact:
Potential contamination and alteration of surrounding ecosystems including the Adjacent Wandoo National Park and Thirteen Mile Brook (located 350 metres west of the proposed landfill cells). Potential nuisance and degradation to the aesthetic value of local properties. The nearest residences located outside of the proposed premises boundary are located approximately 1.9km north-east and 2.4km south-east of the landfill cells and surrounding area.

Controls: Windblown waste has been addressed under the proponent's Dust Management Plan (DMP) and includes the following proposed controls:

- Covering all vehicles entering and exiting the premises to prevent windblown waste; and
- Daily collection of windblown waste from mobile and fixed litter screens, with a minimum height of 1.8 metres

Further to the DMP, the proponent has provided the *Allawuna Farm Landfill – Litter Management Plan,* 16 July 2015, prepared by Bowman & Associates Pty Ltd (LMP), for assessment as part of this application. The LMP outlines further controls including:

- The specification that mobile litter screens will be a minimum height of 1.8 metres;
- Ongoing daily covering of waste; and

- Gates, litter screens and fences to be regularly cleared of litter.

Risk Assessment
Consequence: Moderate
Likelihood: Possible
Risk Rating: Moderate

Regulatory Controls
Conditions relating to the ongoing management of windblown waste will likely be applied to the licence.

Residual Risk
Consequence: Moderate
Likelihood: Possible
Risk Rating: Moderate

A20 Fire Management

Emission Description
Fires at landfills can occur as a result of acceptance of hot loads, vandalism, biological decomposition within the waste mass, and bush fires which can lead to:

- Generation of smoke which may contain contaminants such as carbon monoxide.
- Odour emissions generated from the smoke.
- Leachate release if containment systems fail.

Impact
Contamination of atmosphere with release of smoke and contaminants. Nuisance odour emissions to neighbouring properties. Fires also have the potential to damage site infrastructure and containment including liner systems which may result in leachate release to groundwater or surface water. Destruction to native flora and fauna. Damage to neighbouring properties and threats to human life.

Controls
The VIC BPEM recommends that at least 50,000 litres of water should be retained on-site for use in fighting small fires. The proponent will be installing a 150,000 litre water tank for firefighting use which will be fitted with outlets compatible with the Bush Fire Brigade's equipment. A second water tank will also be installed with a 100,000 litre capacity for general site use but will also have compatible outlets for use in emergencies, as well as the ability to refill tanks from the stormwater dam via an automatic pump system. A pipe and stand pump will be located next to the tanks to refill any water trucks. Additional firefighting equipment such as extinguisher units will be available at the premises.

The proponent has provided the *Fire Management Plan: Allawuna Farm Landfill* (FMP), March 2015, prepared by Bowman & Associates Pty Ltd, which was developed in consultation with the Shire of York's Community Emergency Services Manager and the Department of Fire and Emergency Services (DFES). The proponent will seek endorsement of the FMP by DFES.

Risk Assessment
Consequence: Major
Likelihood: Unlikely
Risk Rating: Moderate

Regulatory Controls
A condition will be included on the licence to require that no waste is burnt on-site. Under the conditions of the planning approval, the FMP is to be prepared on advice from DFES, prior to landfilling activities commencing. It is recommended that the FMP is submitted with the licence application.

Residual Risk
Consequence: Major
Likelihood: Unlikely
Risk Rating: Moderate

A21 Referrals

A21.1 Department of Agriculture and Food:

Extracts of the application that related to the proposal to clear native vegetation were sent to the Commissioner of Soil and Land Conservation, Biosecurity and Regulation on 6 October 2015.

The commissioner provided comments to DER on 5 November 2015 which stated *"the Commissioner has informed the proponent that he has no objection to the removal of the scattered trees adjacent to the existing access track into Allawuna farm."*

On 24 December 2015 the application was again referred to the Department of Agriculture and Food (DAFWA) to request advice in regards to biosecurity risks and any potential losses of organic certification from farms in the region.

DAFWA provided comments to DER on 23 February 2016 to advise that DAFWA had *"no evidence that the many landfill sites already in operation in rural areas pose an unacceptable biosecurity risk for agriculture."* DAFWA also commented that certification requirements are not a function of DAFWA but of the relevant certifying bodies, however *"DAFWA maintains a register of sensitive properties."* DAFWA also noted that landfills may be sources of disease, pollutants, weeds and pests, and that fencing would be required to reduce site access for feral species such as feral pigs.

A21.2 Environmental Protection Authority:

A copy of the initial works approval application was referred to the Environmental Protection Authority (EPA) in 2013 by the applicant's previous consultants. The EPA responded in July 2013 that the application was "Not assessed – Public Advice Given".

The advice on this referral is available on the EPA's website, reference A584547. DER referred this current application to the EPA on 22 April 2014 and was advised that advice is not normally provided for works approval applications so therefore no formal comments would be provided.

A21.3 Department of Health:

A copy of the application was sent to the Department of Health (DoH) on 22 April 2015.

DoH provided comments to DER, dated 20 May 2015, to advise that it had no objection to the proposal so long as monitoring of water quality continued prior to and during landfill operations, and that sufficient contingencies are in place if water monitoring demonstrated an impact on water quality. DoH also requested that DER consider including a condition on the licence to implement and maintain a complaints record and to investigate any complaints received.

During the licence application assessment process, DER will consider the inclusion of a condition requiring a complaints management system to be maintained.

A21.4 Department of Parks and Wildlife:

A copy of the application was sent to the Department of Parks and Wildlife (DPaW) on 22 April 2015.

DPaW sent comments to DER on 28 May 2015 noting that the premises adjoins the Wandoo National Park and have requested that the premises be managed in a way that does not impact on the values of this park, in particular, increases in feral cat and fox activity within the park as a result of the landfill attracting vermin.

During the licence application assessment process, DER will consider the inclusion of a condition requiring the management and control of pests and vermin. Conditions related to waste acceptance and requirements to cover waste will also be considered for inclusion on the licence which assists in reducing the risk of pests and vermin.

A21.5 Department of Water:

A copy of the application was sent to the Department of Water (DoW) on 22 April 2015.

DoW provided comments to DER, dated 25 May 2015, to advise that it had no objection to the proposal however it noted the following:

- preference to have the proposed dam located off-stream;
- that an assessment for an emergency water supply be undertaken for extreme dry periods;
- that revegetation and regeneration of the 13 Mile Brook be considered as best practice; and
- that a licence issued under the *Rights in Water and Irrigation Act 1914* is required for dam construction and to take water.

DER will consider the inclusion of licence conditions to regulate emissions to surface water and groundwater during the licence application assessment process. DER has communicated to the occupier that a licence to construct the stormwater dam and take water is required from DoW.

A21.6 Shire of York:

The proposal is located within the Shire of York (the Shire) in an area currently zoned as 'General Agriculture' and requires planning approval. On 14 April 2014 the Wheatbelt Joint Development Assessment Panel (JDAP) considered the development application for the previous proposal and voted against approving the application. The panel determined that a landfill was inconsistent with the 'general agriculture' zoning of the farming property and this decision was appealed by the proponent through the State Administrative Tribunal (SAT).

DER referred this current works approval application to the Shire for comment on 22 April 2015. The Shire provided a response to DER on 20 July 2015 to advise that a "*landfill is not a use listed within our Scheme and has to be considered accordingly through a development application*." The Shire also advised that the planning matter had not been resolved.

The amended planning application was referred back to JDAP and was refused on 31 August 2015. This matter was heard by SAT in November 2015. A decision by SAT was delivered on 8 March 2016 ([2016] WASAT 22) allowing planning approval subject to conditions. These conditions have been discussed in the Decision Document as they apply.

Appendix B

Summary of Issues Raised in Public Submissions

The submitter numbers listed below correspond to interested parties who provided comment and submissions regarding the works approval application. These numbers may relate to individuals, families or community groups. The 'Summary of Submission Points' provides a representation of the main points raised in the community submissions.

Number	Submitter	Summary of Submission Points	Response
1	**Seismic Issues** 4, 5, 9, 10, 11, 12, 13, 15, 16, 18, 19, 20, 21, 22, 23, 28, 29, 30, 31, 32, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 56, 58, 59, 62, 68, 69	• Comments that York is located within the South West Seismic Zone. • There is concern that in the event of an earthquake there is potential for the pit to collapse, liquefaction to occur and a risk of damaging the liner integrity resulting in contamination to surface water, groundwater and land as well as the release of landfill gas.	The risk associated with earthquakes has been considered in the stability assessment. Further information is detailed in Section A6 in Appendix A.
2	**Composite Liner** 13, 15, 18, 23, 28, 5, 14, 16, 18, 34, 36, 41, 42, 44, 46, 48, 51, 59	• Community has concerns that HDPE liners degrade and break down over time. • Concerns that any failure of the liner will results in contamination and impacts to the drinking water catchments. • There are concerns that the manufacturers of HDPE liners are unable to guarantee 100 per cent, the integrity of the liner system. • Concerns that the 2m separation distance between groundwater will not be maintained.	It is recognised that HDPE liners deteriorate over time. The potential for liner defects and degradation to occur has been incorporated into the assessment of liner performance and calculations of liner leakage rates. An assessment of the liner design and leachate management systems is included in Section A3 in Appendix A. The landfill design in the application includes a minimum 2m separation to the maximum recorded potentiometric surface of the confined aquifer. Conditions 1.2.2 and 1.2.3 have been included in the Works Approval, which requires at least 2m separation to any seasonal shallow or perched groundwater. Licence conditions will be included for monitoring of groundwater which will include the ongoing verification that the minimum 2m separation distance is maintained throughout the landfill operations.

Number	Submitter	Summary of Submission Points	Response
3	**Hydrocarbons** 5, 10, 33	Concerns about the storage of hydrocarbons and environmentally hazardous materials especially in regards to risk of contaminants entering the land and water as well as providing a fuel source in the event of fires.	The storage of environmentally hazardous materials has been considered in the assessment in Section A1 of Appendix A.
4	**Hydrogeology** 5, 17, 21, 22, 23, 28, 36, 44, 56, 59, 62, 68	• The community believes that not enough is known about the surrounding geology and hydrogeology in the area where the landfill is proposed. • There are concerns there is a lack of baseline data. • Concerns that the data used in the application is factually incorrect. • Concerns that a palaeochannel is present under the site which connects to the water catchment areas. • The community believe there is unsuitable complex hydrology and the proponent provided an insufficient study to evaluate the risk. • There is community concern about the insufficient data available on the soil types under the landfill. • Concerns that there are too many unknown variables and factors at the site that Golder/SITA have not considered in the application.	An assessment of the local hydrogeology (including but not limited to assessments of recharge, groundwater flow directions and groundwater levels in proximity to the designed basal liner) is included in section A2 of Appendix A. This also considers the environmental risk setting of the site. An assessment of liner integrity and stability is included in section A6 of Appendix A. The CEO's delegate has determined that sufficient groundwater monitoring data is provided for the purpose of the works approval application. An assessment of the groundwater level and quality data provided is included in Section A2 of Appendix A. Condition 2.1.4 of the works approval required quarterly monitoring of groundwater to monitor baseline groundwater quality and water levels throughout the duration of the works approval. An assessment of soil types is considered under the heading 'Groundwater' in section A2.3 of Appendix A. The landfill design in the application includes a minimum 2.5m separation to the maximum recorded potentiometric surface of the confined aquifer. Conditions 1.2.2 and 1.2.3 have been included in the Works Approval, which requires at least 2m separation to groundwater.
5	**Fugitive dust emissions** 1, 2, 4, 5, 6, 7, 8, 9, 10, 11, 13, 15, 16,	• Concerns relating to dust impacts on the surrounding community including the risk of hazardous waste, asbestos fibres and rainwater tank contamination.	An assessment of fugitive dust emissions is included in section A12 of Appendix A. DER considers emissions and discharges from premises only, and whether these are likely to cause unacceptable impacts.

Number	Submitter	Summary of Submission Points	Response
	20, 21, 23, 24, 25, 26, 27, 28, 30, 32, 33, 35, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 61, 62, 63, 64, 67, 69	• Concerns over dust storms in the region (occurrence in January 2011). • Concerns that willie willies will transport toxic dust from dried out leachate ponds onto surrounding land.	Should a licence be granted for the operation of the landfill, DER will include condition requiring the leachate ponds to be kept wet at all times.
6	**Landfill gas emissions** 2, 5, 6, 7, 8, 10, 13, 15, 16, 21, 24, 26, 27, 29, 36, 38, 39, 40, 41, 42, 43, 44, 45, 46, 48, 49, 54, 56, 58, 59, 61, 67	There is concern that the landfill gas emissions may impact on the surrounding community including a detriment to local air quality, impacts to local flora and fauna, increased risk of fires and increase of greenhouse gases.	An assessment of landfill gas emissions are included in sections A10 of Appendix A.
7	**Noise emissions** 5, 7, 8, 9, 10 , 13, 16, 24, 26, 27, 32, 33, 35, 38, 39, 40, 41, 43, 45, 46, 47, 48, 50, 51, 52, 56, 58, 59, 61, 62, 63, 64, 65, 67	• Community concerns relating to the noise impacts from the landfill on residents located nearby. Most submissions made about noise emissions specifically related to truck movements to and from the premises. • Concerns over amphitheatre effect with the landfill being located in a valley. • Risk of multiple operations (borrow pits and landfilling) occurring at the same time have not been appropriately considered.	• Noise emissions from the construction and operation of the landfill were assessed and are discussed in section A14 of Appendix A. • Under Part V of the Act, DER's assessment of the proposal is constrained to the environmental acceptability of potential emissions and discharges from prescribed premises. Vehicle movements to and from the prescribed premises are not considered to be an emission from the prescribed premises and have not been assessed by DER. • The CEO's delegate considered that noise emissions from the premises would not cause an unreasonable impact to the surrounding farming community.
8	**Light emissions** 10, 13, 16	Community concerns regarding the light impacts from night operations and how these impact on the local community and fauna.	The Works Approval requires that the works are constructed in accordance with the documentation submitted. The application documentation specified construction and operations will only occur predominantly during the daytime, with some operations occurring from 6am which may still be dark during the winter

Number	Submitter	Summary of Submission Points	Response
			periods. It is considered that these limited periods of operations during the mornings will pose little to no risk to the environment.
9	**Stormwater management** 1, 2, 4, 5, 6, 7, 10, 11, 12, 13, 15, 16, 17, 20, 21, 23, 26, 27, 28, 30, 31, 33, 34, 35, 36, 37, 39, 40, 41, 42, 43, 44, 45, 46, 48, 49, 50, 52, 53, 54, 55, 56, 57, 59, 61, 62, 63, 64, 67, 68, 69	• Concerns over flooding resulting in release of contaminants from the landfill. • Concerns over changes to localised drainage paths and changes to the flow paths of the seasonal creek. • Concerns that the local waterways (Thirteen Mile Creek, Avon and Helena Rivers) will become contaminated. • Concerns of increased erosion from the changes in flow paths. • Concerns of sediment migration.	An assessment of surface water management is presented in sections A7 and A15 of Appendix A. Drainage infrastructure is to be installed to divert surface water/stormwater around the landfill footprint.
10	**Odour emissions** 5, 7, 8, 9, 10, 13, 16, 20, 21, 23, 24, 26, 27, 33, 35, 39, 40, 41, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 61, 63, 64, 65, 67	Concerns regarding potential odour from a landfill accepting Class II odorous waste and emissions from leachate and landfill gas.	An assessment of odour emissions is included in section A13 of Appendix A.
11	**Fugitive emissions to groundwater** 1, 2, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 38, 39, 40, 41, 42, 43, 44, 45, 46, 48, 49, 50, 51, 52,	The community have concerns regarding the management of leachate and the impact to groundwater supplies in the event of liner fail or spills. This includes impacts to the groundwater catchment areas.	An assessment of fugitive emissions to groundwater and the management of leachate are included in sections A3 and A11 of Appendix A.

Number	Submitter	Summary of Submission Points	Response
	53, 54, 55, 56, 57, 58, 59, 61, 62, 63, 64, 65, 67, 68, 69		
12	**Contamination** 1, 2, 4, 5, 6, 8, 9, 10, 11, 12, 15, 16, 17, 19, 20, 21, 25, 26, 27, 28, 29, 30, 31, 33, 36, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 52, 54, 56, 58, 59, 67, 69	• The community is concerned about the risk of contamination to Thirteen Mile Brook and the Avon and Helena Rivers. • Concerns have been raised regarding contamination to the Mundaring Weir and Helena River catchments. • The issues raised include the risk of affecting agricultural production, their reputation, their image and biosecurity. • Contamination to the land, air and water from the release of emissions.	An assessment of fugitive emissions to groundwater and the management of leachate are included in sections A3 and A11 of Appendix A. An assessment of emissions to surface water is included in sections A7 and A15 of Appendix A. Other emissions which impact on air and land have been discussed in their relevant sections within Appendix A.
13	**Waste reduction and avoidance** 2, 5, 6, 11, 12, 13, 14, 15, 16, 17, 18, 20, 23, 28, 29, 34, 37, 40, 42, 43, 44, 45, 57, 59, 60, 66	• There are community concerns that their town is being used as a dumping location for metropolitan waste. The Waste Authority issued documents called 'Towards Zero Waste' Strategy and 'Creating the Right Environment' but the community are afraid that DER is considering a landfill that appears to contradict these documents. • There are concerns that alternatives to SITA are not being used, for example, utilising pre-existing sites, incineration or other new locations. • The community questions the role of government to serve the interest of the community, and who should be ultimately responsible for long-term control of the waste. • Recommendations from the community that the site should be located away from agricultural land and away from drinking water catchment areas. • Concerns that there is a lack of recycling involved	Under Part V of the Act, DER's assessment of the proposal is limited to the environmental acceptability of potential emissions and discharges from the Premises.

Number	Submitter	Summary of Submission Points	Response
		with landfilling applications.	
14	**Buffers** 5, 34	Concerns that the buffers are insufficient	The separation distances indicated in the application supporting documentation are sourced from Environmental Protection Authority (EPA) Guidance Statement 3: *Separation Distances Between Industrial and Sensitive Land Uses*, published on the EPA's website. These separation distances are not intended to represent scheduled buffer zones that Planning Authorities can establish. The Guidance Statement recommends a 500m separation for sensitive uses (subdivisions), 150m for single residences and an internal buffer of 35 m from the boundary for class II landfills. This landfill proposal meets the recommended separation distances set out in this guidance statement.
15	**Waste handling and acceptance procedures** 5, 16, 36, 56	There are concerns regarding the management of the waste streams. These include how a visual inspection of the waste will ensure chemical contamination levels meet those specified for a Class II landfill, as well as general comments on the waste that is proposed.	Conditions for waste acceptance and management will be considered under the licence assessment however it is likely that regulatory controls will be placed on the licence to control the volumes and types of waste accepted at the site, and to include specified requirements for the handling and management of waste. This premises will only be authorised to accept wastes that consistent with the acceptance criteria for Class II landfills as specified in the *Landfill Waste Classification and Waste Definitions 1996 (as amended 2009)* published by the former Department of Environment and Conservation (Waste Definitions), and will be subject to the sampling and validation requirements specified in these definitions.
16	**SITA** 2, 4, 5, 6, 9, 13, 14, 16, 21, 22, 23, 28, 36, 44, 59, 61, 62, 69	• The community believe that the previous compliance history of SITA is poor. • Limitations, uncertainties or inaccuracies in Golder's/SITA's documents.	Landfill operations will be regulated under any licence granted for the premises. DER will assess compliance with licence conditions. It is an offence to contravene the conditions of a licence granted under the *Environmental Protection Act 1986*. In addition, DER can amend a licence to vary conditions or impose

Number	Submitter	Summary of Submission Points	Response
		• Expansions for the site including the proposal of being extend from 20 to 40 years.	additional conditions if necessary. Any licence granted for the Premises is likely to include limitations on the types and volumes of waste permitted. Under the provisions of the Act, DER can have regard to an applicant's previous compliance history during the decision making process. In this assessment, the CEO's delegate considers that it is appropriate to grant the works approval. Through this assessment, the CEO's delegate has reduced the size of the prescribed premises boundary to only incorporate the area of the landfill footprint and monitoring points.
17	**Traffic Management** 1, 3, 5, 6, 7, 8, 10, 13, 14, 16, 17, 18, 19, 23, 24, 26, 27, 29, 31, 35, 36, 42, 44, 45, 47, 48, 53, 55, 56, 58, 60, 63, 64, 65	Traffic management concerns include: safety, increased noise, increased vehicle movement, and increased air emissions from trucks.	Under Part V of the Act, DER's assessment of the proposal is constrained to the environmental acceptability of potential emissions and discharges from the Premises. This does not include wider traffic matters relating to the development.
18	**Flora and Fauna** 5, 10, 16, 20, 21, 24, 26, 27, 30, 32, 33, 35, 41, 43, 44, 45, 46, 47, 56, 59	• Concerns relating to the negative impacts to native flora and fauna, including cockatoo breeding and roosting areas, and impacts to the Wandoo National Park. • There are also community concerns regarding the impact the landfill will have on cattle and other livestock such as contamination to stock water supplies, animals being frightened by the noise of the landfill, and animals getting sick from the landfill.	DER's assessment of the works approval application under Part V of the Act considered the risk to the environment as a whole from potential emissions and discharges from the Premises. Sections A18 and A19 of Appendix A outlines the assessment of vermin and litter management. The applicant was given approval from the Commissioner of Soil and Land Conservation to clear limited native vegetation at the premises for the purpose of upgrading access to the site. This application was 'not assessed' under part IV of the Act by the Environmental Protection Authority. This application was referred to the Department of Parks and Wildlife (DPAW) and comments received stated that DPAW "is

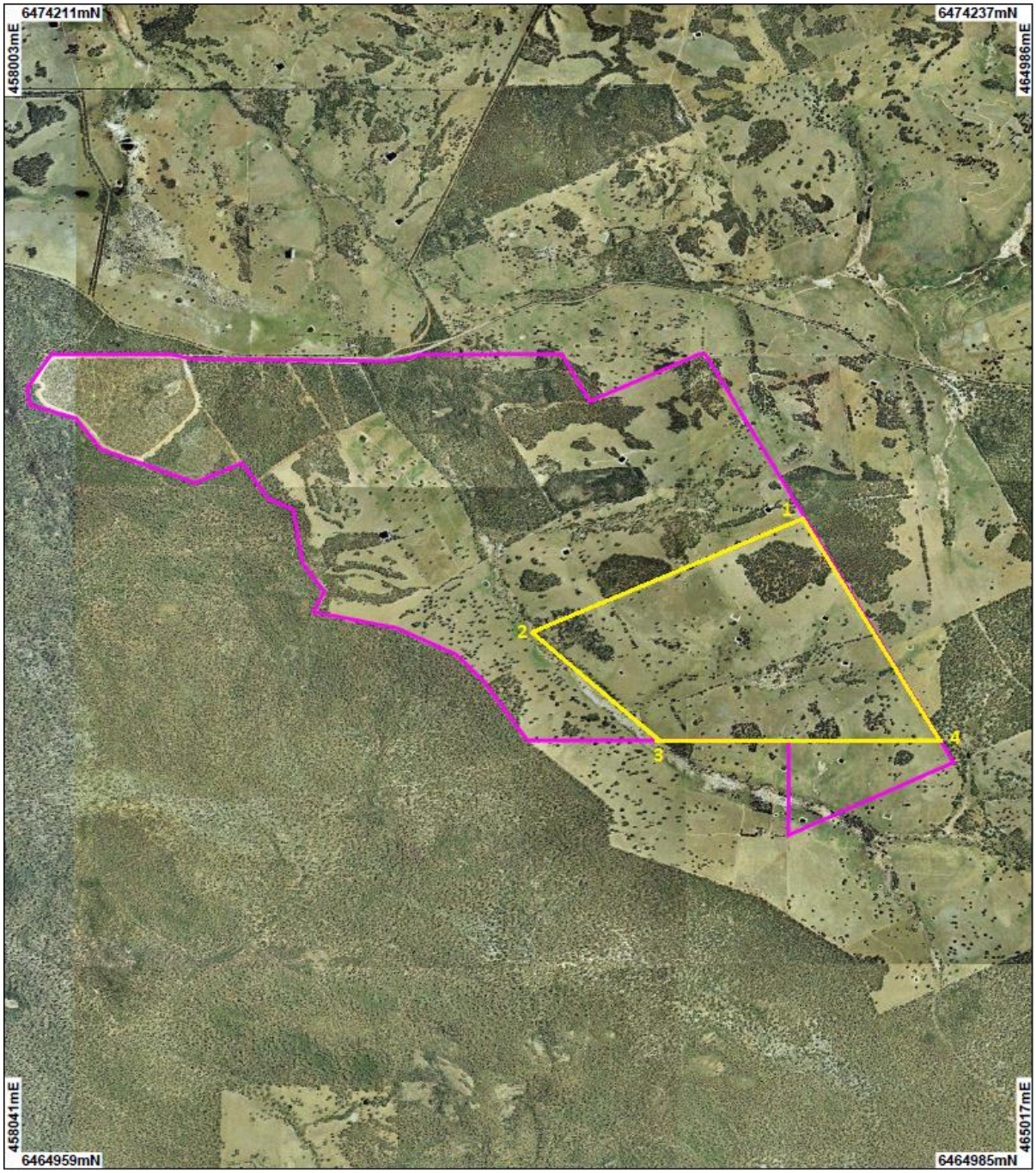
Number	Submitter	Summary of Submission Points	Response
			satisfied that potential impacts to nature conservation values on Allawuna farm have been adequately addressed" and identified that the proposal should be managed in a manner that does not impact on the values of the Wandoo National Park, particularly in regards to increases in feral animals. DER will consider imposing conditions on the operational licence to address this. Individual emissions including emissions to air, land and water have been discussed under their relevant sections in Appendix A.
19	**Fire Hazards** 4, 5, 9, 12, 15, 16, 23, 24, 28, 30, 32, 33, 35, 41, 43, 44, 45, 46, 47, 50, 52, 53, 56, 58, 59, 61, 62, 69	• The community considered the lack of an appropriate Fire Management Plan and has concerns regarding vandalism. • There is concern that the landfill gas flare will have open flame flaring causing a fire hazard. • The community have concerns regarding deep-seated fires. This can be defined as a fire burning below the surface of the landfill. • Concerns that emissions to land, air and water will be released during a fire. • Concerns that the local volunteer fire brigade hasn't been consulted.	Fire risk is assessed in Section A20 of Appendix A. This assessment has identified that the Fire Management Plan should have endorsement from the Department of Fire and Emergency Services prior to the submission of any licence application. This is reflected in the planning conditions.
20	**Tourism** 6, 12, 13, 14, 16, 17, 19, 33, 39, 40, 42, 55	There are community concerns that a waste facility in York may be detrimental to tourism.	Under Part V of the Act, DER's assessment of the proposal is constrained to the environmental acceptability of potential emissions and discharges from the premises and does not consider potential effects on tourism.
21	**Clearing** 16	Concerns over the clearing of native vegetation.	The clearing within the Premises boundary has been referred to the Commissioner of Soil and Land Conservation as discussed under Section A21.1 of Appendix A.
22	**Community Effects** 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 29, 32, 33, 34, 35,	There are community concerns about the effects on the community including: amenities, social aspects/lifestyle, use of community resources such as drinking water, impacts from asbestos, decreased property values, loss of farming production and land, impacts to organic licences, biosecurity, visual	Consideration has been given to potential impacts on health arising from potential emissions and discharges from the premises. Human receptors have been considered in the environmental setting /conceptual site model outlined in Section A2 of Appendix 1.

Number	Submitter	Summary of Submission Points	Response
	36, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 53, 55, 56, 58, 59, 62, 64, 68	impacts, and decrease in population growth.	An assessment of all emissions and discharges from the premises has included an assessment of risk to human health and the environment. Section A18 of Appendix 1 outlines the assessment of potential impacts due to vermin. Under Part V of the Act, DER's assessment of the proposal is constrained to the environmental acceptability of potential emissions and discharges from the premises and does not consider potential effects on property values and community resources. The Department of Agriculture and Food Western Australia (DAFWA) advised that there is no evidence of biosecurity risks from existing rural landfills and that organic certifications are a function of certifying bodies and not DAFWA. DAFWA noted that fencing would be required to control animal pest species.
23	**Windblown waste and vermin** 5, 7, 8, 10, 13, 16, 20, 33, 35, 38, 41, 43, 44, 45, 47, 48, 50, 51, 52, 56, 63	• There are community concerns regarding the increase in pests and vermin from a nuisance impact as well as impacting on native flora and fauna. • Concerns that windblown waste will travel across the site and into adjacent properties and waterways.	Sections A18 and A19 of Appendix A outlines the assessment of vermin and litter management.
24	**Health impacts** 1, 5, 10, 15, 16, 21, 33, 39, 41, 42, 43, 44, 45, 46, 48, 55, 57, 59	The community is concerned over the health impacts associated with a landfill (i.e. salmonella, carcinogens) and disease from the pests/vermin that are attracted to the landfill.	The works approval application was referred to the Department of Health (DoH) for comment as discussed in Section 21.3 of Appendix A. DoH had no objection to the proposal provided that "monitoring of environmental water quality is maintained prior to and during the operation of the landfill" The works approval includes conditions for the monitoring of surface water and groundwater and similar conditions are likely to be included on the operational licence. An assessment of pests and vermin is discussed in Section A18 of Appendix A.

Number	Submitter	Summary of Submission Points	Response
25	**Borrow pits/extractive industry** 5, 12, 17, 21, 27, 40, 41, 44, 45, 46, 56, 59, 62	• Concerns that the borrow pits were never part of the original landfill design; • Borrow pits will have increased noise and dust emissions; • The borrow pits impact on visual amenity and may impact on surface water flow, erosion and destroy the land for agricultural use.	The borrow pits are not part of this works approval application and have not been assessed. DER will assess any emissions associated with the borrow pits and determine relevant regulatory controls under a future works approval or licence amendment application in accordance with DER's *Guidance Statement: Licensing and works approvals process*.
26	**The Act and other legislation** 5, 9, 15, 21, 22, 23, 28, 34, 36, 41, 44, 46, 48, 57, 62, 68	• There is community concern that the object and principles of the *Environmental Protection Act 1986* (the Act) are not being used. These include the precautionary principle and intergenerational equality. • Other legislation discussed in community submissions included the *Biosecurity and Agriculture Management Act 2007* and the *Rights in Water and Irrigation Act 1914.*	The assessment has taken into account the object and principles of the Act by regulating in accordance with the DER Guidance Statement: *Regulatory Principles – Environmental Protection Act 1986, Part V, Effective and Efficient Regulation, July 2015*. DER considers its assessment and decision making to be consistent with this Guidance Statement. The Department of Agriculture (Commissioner of Soil and Land Conservation) and the Department of Water were referred the works approval application for comment as discussed in Sections A21.1 and A21.5 of Appendix A.
27	**Financial assurance** 9, 23, 28, 36, 44, 68	• Multiple submissions by the community believe there is a need for financial assurance under s86C of the Act. • The United States of America Environmental Protection Agency (USEPA) requires proponents to demonstrate they will be able to pay for closure and corrective actions. • Community submissions questioned who is responsible for clean-up and remediation if the proponent goes bankrupt.	Please refer to the Decision Table in Section 4 of this document.
28	**Rehabilitation** 5, 41	There is insufficient information on what will be done to rehabilitate the land.	The occupier will provide a Rehabilitation Management Plan as part of the licence application which will be assessed by DER. This plan is required to be submitted as part of the conditional planning approval.

Number	Submitter	Summary of Submission Points	Response
29	**Local Zoning** 2, 5, 6, 15, 16, 17, 20, 21, 34, 44, 57	• Community concern that the landfill is located within an area zoned 'General Agricultural'. • The landfill does not confirm to the Shire of York's Town Planning Scheme No. 2 and the general principles of this Scheme. • The landfill does not have planning approval.	The State Administrative Tribunal granted conditional planning approval of the facility on 8 March 2016 ([2016] WASAT 22).

Appendix C
Prescribed Premises Boundary



Note: the yellow line depicts the prescribed premises boundary and the pink line depicts the cadastral boundary (Lot 4869)

Appendix D
Construction Overview

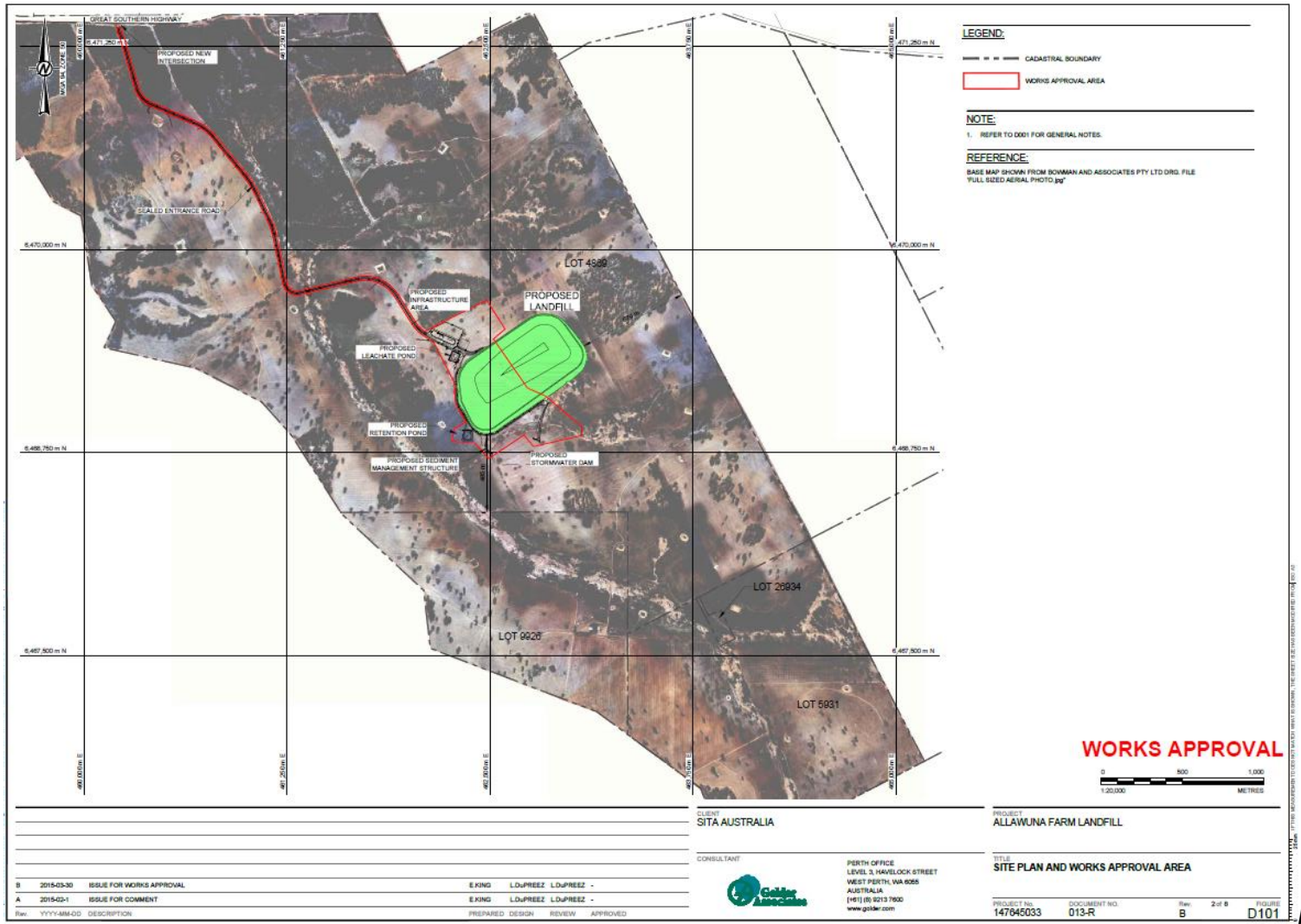


Figure D1

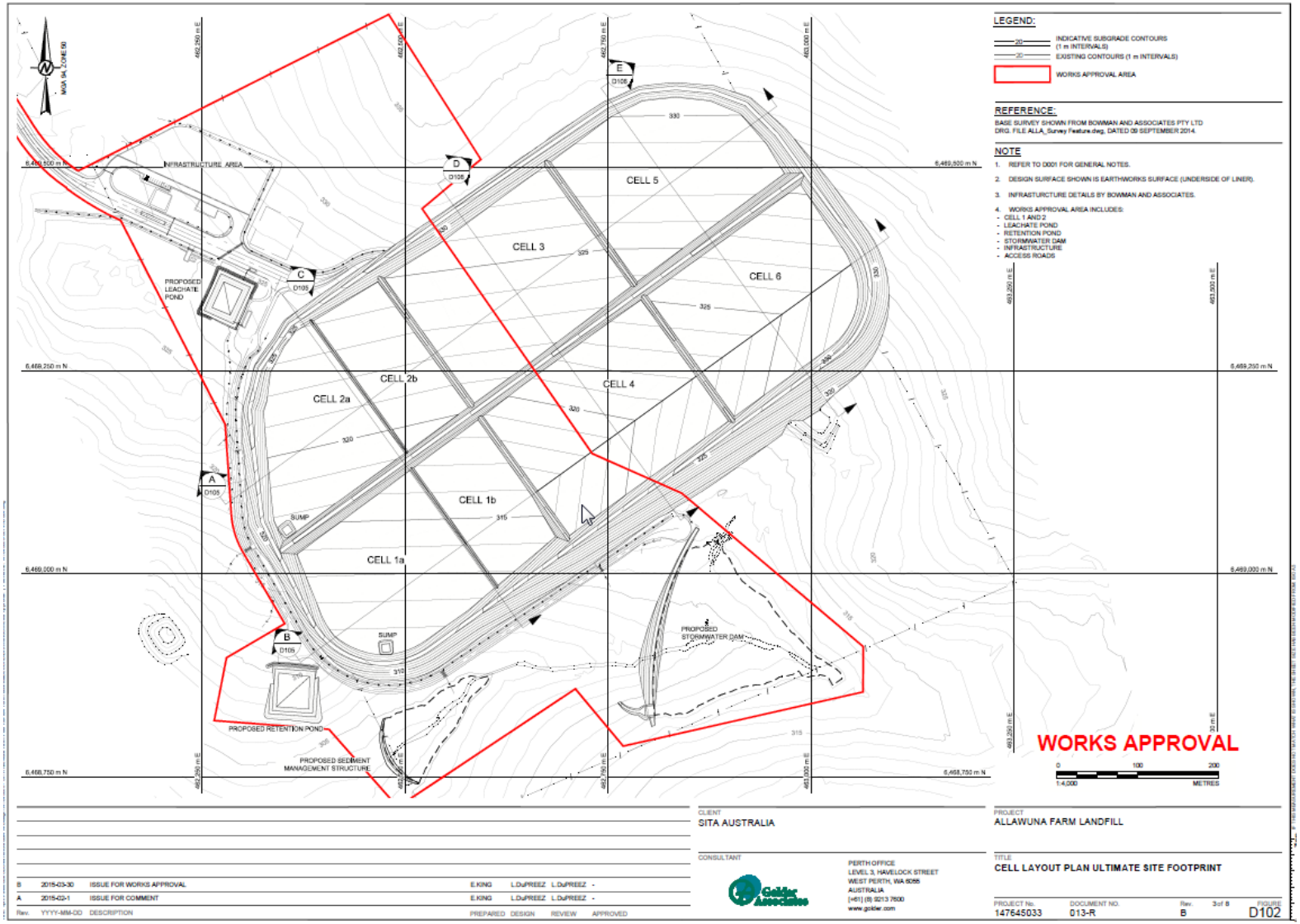

LEGEND:
INDICATIVE SUBGRADE CONTOURS (1 m INTERVALS)
EXISTING CONTOURS (1 m INTERVALS)
WORKS APPROVAL AREA
REFERENCE:
BASE SURVEY SHOWN FROM BOWMAN AND ASSOCIATES PTY LTD
DRG. FILE ALLA_Survey Feature.dwg, DATED 09 SEPTEMBER 2014.
NOTE
1. REFER TO D001 FOR GENERAL NOTES.
2. DESIGN SURFACE SHOWN IS EARTHWORKS SURFACE (UNDERSIDE OF LINER).
3. INFRASTURCTURE DETAILS BY BOWMAN AND ASSOCIATES.
4. WORKS APPROVAL AREA INCLUDES:
- CELL 1 AND 2
- LEACHATE POND
- RETENTION POND
- STORMWATER DAM
- INFRASTRUCTURE
- ACCESS ROADS
INFRASTRUCTURE AREA
CELL 1a
CELL 1b
CELL 2a
CELL 2b
CELL 3
CELL 4
CELL 5
CELL 6
PROPOSED LEACHATE POND
PROPOSED RETENTION POND
PROPOSED STORMWATER DAM
PROPOSED SEDIMENT MANAGEMENT STRUCTURE
SUMP
WORKS APPROVAL
METRES
CLIENT
SITA AUSTRALIA
PROJECT
ALLAWUNA FARM LANDFILL
CONSULTANT
PERTH OFFICE
LEVEL 3, HAVELOCK STREET
WEST PERTH, WA 6005
AUSTRALIA
TITLE
CELL LAYOUT PLAN ULTIMATE SITE FOOTPRINT
PROJECT No. 147645033
DOCUMENT NO. 013-R
Rev. B
FIGURE D102
B 2015-03-30 ISSUE FOR WORKS APPROVAL E.KING L.DuPREEZ L.DuPREEZ -
A 2015-02-1 ISSUE FOR COMMENT E.KING L.DuPREEZ L.DuPREEZ -

Figure D2

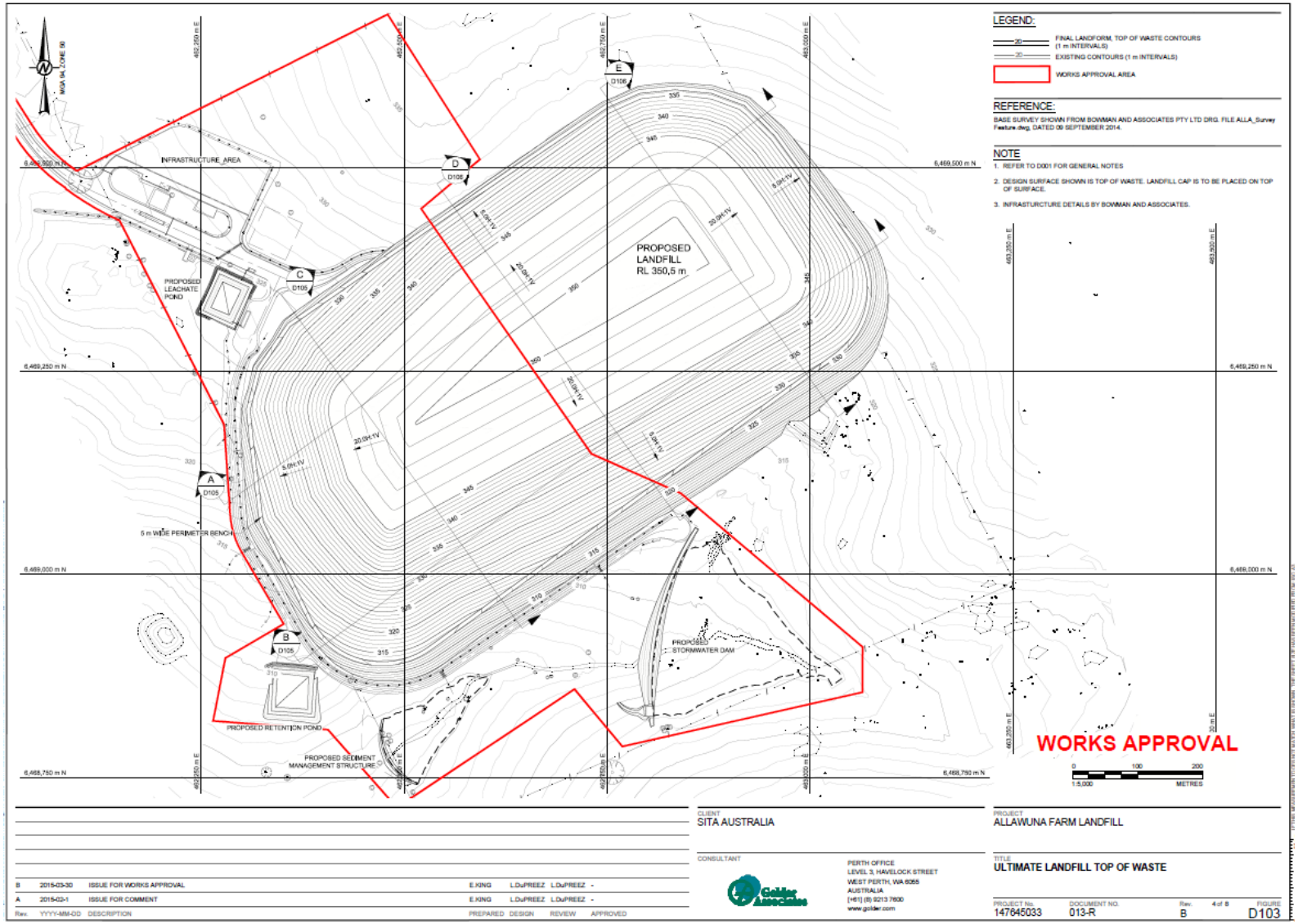
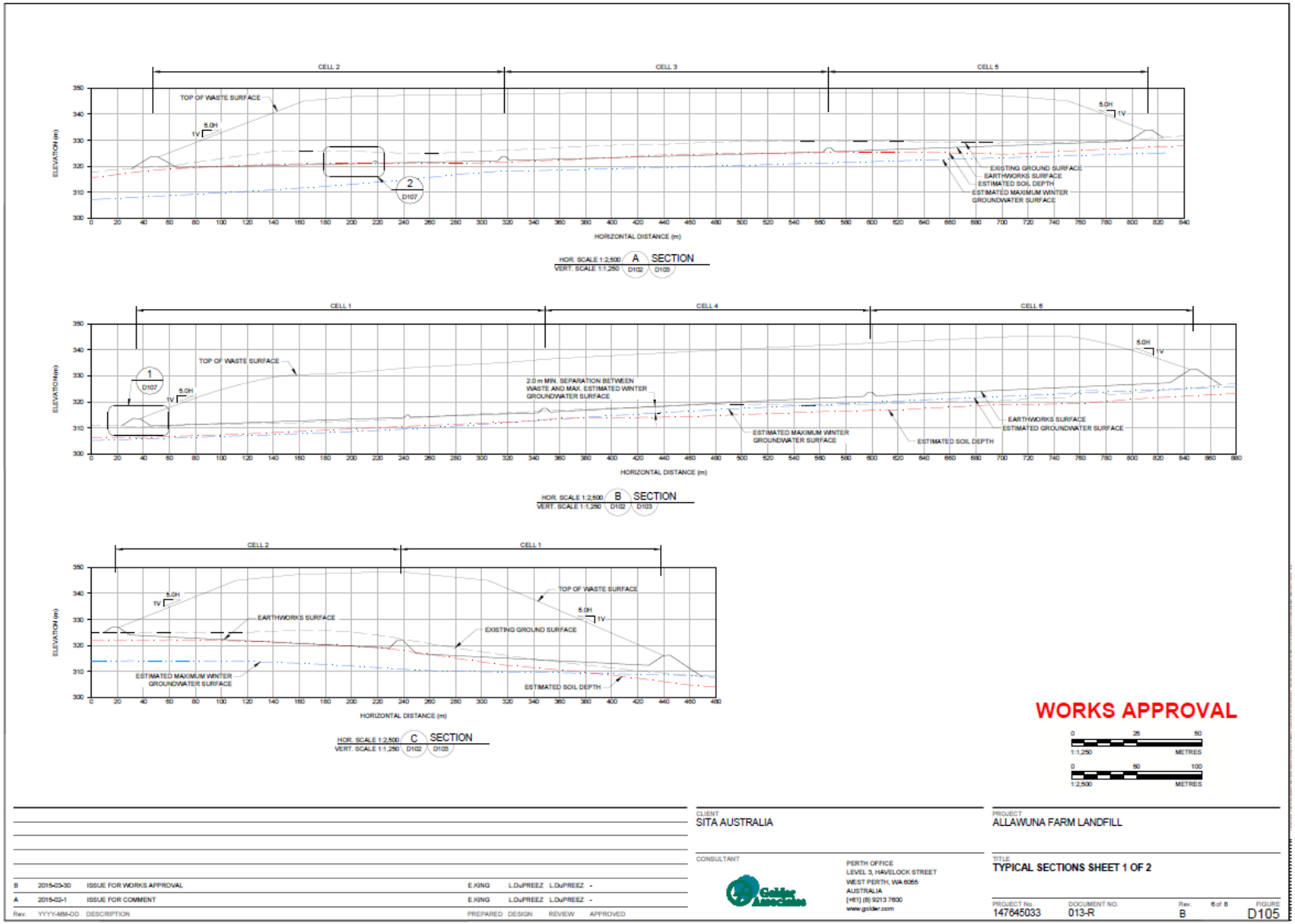

LEGEND:
FINAL LANDFORM, TOP OF WASTE CONTOURS (1 m INTERVALS)
EXISTING CONTOURS (1 m INTERVALS)
WORKS APPROVAL AREA
REFERENCE:
BASE SURVEY SHOWN FROM BOWMAN AND ASSOCIATES PTY LTD DRG. FILE ALLA_Survey Feature.dwg, DATED 09 SEPTEMBER 2014.
NOTE
1. REFER TO D001 FOR GENERAL NOTES
2. DESIGN SURFACE SHOWN IS TOP OF WASTE. LANDFILL CAP IS TO BE PLACED ON TOP OF SURFACE.
3. INFRASTRUCTURE DETAILS BY BOWMAN AND ASSOCIATES.
INFRASTRUCTURE AREA
PROPOSED LEACHATE POND
PROPOSED LANDFILL RL 350,5 m
5 m WIDE PERIMETER BENCH
PROPOSED STORMWATER DAM
PROPOSED RETENTION POND
PROPOSED SEDIMENT MANAGEMENT STRUCTURE
WORKS APPROVAL
CLIENT
SITA AUSTRALIA
PROJECT
ALLAWUNA FARM LANDFILL
TITLE
ULTIMATE LANDFILL TOP OF WASTE
PERTH OFFICE
LEVEL 3, HAVELOCK STREET
WEST PERTH, WA 6005
AUSTRALIA
PROJECT No. 147645033
DOCUMENT NO. 013-R
Rev. B
FIGURE D103

Figure D3


CELL 2
CELL 3
CELL 5
TOP OF WASTE SURFACE
5.0H
1V
EXISTING GROUND SURFACE
EARTHWORKS SURFACE
ESTIMATED SOIL DEPTH
ESTIMATED MAXIMUM WINTER GROUNDWATER SURFACE
ELEVATION (m)
HORIZONTAL DISTANCE (m)
HOR. SCALE 1:2,500
VERT. SCALE 1:1,250
A SECTION
CELL 1
CELL 4
CELL 6
2.0 m MIN. SEPARATION BETWEEN WASTE AND MAX. ESTIMATED WINTER GROUNDWATER SURFACE
EARTHWORKS SURFACE
ESTIMATED GROUNDWATER SURFACE
B SECTION
C SECTION
WORKS APPROVAL
METRES
B 2015-03-30 ISSUE FOR WORKS APPROVAL E.KING L.DuPREEZ L.DuPREEZ -
A 2015-02-1 ISSUE FOR COMMENT E.KING L.DuPREEZ L.DuPREEZ -
CLIENT
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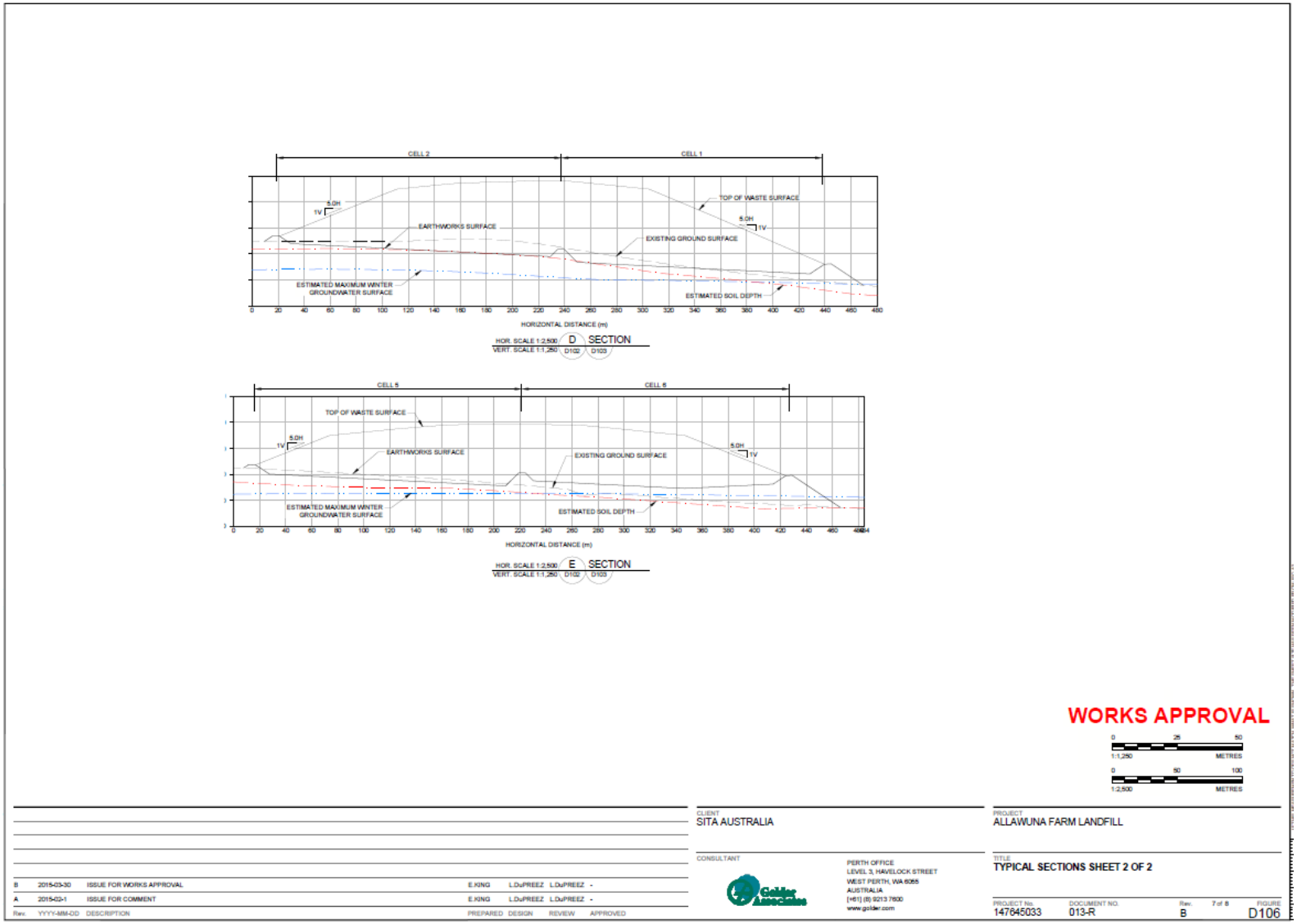
TITLE
TYPICAL SECTIONS SHEET 1 OF 2
PROJECT No. 147645033
DOCUMENT NO. 013-R
Rev. B
FIGURE D105

Figure D4


CELL 2
CELL 1
5.0H
1V
TOP OF WASTE SURFACE
EARTHWORKS SURFACE
EXISTING GROUND SURFACE
ESTIMATED MAXIMUM WINTER GROUNDWATER SURFACE
ESTIMATED SOIL DEPTH
HORIZONTAL DISTANCE (m)
HOR. SCALE 1:2,500
VERT. SCALE 1:1,250
D SECTION
D102
D103
CELL 5
CELL 6
TOP OF WASTE SURFACE
EARTHWORKS SURFACE
EXISTING GROUND SURFACE
ESTIMATED MAXIMUM WINTER GROUNDWATER SURFACE
ESTIMATED SOIL DEPTH
HORIZONTAL DISTANCE (m)
HOR. SCALE 1:2,500
VERT. SCALE 1:1,250
E SECTION
D102
D103
WORKS APPROVAL
1:1,250
METRES
1:2,500
METRES
B 2015-03-30 ISSUE FOR WORKS APPROVAL E.KING L.DuPREEZ L.DuPREEZ -
A 2015-02-1 ISSUE FOR COMMENT E.KING L.DuPREEZ L.DuPREEZ -
Rev. YYYY-MM-DD DESCRIPTION PREPARED DESIGN REVIEW APPROVED
CLIENT
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AUSTRALIA
[+61] (8) 9213 7600
www.golder.com
PROJECT
ALLAWUNA FARM LANDFILL
TITLE
TYPICAL SECTIONS SHEET 2 OF 2
PROJECT No. 147645033
DOCUMENT NO. 013-R
Rev. B
7 of 8
FIGURE D106

Figure D5

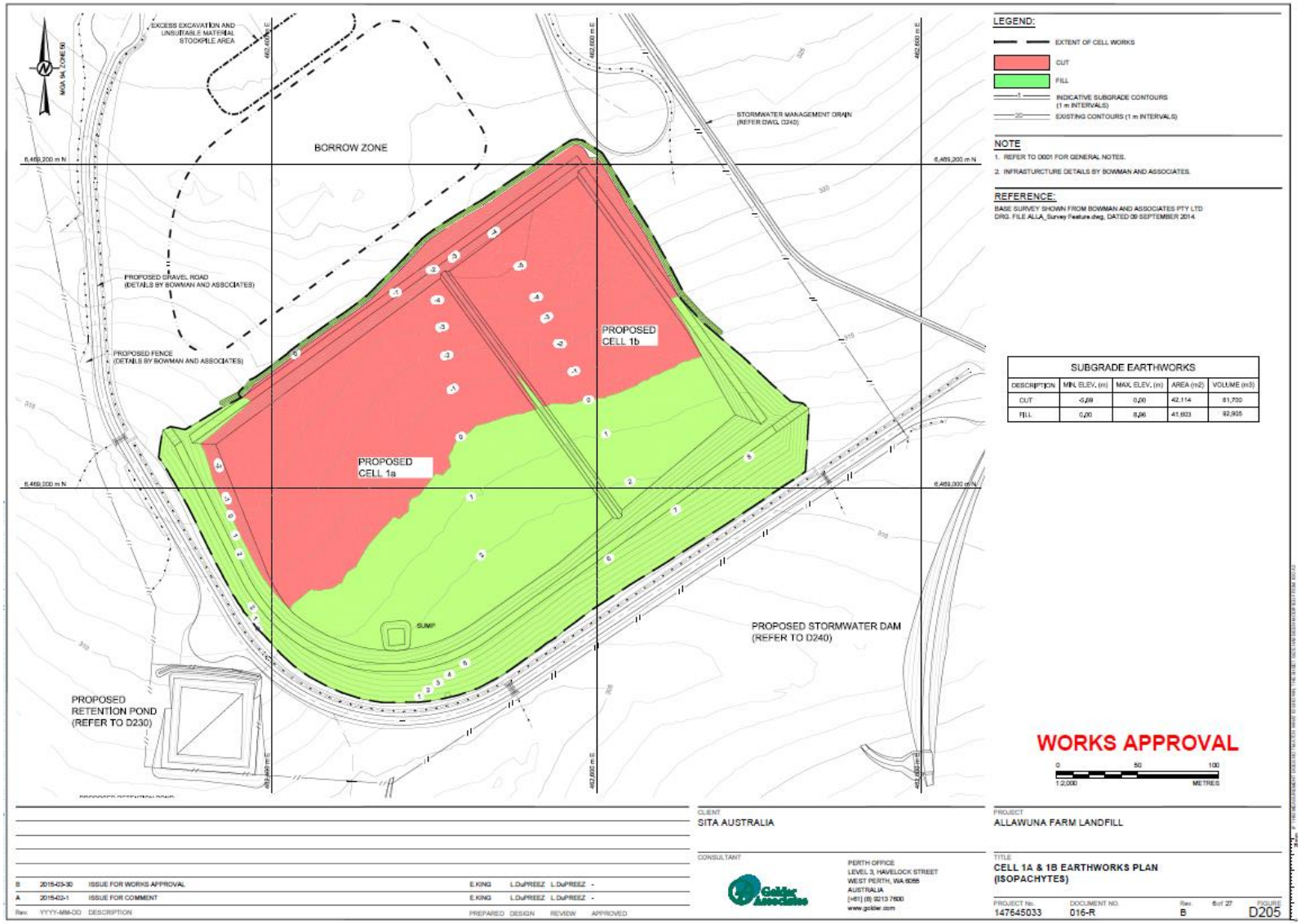
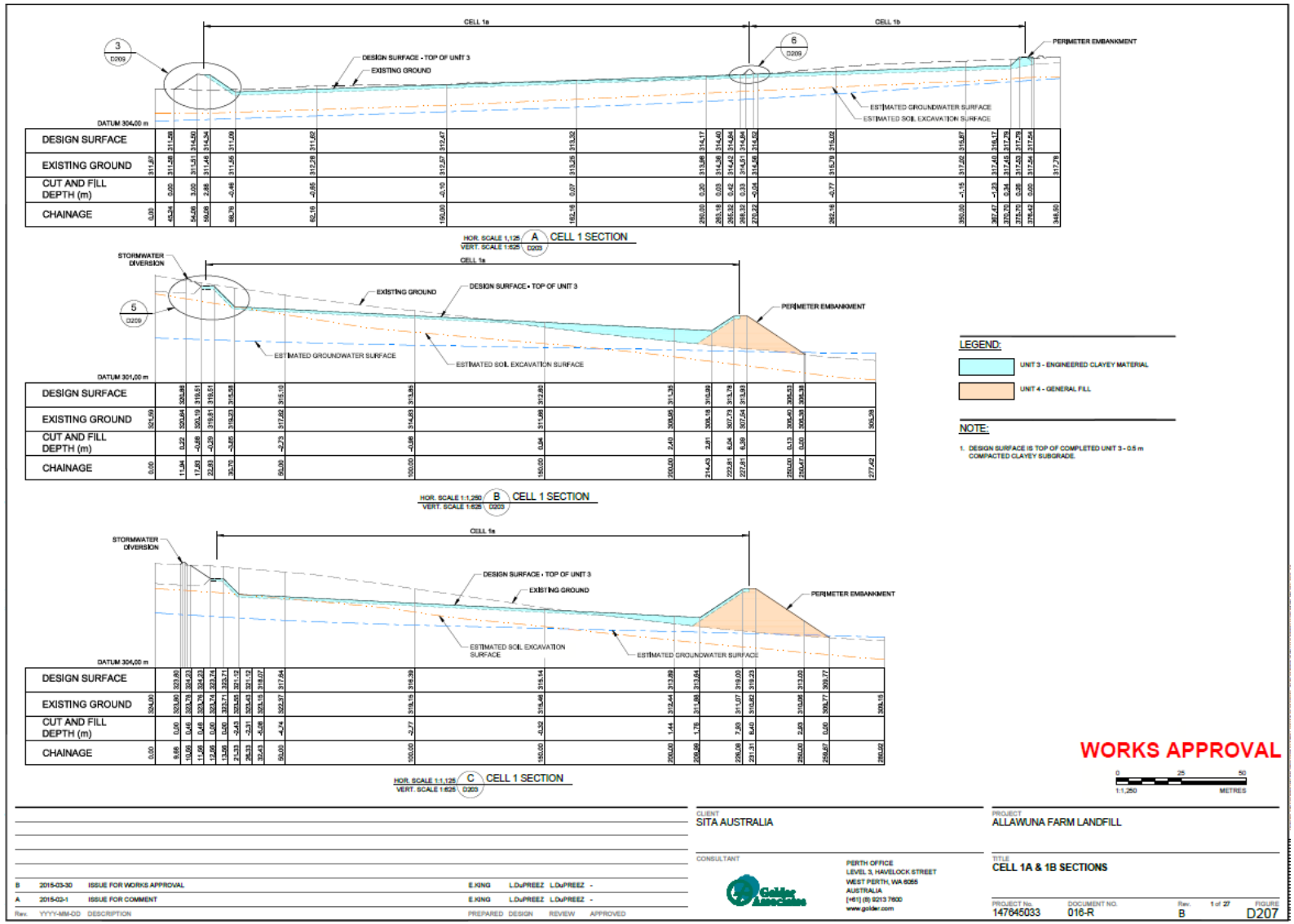

EXCESS EXCAVATION AND UNSUITABLE MATERIAL STOCKPILE AREA
BORROW ZONE
STORMWATER MANAGEMENT DRAIN (REFER DWG D240)
PROPOSED GRAVEL ROAD (DETAILS BY BOWMAN AND ASSOCIATES)
PROPOSED FENCE (DETAILS BY BOWMAN AND ASSOCIATES)
PROPOSED CELL 1b
PROPOSED CELL 1a
SUMP
PROPOSED STORMWATER DAM (REFER TO D240)
PROPOSED RETENTION POND (REFER TO D230)
LEGEND:
EXTENT OF CELL WORKS
CUT
FILL
INDICATIVE SUBGRADE CONTOURS (1 m INTERVALS)
EXISTING CONTOURS (1 m INTERVALS)
NOTE
1. REFER TO D001 FOR GENERAL NOTES.
2. INFRASTURCTURE DETAILS BY BOWMAN AND ASSOCIATES.
REFERENCE:
BASE SURVEY SHOWN FROM BOWMAN AND ASSOCIATES PTY LTD
DRG. FILE ALLA_Survey Feature.dwg, DATED 09 SEPTEMBER 2014.
SUBGRADE EARTHWORKS
DESCRIPTION | MIN. ELEV. (m) | MAX. ELEV. (m) | AREA (m2) | VOLUME (m3)
CUT | -5.69 | 0.00 | 42,114 | 81,700
FILL | 0.00 | 8.96 | 41,933 | 92,905
WORKS APPROVAL
0 50 100
1:2,000 METRES
B 2015-03-30 ISSUE FOR WORKS APPROVAL E.KING L.DuPREEZ L.DuPREEZ -
A 2015-02-1 ISSUE FOR COMMENT E.KING L.DuPREEZ L.DuPREEZ -
Rev. YYYY-MM-DD DESCRIPTION PREPARED DESIGN REVIEW APPROVED
CLIENT
SITA AUSTRALIA
CONSULTANT
Golder Associates
PERTH OFFICE
LEVEL 3, HAVELOCK STREET
WEST PERTH, WA 6005
AUSTRALIA
(+61) (8) 9213 7600
www.golder.com
PROJECT
ALLAWUNA FARM LANDFILL
TITLE
CELL 1A & 1B EARTHWORKS PLAN
(ISOPACHYTES)
PROJECT No. 147645033
DOCUMENT NO. 016-R
Rev. B
Sheet 6 of 27
FIGURE D205

Figure D6


CELL 1a
CELL 1b
PERIMETER EMBANKMENT
DESIGN SURFACE - TOP OF UNIT 3
EXISTING GROUND
ESTIMATED GROUNDWATER SURFACE
ESTIMATED SOIL EXCAVATION SURFACE
DATUM 304,00 m
DESIGN SURFACE
EXISTING GROUND
CUT AND FILL DEPTH (m)
CHAINAGE
HOR. SCALE 1:1,125 VERT. SCALE 1:625 A CELL 1 SECTION
STORMWATER DIVERSION
DATUM 301,00 m
HOR. SCALE 1:1,250 VERT. SCALE 1:625 B CELL 1 SECTION
HOR. SCALE 1:1,125 VERT. SCALE 1:625 C CELL 1 SECTION
LEGEND:
UNIT 3 - ENGINEERED CLAYEY MATERIAL
UNIT 4 - GENERAL FILL
NOTE:
1. DESIGN SURFACE IS TOP OF COMPLETED UNIT 3 - 0.5 m COMPACTED CLAYEY SUBGRADE.
WORKS APPROVAL
METRES
B 2015-03-30 ISSUE FOR WORKS APPROVAL
A 2015-02-1 ISSUE FOR COMMENT
CLIENT SITA AUSTRALIA
PROJECT ALLAWUNA FARM LANDFILL
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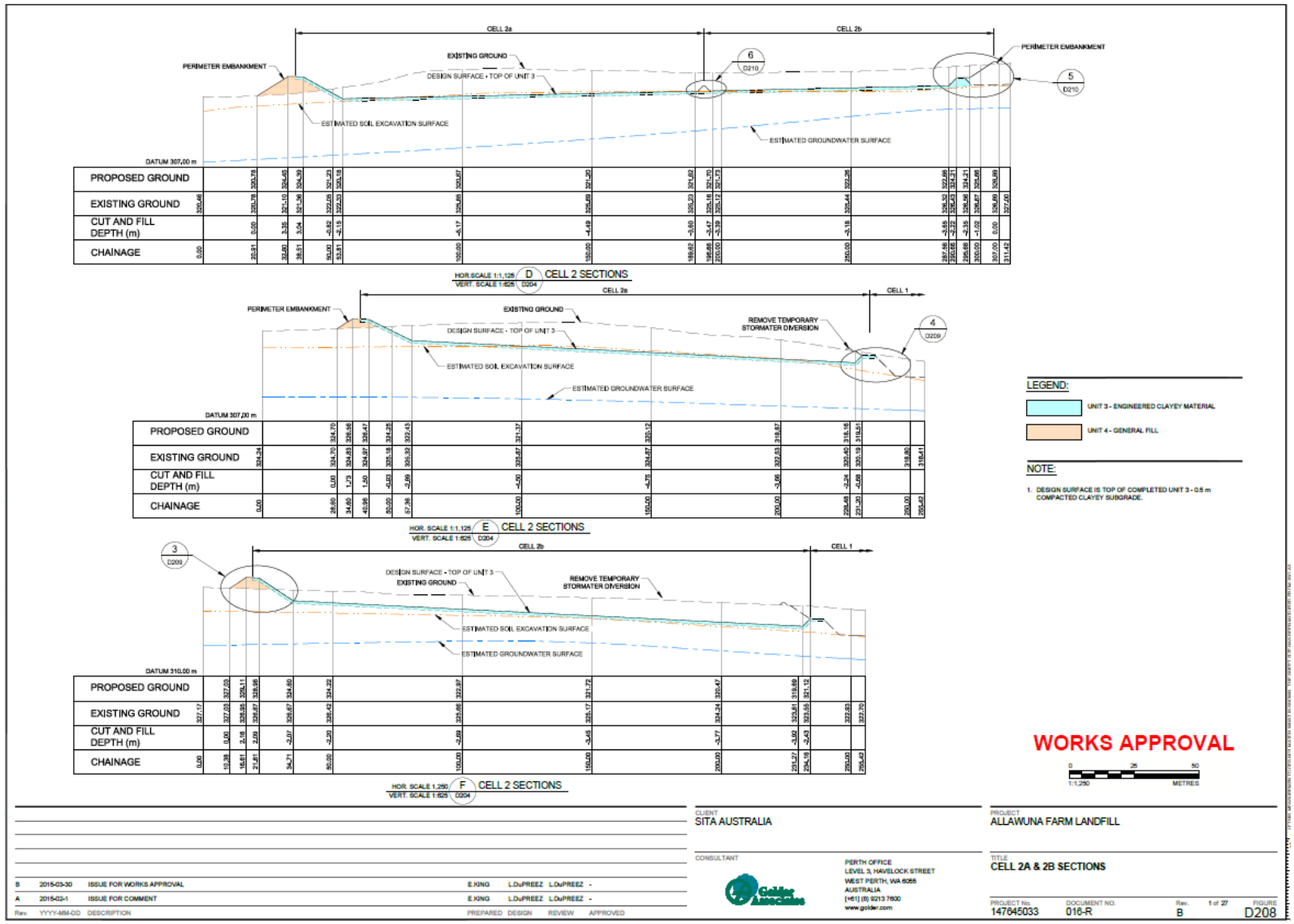
TITLE CELL 1A & 1B SECTIONS
PROJECT No. 147645033
DOCUMENT NO. 016-R
Rev. B
1 of 27
FIGURE D207

Figure D7


CELL 2a
CELL 2b
PERIMETER EMBANKMENT
EXISTING GROUND
DESIGN SURFACE - TOP OF UNIT 3
ESTIMATED SOIL EXCAVATION SURFACE
ESTIMATED GROUNDWATER SURFACE
DATUM 307.00 m
PROPOSED GROUND
EXISTING GROUND
CUT AND FILL DEPTH (m)
CHAINAGE
HOR.SCALE 1:1,125 D CELL 2 SECTIONS
VERT. SCALE 1:625 D204
CELL 1
REMOVE TEMPORARY STORMWATER DIVERSION
HOR. SCALE 1:1,125 E CELL 2 SECTIONS
VERT. SCALE 1:625 D204
DATUM 310.00 m
HOR. SCALE 1:1,250 F CELL 2 SECTIONS
VERT. SCALE 1:625 D204
LEGEND:
UNIT 3 - ENGINEERED CLAYEY MATERIAL
UNIT 4 - GENERAL FILL
NOTE:
1. DESIGN SURFACE IS TOP OF COMPLETED UNIT 3 - 0.5 m COMPACTED CLAYEY SUBGRADE.
WORKS APPROVAL
1:1,250
METRES
B 2015-03-30 ISSUE FOR WORKS APPROVAL E.KING L.DuPREEZ L.DuPREEZ -
A 2015-02-1 ISSUE FOR COMMENT E.KING L.DuPREEZ L.DuPREEZ -
Rev. YYYY-MM-DD DESCRIPTION PREPARED DESIGN REVIEW APPROVED
CLIENT
SITA AUSTRALIA
CONSULTANT
PERTH OFFICE
LEVEL 3, HAVELOCK STREET
WEST PERTH, WA 6005
AUSTRALIA
(+61) (8) 9213 7600
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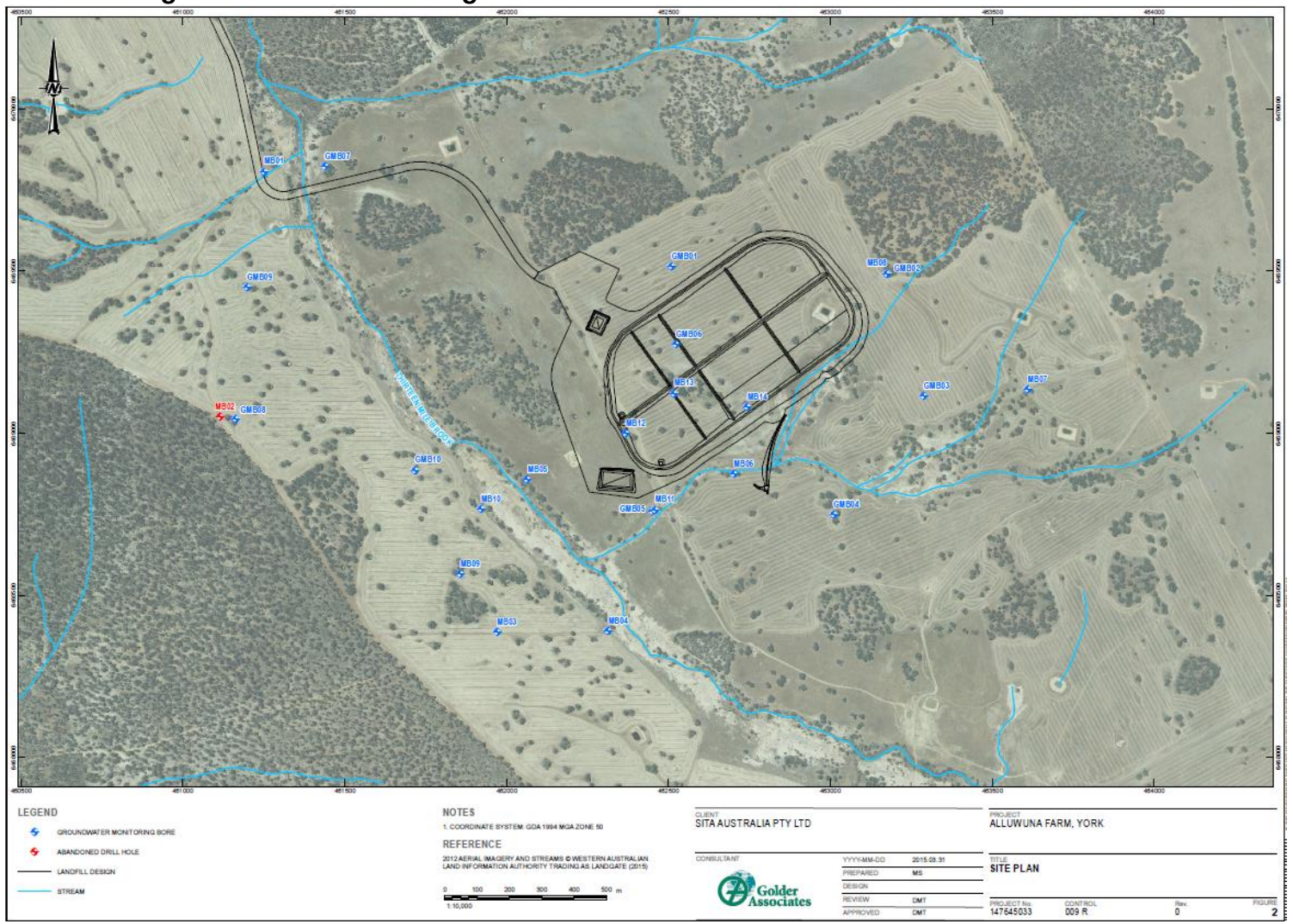
PROJECT
ALLAWUNA FARM LANDFILL
TITLE
CELL 2A & 2B SECTIONS
PROJECT No. 147645033
DOCUMENT NO. 016-R
Rev. B
1 of 27
FIGURE D208

Figure D8

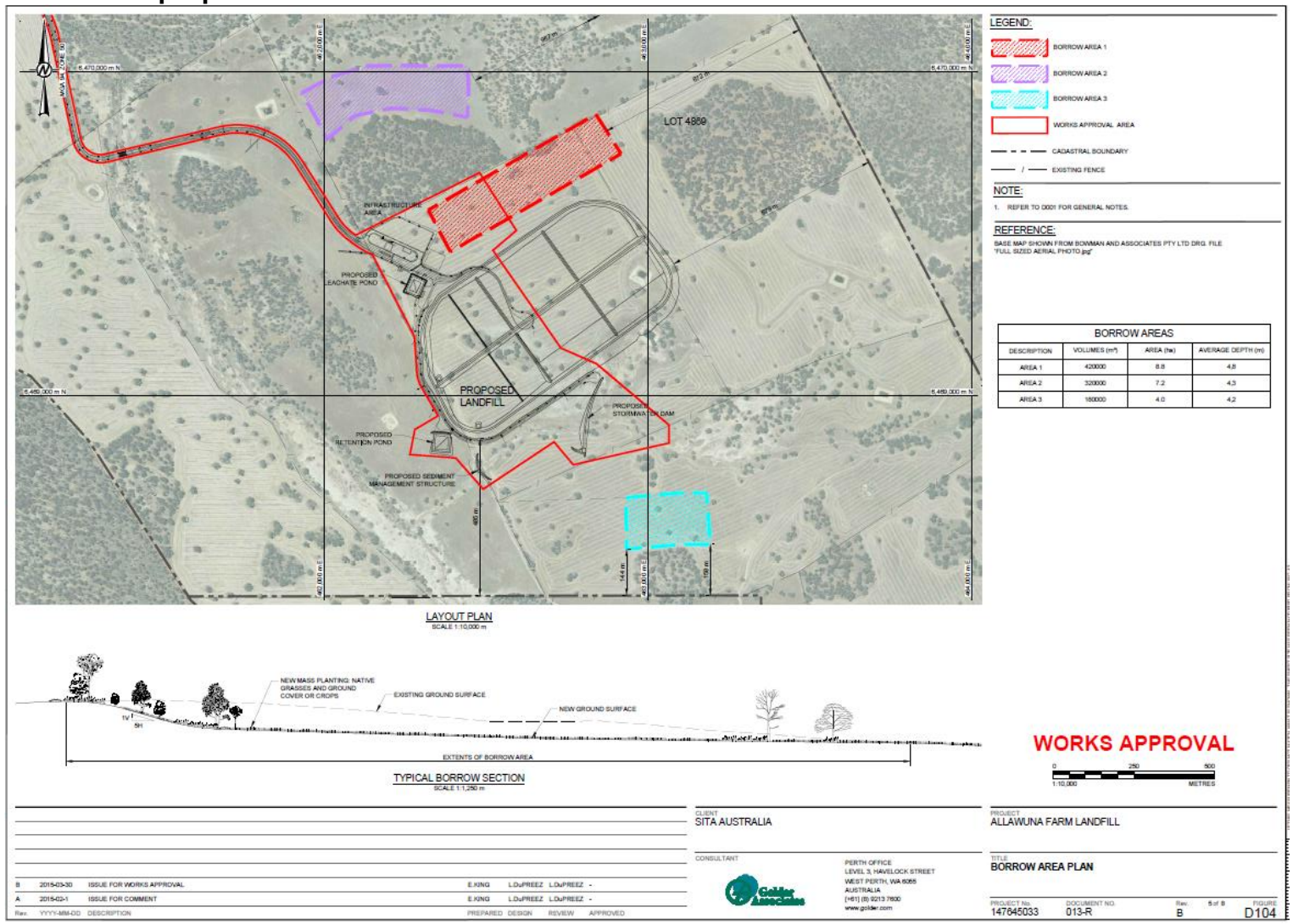
Appendix E

Location of groundwater monitoring bores



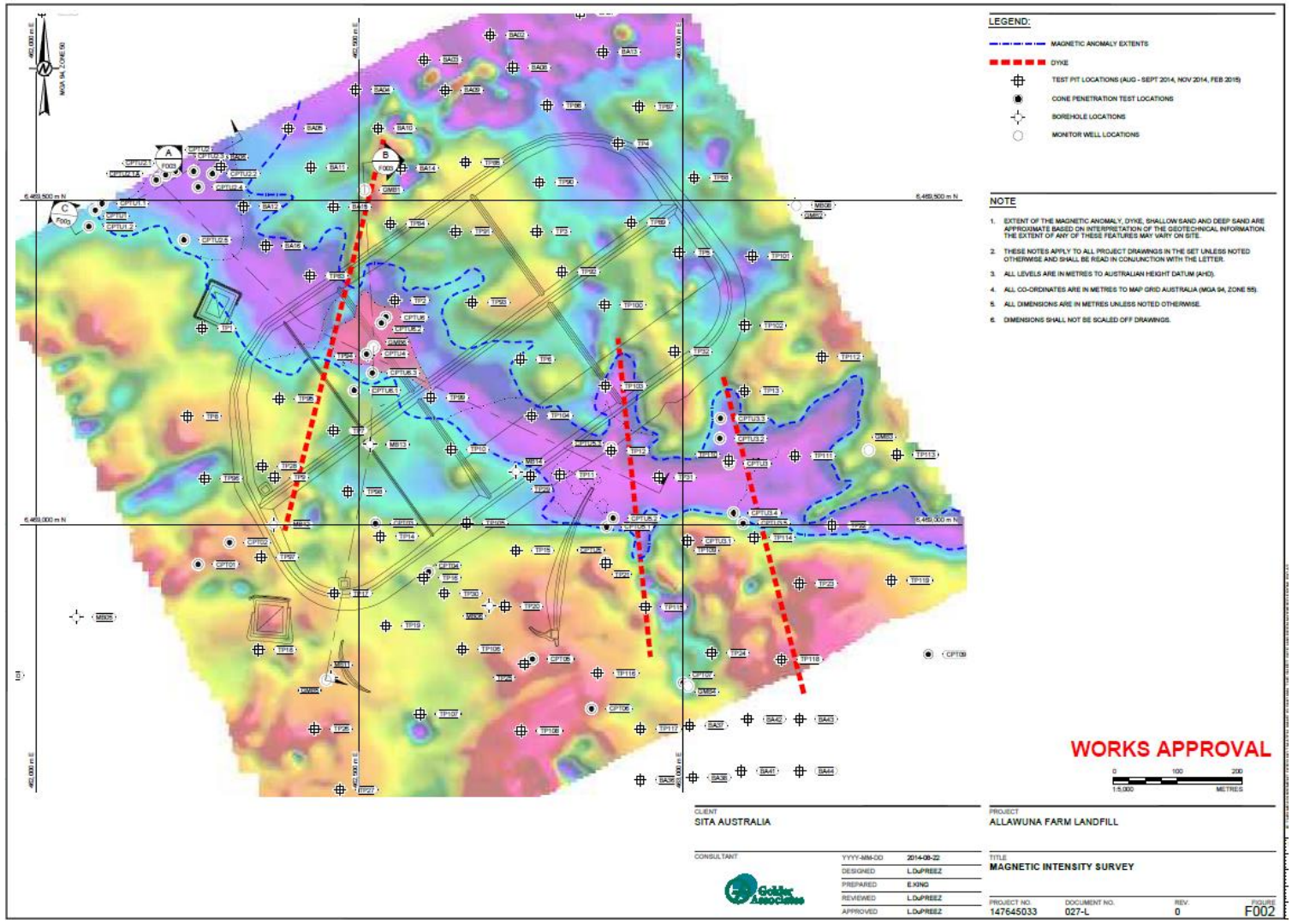
Appendix F

Location of proposed Borrow Areas



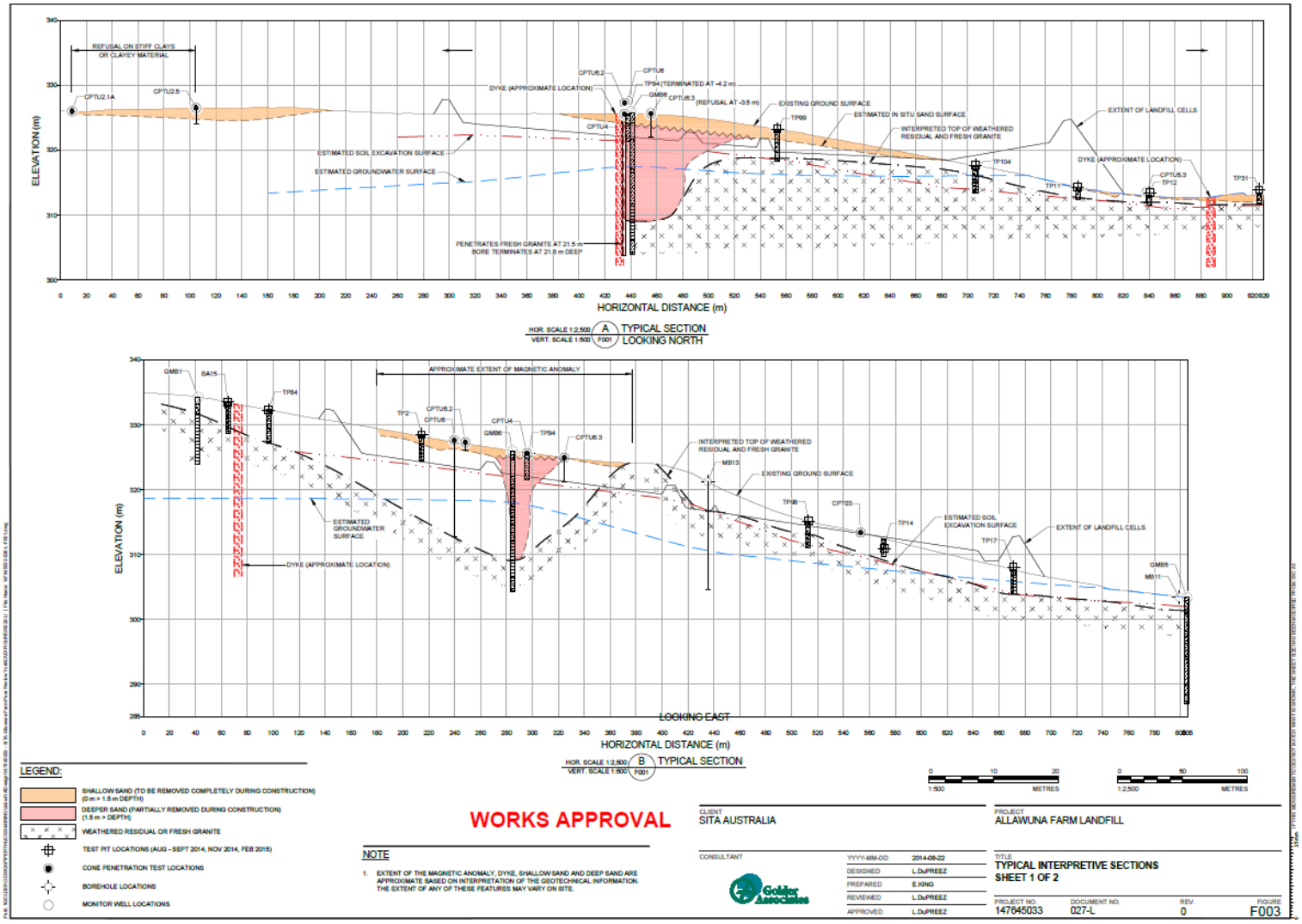
Appendix G

Cone penetrometer locations including the locations of cross-sections depicted in Appendix H



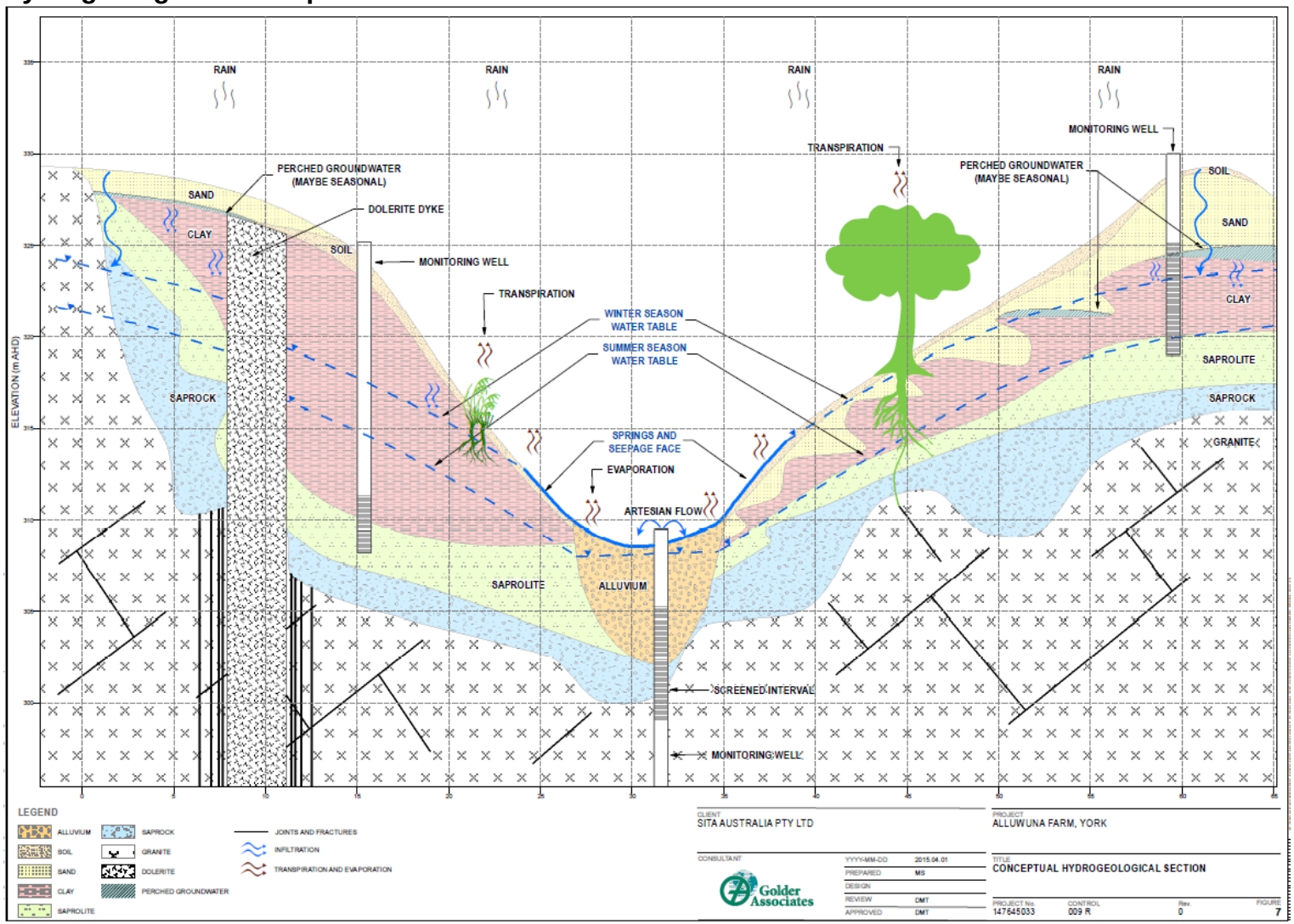
Appendix H

Cross sections of liner geophysical feature

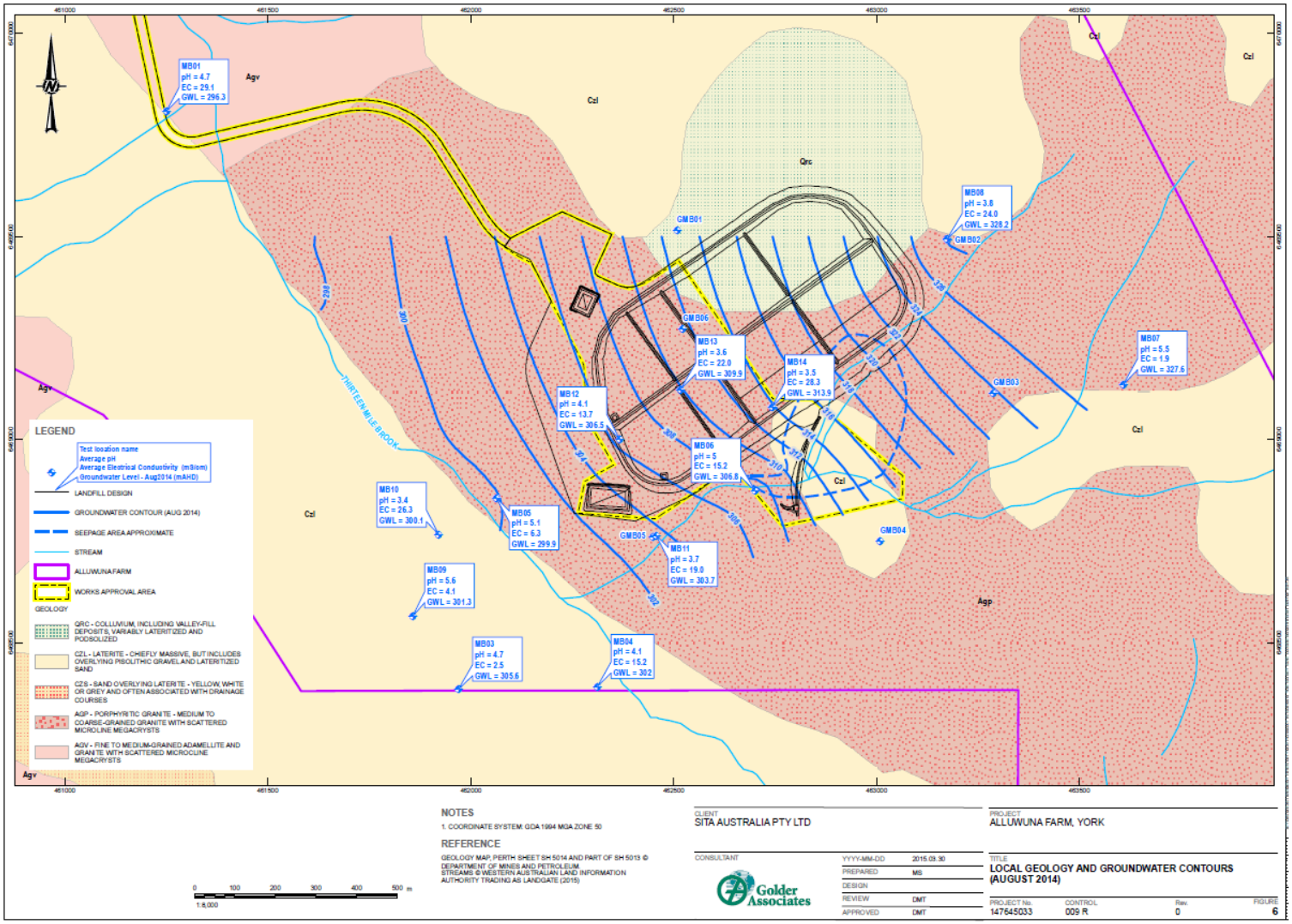


Appendix I

Hydrogeological Conceptual Site Model



Appendix J
Groundwater contours



Appendix K
Technical Memoranda from GHD Pty Ltd

29 May 2015

Lauren Fox
Licensing Officer - Waste Industries (South A)
Department of Environment Regulation
Locked Bag 33, Cloisters Square
PERTH WA 6850

Our ref: 61/32250
14899
Your ref: DER2015/000628

Dear Lauren

Allawuna Farm Landfill - Works Approval W5830:ALLAWUNA
Independent Stability Assessment

1 Introduction

GHD has been instructed by the Department of Environment Regulation (DER) to carry out an independent stability assessment for the proposed Allawuna Farm Class II landfill site, located approximately 20km west of the town of York, WA. GHD was instructed via email dated 18 May 2015.

2 Scope of work

The scope of work as identified in GHD's proposal letter dated 24 April 2015 is as follows. GHD will review documentation and information provided by the DER in terms of:

- Landfill geometry (i.e. ground model including leachate water levels and seismicity)
- Material parameters applied – soil / waste / other materials including geo-materials
- Slope stability approach / philosophy / FoS applied etc.
- Appropriateness of the method of analysis
- Review of the slope stability analysis in accordance with the requirements of DER's Brief

3 Available documentation

The following documentation has been made available to GHD:

1. Golder Associates (2015). Works Approval Application Supporting Documentation – Allawuna Landfill. Submitted to: Mr John Jones, SITA Australia. Report number 147645033-013-R-Rev0. March.

The works approval includes a total of 23 appendices (A to W) of which the following are considered of relevance to the stability assessment:

2. **Appendix A**: Allawuna Landfill Layout Plans and Sections
3. **Appendix B**: Allawuna Landfill Cell 1 and 2, Leachate Pond, Subsurface Drainage, Retention Pond and Stormwater Dam Construction Plans

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T 61 2 9462 4700 **F** 61 2 9462 4710 **E** atnmail@ghd.com **W** www.ghd.com

4. **Appendix D**: Golder Associates (2015). Allawuna Farm Landfill Development Geotechnical Investigations for Landfill Development. Submitted to: SITA Australia. Report number 147645033-008-R-Rev0. March.
5. **Appendix E:** Golder Associates (2015). Allawuna Farm Landfill Hydrogeological Site Characterisation Studies. Submitted to: SITA Australia. Report number 147645033-009-R-Rev0. March.
6. **Appendix F**: Golder Associates (2015). Stability Analysis and Liner System Integrity Assessment for Landfill Development. Submitted to: SITA Australia. Report number 147645033-012-R-Rev0. March.

4 Geotechnical review

4.1 Geotechnical model review

A number of geotechnical investigations have been undertaken by Golder as illustrated in Figure 4 of the Geotechnical Investigations Report (Appendix D). The investigations undertaken provide good spatial coverage of the site, both of the proposed landfill cells and the surrounding area including borrow areas. The majority of the exploratory holes within the landfill ultimate boundary consisted of shallow test pits, with around 50% of logs not recording bedrock. Four boreholes were drilled for hydrogeological monitoring (Appendix E), with limited geotechnical information provided within the logs.

The subsurface conditions are noted by Golder as representative of a typical latertic profile. Material encountered within 1m of the surface was typically granular and this was confirmed by the cone penetration testing (CPT) undertaken both within the proposed landfill footprint and the surrounding area. The dominant underlying material was noted to comprise stiff sandy clay.

GHD has undertaken a detailed review of individual test pit logs, which has highlighted some lateral variation in the near surface soils. The geotechnical parameters assigned to the in situ soil in Table 5 of the Stability Analysis Report (Appendix F) are consistent with a cohesive material. Material descriptions for test pits undertaken within the area of the proposed cell 2b suggest a more granular material, with TP94 encountering sand with only traces of silt and clay to its base at a depth of 4m. This has implications for stability analysis, particularly under seismic conditions (further detail provided with Section 4.2).

No rock mass properties have been quoted within the relevant reports appending the works approval (Appendices D and F), whether assumed or otherwise. Test pits and CPTs are not considered to be the most appropriate techniques for confirming bedrock and the exploratory holes undertaken may have refused on weathered material or boulders, i.e. rock head levels are not clear. Three of the hydrogeological boreholes (MB12, MB13 and MB14) did not encounter rock and were drilled to depths between 8 and 16m. Borehole GMB6 encountered granite at a depth of 21.5m.

CPTu6 undertaken within the area of the proposed cell 2b encountered soil strength materials up to a depth of 14.5m at which point it refused. This is not reflected in any of the geotechnical models presented despite acknowledgement by Golder of the variability in ground conditions in Section 6.2 of Appendix F, where the presence of colluvium and vertical fissures are discussed. The ground model definition is not clear in this area.

4.2 Global stability analysis review

A number of cases have been considered for stability analysis as described in the report presented as Appendix F of the works approval document. The analyses have been based on the proposed geometry of Sections B and C as indicated in Figure 1 within Appendix F, which are considered by Golder to represent the critical sections for global stability. It is noted that all reported minimum factors of safety (FoS) within Tables 6, 8 and 9 of Appendix F relate to analyses based on the geometry of Section C.

A range of groundwater conditions have been considered in the analyses and the assessment of horizontal seismic load coefficients has been carried out consistent with the method set out in AS1170.4.

The calculated minimum FoS' are above the required minimums for all cases with the exception of selected analyses under maximum credible earthquake (MCE) conditions. As discussed in Section 4.1, the geotechnical models adopted for stability analysis do not appear to consider the variability in soil depth as per the indicated ground conditions.

The strength parameters attributed to the waste as presented within Table 5 of Appendix F (φ' = 25° and c' = 5kPa) are considered lower bound based on published values as shown in Figure 1.

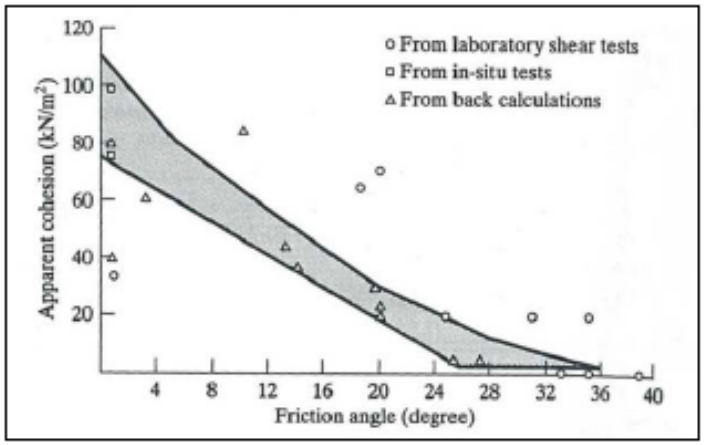

Figure 1 Summary of municpal solid waste strength data (based upon Singh and Murphy, *1990, source ref.1)*

It is considered that increasing the effective cohesion of the waste material may result in the minimum FoS for waste stability under MCE conditions (Appendix F output Figure B8) increasing to from 0.95 above 1.0.

It is acknowledged that under static conditions critical slip surfaces are not likely to penetrate bedrock. Golder have modelled bedrock as a material "considered to have infinite strength" as stated in note 5 to Table 5 within Appendix F. With consideration to the likely variable weathering profile and confidence in true bedrock depth given the site investigations techniques adopted, this analytical approach is not considered appropriate for stability analysis under pseudo-seismic conditions.

4.3 Veneer stability analysis review

Stability analysis of the proposed capping arrangement has been undertaken based on the proposed geometry of Section A as indicated in Figure 1 within Appendix F. It is acknowledged that the input parameters are conservative and the inclusion of a textured LLDPE geomembrane to provide an acceptable FoS is considered acceptable.

5 Conclusion and recommendations

Following our review of the works approval document and accompanying appendices, some specific clarifications are required to demonstrate stability under all required scenarios as follows:

1. Reassessment of stratigraphic models for global stability analysis to consider and clearly identify the variable soil and potentially significant rock depths across the proposed landfill footprint;
2. Re-analysis of critical stability analyses (Figure C1, C2) with reduced effective cohesion to consider the presence of granular soils as encountered within selected test pits;
3. Sensitivity analysis of the strength parameters assigned to the waste under MCE conditions.

The stability of the capping system for the final landform is considered stable based on the veneer stability analysis undertaken and noting the specification of a textured rather than smooth LLDPE.

6 References

1. Qian, X, Koerner, R & Gray, D. (2001). *Geotechnical Aspects of Landfill Design and Construction.* Prentice Hall, Sydney

Written by:

Ben Dening

Senior Geotechnical Engineer

Reviewed by:

Dr Bryn Thomas

Senior Geotechnical Engineer

Government of **Western Australia**
Department of **Environment Regulation**

06 August 2015

Lauren Fox
Licensing Officer - Waste Industries (South A)
Department of Environment Regulation
Locked Bag 33, Cloisters Square
PERTH WA 6850

Our ref: 61/32250 14965
Your ref: DER2015/000628

Dear Lauren

Allawuna Farm Landfill - Works Approval W5830:ALLAWUNA
Independent Stability Assessment - Additional Information Review

1 Introduction

GHD were instructed by the Department of Environment Regulation (DER) via email dated 18 May 2015 to carry out an independent stability assessment for the proposed Allawuna Farm Class II landfill site, located approximately 20km west of the town of York, WA. The landfill design including stability analysis submitted for the Works Aproval Application (WAA) was prepared by Golder Associates Pty Ltd (Golder). The GHD independent stability assessment (ref. 61/32250 dated 29 May 2015) concluded that some specific clarifications were required to demonstrate stability under all scenarios.

2 Scope of work

The scope of work as identified in GHD's proposal letter dated 28 July 2015 is as follows. GHD will review additional documentation provided by the DER with consideration of the conclusions and recommendations provided within GHD's independent stability assessment (Ref. 61/32250), dated 29 May 2015. These recommendations are:

- Reassessment of stratigraphic models for global stability analysis to consider and clearly identify the variable soil and potentially significant rock depths across the proposed landfill footprint;
- Re-analysis of critical stability analyses with reduced effective cohesion to consider the presence of granular soils as encountered within selected test pits;
- Sensitivity analysis of the strength parameters assigned to the waste under MCE conditions.

3 Available documentation

In addition to the documentation provided for the independent stability assessment (and listed within Section 3 of that document). The following document has been made available to GHD:

- Golder Associates (2015). Addendum to the Allawuna Farm Landfill Works Approval Application (mky1ff) Landfill Stability. Submitted to: Mr John Jones, SITA Australia. Report number 147645033-025-M-RevA DRAFT. 14 July.

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4 Geotechnical review

The following sections provide our assessment of Golder's response dated 14 July 2015 to the recommendation and conclusions of GHD's independent stability assessment.

4.1 Reassessment of stratigraphic models

Section 3.1 of the Golder addendum stability report provides details of the updated stability analyses to consider the variable subgrade materials. The geotechnical parameters provided for in situ sand are acceptable, with adopted friction angle considered to be lower bound.

Golder considers that the critical failure mode is sliding along the proposed liner system. The minimum calculated factors of safety (FoS) remained unchanged for all cases, with the exception of output figures A3 and A4, where slight improvement was recorded.

As discussed in Section 4.1 of the GHD independent stability assessment, the adopted ground model stratigraphy in this area (cell 2) for Section C is not consistent with the available geotechnical information and the supplied design cross sections. The cut depth in this area is indicated to be less than 4m and none of the test pits undertaken within this area (TP2, TP83, TP84, TP91, BA14, BA15 and BA16) encountered rock. The nearest boreholes which were drilled for groundwater monitoring (GMB1 and GMB6) encountered rock at 10.35m (RL 323.94m) and 21.5m (RL304.11m) respectively. The dominant underlying material was noted to comprise stiff sandy clay as confirmed by cone penetration (CPT) testing, with localised zones of more granular material.

This is not considered to have a significant impact on these analyses, though this has not been checked through independent stability analysis by GHD. It is recommended that Golder Associates confirm this.

4.2 Reassessment of critical stability analysis to consider granular soils

Additional analyses were undertaken to consider the influence of granular materials within the embankment foundation for the critical sections (Section C). The details provided within Section 3.2 and Figures C1 and C2 of the addendum report indicate reduced calculated FoS' in comparison to the previous analyses of these sections, though they are above the required minimum values.

4.3 Waste sensitivity analysis

Golder have carried out a sensitivity analysis to the strength parameters adopted for the waste material and details of this are provided with Section 3.3 of the addendum report. A range of values has been adopted including increased cohesion which has resulted in a calculated FoS above 1.0 as suggested by GHD in the letter report dated 29 May 2015.

The values adopted in the Works Approval Application are acknowledged as being conservative as supported by Figure 1 in the addendum report. The additional stability analysis of the waste is therefore considered to be acceptable.

5 Conclusions and recommendations

1. Following our review of the additional information supplied by Golder Associates (Addendum dated 14 July 2015), GHD is satisfied that the operational landform design is considered to be stable.
2. The stratigraphic model for analysis of cell 2 (Section C) does not reflect the indicated ground conditions from the available geotechnical information, though based on the analysis presented in figures C1 and C2, the global stability of the landfill in this area is likely to be acceptable. Golder Associates should confirm this.
3. No additional stability monitoring is recommended for the landfill assuming that it is constructed in accordance with the design.

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Appendix L
Surface water diversion system