Banksia Road Landfill Cell 12A – Application for an Amendment to Licence L8904/2015/1 (APP-0026710)

Cleanaway Solid Waste Pty Ltd

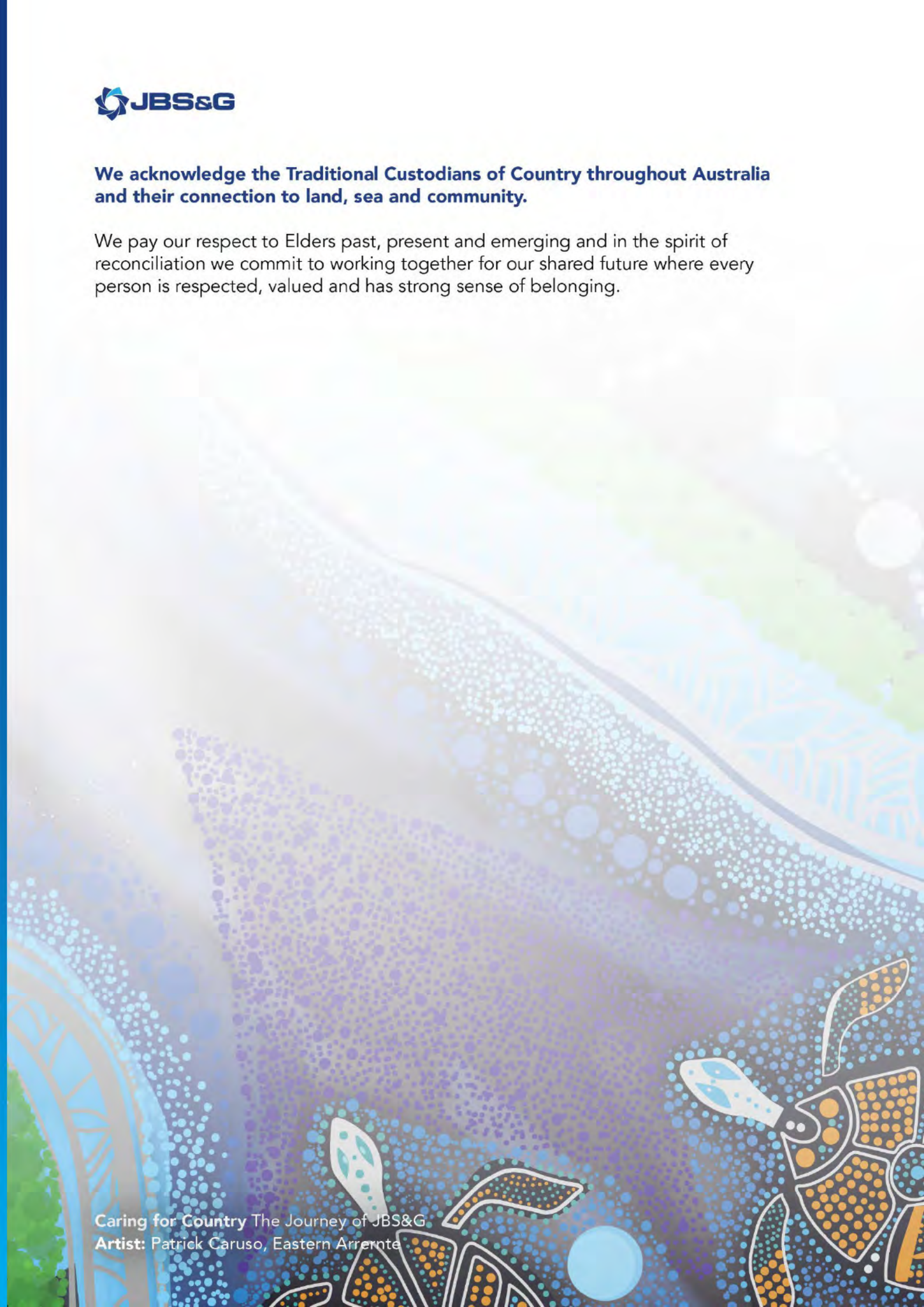
Response to Request for Further Information

70228 | 169,194 (Rev 0)

29 July 2025

We acknowledge the Traditional Custodians of Country throughout Australia and their connection to land, sea and community.

We pay our respect to Elders past, present and emerging and in the spirit of reconciliation we commit to working together for our shared future where every person is respected, valued and has strong sense of belonging.



Caring for Country The Journey of JBS&G
Artist: Patrick Caruso, Eastern Arrernte

Table of Contents

List of Tables

Appendices

Abbreviations

Term	Definition
AACR	Annual Audit Compliance Report
DWER	The Department of Water and Environmental Regulation
EP Act	*Environmental Protection Act 1986*
RFI	Request for further information

1. Introduction

Cleanaway Solid Waste Pty Ltd (Cleanaway) operates the Banksia Road Putrescible Landfill at Banksia Road, Crooked Brooke in Western Australia, under *Environmental Protection Act 1986* (EP Act) Licence L8904/2015/1. Cleanaway has recently finished construction of a new cell at the landfill (Cell 12A) under Works Approval W6855/2023/1.

Cleanaway has applied to the Department of Water and Environmental Regulation (DWER) to amend Licence L8904/2015/1 to allow ongoing operation of Cell 12A. DWER has provided Cleanaway with a request for further information (RFI) regarding the application, for which Cleanaway has engaged JBS&G Australia Pty Ltd (JBS&G) to prepare a response.

The RFI listed documents required to be submitted in support of the licence amendment application to facilitate its validation and advertisement for public comment by DWER. This document provides a response to the RFI and contains the requested documents.

2. Response to Request for Information

Table 1 provides a summary of Cleanaway's response to the DWER RFI.

Table 1: Response to the RFI

No.	DWER request	Cleanaway response
1.	A summary report detailing how the current operation of Cell 12A is compliant with time limited operation conditions outlined in Works Approval W6855/2023/1	Section 3 of this document.
2.	Details around any minor changes that were made to the Cell 12A design during construction, that may differ from construction conditions within Works Approval W6855/2023/1, and confirmation that these changes have not impacted the cells performance.	Section 4 of this document
3.	Details of any changes to the existing licence that Cleanaway anticipates are required to allow operation of Cell 12A.	Section 5 of this document
4.	The Critical Containment Infrastructure Report submitted under Works Approval W6855/2023/1.	Provided in Appendix A with correspondence from DWER that the report meets the requirements of Works Approval W6855/2023/1.
5.	The Groundwater Well Construction Report submitted under Works Approval W6855/2023/1.	Provided in Appendix B with correspondence from DWER that it meets the requirements of Conditions 11 and 12 of Works Approval W6855/2023/1.
6.	A new premises map and groundwater monitoring bore network map for the premises.	Appendix C and Appendix D, respectively

3. Compliance with Works Approval W6855/2023/1

The current operation of Cell 12A has been deemed to be compliant with time limited operation conditions in Works Approval W6855/2023/1, as outlined in Table 2.

Table 2: Compliance with time limited operations conditions of W6855/2023/1

<table>
<tr><th>Condition No.</th><th>Condition Requirement</th><th>Evidence of Compliance</th></tr>
<tr><td>18</td><td>The works approval holder may conduct time limited operations for an item of infrastructure specified in condition 19:
a. Until 1 October 2025: or
b. until such time as a licence for that item of infrastructure is granted in accordance with Part V of the Environmental Protection Act 1986, if one is granted before the end of the period specified in condition 18(a).</td><td>On 9 December 2024, Cleanaway applied to DWER to amend Licence L8904/2015/1 to incorporate provisions for the ongoing operation of Cell 12A beyond the approved time limited operations period. The application is currently being assessed by DWER, and the amended licence is expected to be issued before 1 October 2025.</td></tr>
<tr><td>20</td><td>During time limited operations, the works approval holder must ensure that the premises infrastructure and equipment listed in Table 9 and located at the corresponding infrastructure location is maintained and operated in accordance with the corresponding operational requirement set out in Table 9.
Table 9: Infrastructure and equipment requirements during time limited
<table><tr><th></th><th>Site infrastructure and equipment</th><th>Operational requirement</th><th>Infrastructure location</th></tr><tr><td>1</td><td>Cell 12A</td><td>Lining system in the cell 12A to be maintained to achieve a permeability of at least < 1x 10^{-9} m/s or equivalent</td><td>As depicted by Figure 2 of Schedule 1</td></tr></table></td><td>The groundwater bore monitoring network and groundwater monitoring carried out as per the works approval and licence (L8904/2015/1) confirms if the permeability (integrity) of the lining system is being maintained by detecting contamination that would be associated with any leaks. No leaks have been detected in the lining system.</td></tr>
</table>

<table>
<tr><th>Condition No.</th><th>Condition Requirement</th><th>Evidence of Compliance</th></tr>
<tr><td>21</td><td>The works approval holder must only accept onto the premises solid waste of a waste type, which does not exceed the corresponding rate at which waste is received, and which meets the corresponding acceptance specification set out in Table 10.

Table 10: Types of solid waste authorised to be accepted onto the premises
<table>
<tr><td>Waste type</td><td>Rate at which waste is received</td><td>Acceptance specification</td></tr>
<tr><td>All waste types</td><td>350,000 tonnes per annual period with no more than 20,000 tonnes of Special Waste Type 1 received in any annual period.</td><td>(a) All waste accepted at the Premises must be completely covered;
(b) All waste loads accepted at the Premises must be visually inspected to confirm waste type/s;
(c) Should a hot load be identified, the waste must not be disposed of at the tipping face; and
(d) All waste suspected of containing ACM or asbestos must be treated as being Special Waste Type 1.</td></tr>
<tr><td>Contaminated Solid Waste
Inert Waste Type 1
Inert Waste Type 2
Putrescible Waste
Special Waste Type 2
Processed septage waste</td><td></td><td>(a) Contaminated Solid Waste must be supported by documentation that demonstrates compliance with the Acceptance Criteria for Class III landfills; and
(b) No tyres are to be accepted.</td></tr>
<tr><td>Special Waste Type 1</td><td></td><td>(a) All Special Waste Type 1 accepted at the Premises must be completely contained; and
(b) Acceptance of any waste must not result in the discharge of ACM or asbestos fibres.</td></tr>
<tr><td>Clean Fill</td><td></td><td>None specified</td></tr>
</table></td><td>The works approval condition is consistent with that in the licence. The 2024 Annual Audit Compliance Report (AACR) for the premises indicates ongoing compliance with this condition.</td></tr>
</table>

<table>
<tr><th>Condition No.</th><th>Condition Requirement</th><th>Evidence of Compliance</th></tr>
<tr><td>22</td><td>The works approval holder must ensure that the waste types specified in Table 11 are only subjected to the corresponding processes, subject to the corresponding process limits and/or specifications.

Table 11: Solid waste processing
<table>
<tr><th>Waste type</th><th>Process(es)</th><th>Process limits/specification</th></tr>
<tr><td>Clean fill</td><td rowspan="5">Receipt, handling, and disposal by landfilling.</td><td>None specified</td></tr>
<tr><td>Contaminated Solid Waste</td><td>(a). Only Contaminated solid waste that demonstrates compliance with the Acceptance Criteria for Class II landfills must be disposed of in the area of Cell 12A that overlaps Cell 1 or Cell 2.
(b). Waste will only be disposed of by burial into the Active Landfill Area and must not be used for any other purpose.
(c). All waste will be levelled in layers no greater than 0.5 m thick and compacted; and
(d). Highly Odorous Waste will be disposed of by burial immediately following acceptance.</td></tr>
<tr><td>Drill muds (processed in accordance with Condition 8 in L8904/2015/1)
Inert Waste Type 1
Inert Waste Type 2
Putrescible Waste
Processed septage</td><td>(a) Waste must only be disposed of by burial into the Active Landfill Area and must not be used for any other purpose;
(b) All waste, except Special Waste Type 1, must be levelled in layers no greater than 0.5 m thick and compacted; and
(c) Highly Odorous Waste must be disposed of by burial immediately following acceptance.</td></tr>
<tr><td>Special Waste Type 1</td><td>(d) Waste must only be disposed of by burial to the active Special Waste Disposal Area.
(e) Disposal must not result in the discharge of ACM or asbestos fibres;
(f) Bulk loads of soil containing ACM or asbestos must be wet down during disposal, levelling and immediate burial; and
(g) Waste must not be compacted until covered in accordance with Condition 19.</td></tr>
<tr><td>Special Waste Type 2</td><td>(h) Waste must only be disposed of by burial to the active Special Waste Disposal Area.
(i) Waste must be levelled in layers no greater than 0.5 m thick and compacted; and
(j) Highly Odorous Waste must be disposed of by burial immediately following acceptance.</td></tr>
</table></td><td>The works approval condition is consistent with that in the licence, except for the requirement for only Class II waste to be disposed of in the areas of Cell 12A that overlaps closed Cell1 or Cell 2. However, DWER has provided further advice[1] on this issue and considers that "Cell 12A has been designed and approved as a Class III cell, as such, the Department considers that Class III waste can be accepted to the entirety of the cell".
DWER further advised that "The placement of Class II waste over the footprint of Cells 1 and 2 is an operation control imposed by Cleanaway, which we have carried across to Time Limited Operations conditions within the works approval. However, as we consider that the Class III cell can accept Class III waste, there would be no obligation for Cleanaway to provide us with any information as to where Class II waste is being deposited, or any testing data to confirm this."
For the remaining requirements, the 2024 AACR for the premises indicates ongoing compliance with this condition.</td></tr>
</table>

[1] Hayden, G. (2025) [DWER] Email to Les Egerton [Cleanaway] 8 July 2025.

<table>
<tr><th>Condition No.</th><th>Condition Requirement</th><th>Evidence of Compliance</th></tr>
<tr><td>22 (note error in condition numbering from this point on)</td><td>The licence holder shall ensure that daily and interim cover is applied and maintained on landfilled waste types in accordance with the corresponding cover requirements in Table 12 and Table 13 [and] that sufficient stockpiles of cover are maintained on the premises at all times to meet the requirements of this condition.

Table 12: Daily cover requirements
<table>
<tr><th>Waste type</th><th>Material</th><th>Depth</th><th>Timescales</th></tr>
<tr><td>Clean Fill</td><td colspan="3">No cover requirement</td></tr>
<tr><td>Special Waste Type 1
Special Waste Type 2</td><td colspan="2">Either:
(a). 300 mm of Inert Waste Type 1 or Clean fill; or
(b). 1,000 mm of Solid waste</td><td>As soon as practicable after acceptance and no later than the end of the working day that the waste was accepted, and before being compacted to prevent the release of asbestos fibres and further disturbance as a result of compaction and other landfilling activities.</td></tr>
<tr><td>Contaminated Solid Waste
Drill muds
Inert Waste Type 1
Inert Waste Type 2
Putrescible Waste</td><td>Inert Waste Type I or Clean Fill</td><td>150 mm</td><td>As soon as practicable and not later than the end of the working day that the waste was deposited.</td></tr>
<tr><td>Processed Septage waste</td><td>Inert Waste Type 1 or Clean Fill</td><td>300 mm</td><td>As soon as practicable and not later than the end of the working day that the waste was deposited.</td></tr>
<tr><td rowspan="2">All waste types</td><td>Inert Waste Type 1 or Clean Fill</td><td>300 mm</td><td>Immediately following disposal for any wastes meeting the definition of Highly Odorous Wastes[1] or Dusty Wastes[1].</td></tr>
<tr><td>Putrescible Waste</td><td>1000 mm</td><td>Immediately following disposal for any wastes meeting the definition of Highly Odorous Wastes[1] or Dusty Wastes[1].</td></tr>
</table>
Note 1: Where waste meets the definition of Highly Odorous Wastes and/or Dusty Wastes, the cover requirements for Highly Odorous Wastes and Dusty Wastes take precedence over any other cover requirements.

Table 13: Interim cover requirements
<table>
<tr><th>Waste type</th><th>Material</th><th>Depth</th><th>Timescales</th></tr>
<tr><td>All waste types</td><td>Clean Fill</td><td>1000 mm</td><td>Progressively applied and within 3 months of achieving Interim Waste Contours</td></tr>
</table></td><td>The works approval condition is consistent with that in the licence. The 2024 AACR for the premises indicates ongoing compliance with this condition.</td></tr>
</table>

<table>
<tr><th>Condition No.</th><th>Condition Requirement</th><th>Evidence of Compliance</th></tr>
<tr><td>23</td><td>The works approval holder must record the total amount of waste accepted onto and removed from the premises in accordance with the specifications listed in Table 14.
Table 14: Monitoring of inputs and outputs
<table>
<tr><th>Input/Output</th><th>Unit</th><th>Time period</th><th>Frequency</th></tr>
<tr><td>Waste Inputs</td><td rowspan="2">Tonnes</td><td rowspan="2">Annual period</td><td>Each load arriving at the Premises</td></tr>
<tr><td>Waste Outputs</td><td>Each load leaving or rejected from the premises</td></tr>
</table></td><td>The works approval condition is consistent with that in the licence. The 2024 AACR for the premises indicates ongoing compliance with this condition.</td></tr>
</table>

Condition No.	Condition Requirement	Evidence of Compliance
24	The works approval holder must monitor groundwater for concentrations of the identified parameter(s) in accordance with Table 15. **Table 15: Groundwater monitoring of ambient concentrations** 	The works approval condition is consistent with that in the licence (with the addition of newly constructed bores). The 2024 AACR for the premises indicates ongoing compliance with this condition.

Monitoring well location	Parameter	Unit	Frequency	Averaging period
Monitoring wells as shown in Figure 2, Schedule 1 of the Licence L8904/2015/1 and newly constructed wells GW12S, GW16S/D and GW17S/D	Standing water level[1]	m(AHD)	Quarterly	Spot sample, in accordance with AS/NZS 5667.11
	pH[1]	pH unit		
	Electrical conductivity[1]	µS/cm		
	Redox potential[1]	Eh		
	Chemical oxygen demand	mg/L		
	Nitrate-nitrogen			
	Ammonia-nitrogen			
	Total nitrogen			
	Total phosphorus			
	Total dissolved solids			
	Total organic carbon			
	Dissolved oxygen[1]			
	Major cations and anions: calcium, magnesium, potassium, sodium, chloride, bicarbonate and sulphate			
	Heavy Metals: Aluminium, Arsenic, Cadmium, Chromium, Copper, Iron (total) Lead, Manganese, Mercury, Nickel, Selenium and Zinc			
	PFAS: • Perfluorooctane sulfonate; • Perfluorooctanoic acid; • 6:2 Fluorotelomer sulfonate; • 8:2 Fluorotelomer sulfonate; • Perfluoroheptanoic acid; • Perfluorobutane sulfonate; • Perfluorobutanoic acid;	µg/L	Six monthly	Spot sample, in accordance with AS/NZS 5667.11
	• Perfluorohexanoic acid; • Perfluorohexane sulfonate; • Perfluoropentanoic acid; • Perfluorooctane sulfonamide; • Perfluorodecane sulfonate; • Perfluorononanoic acid; • Perfluorodecanoic acid; • Perfluoroundecanoic acid; • Perfluorododecanoic acid; • Perfluorotridecanoic acid; • Perfluorotetradecanoic acid; • N-Methyl-heptadecafluorooctane sulfonamide; • N-Ethyl-heptadecafluorooctane sulfonamide; • N-Methyl-heptadecafluorooctane sulfonamidoethanol; and N-Ethyl-heptadecafluorooctane sulfonamidoethanol			
	Organics: Phenols, Polyaromatic hydrocarbons (PAH), Organochlorine pesticides, Organophosphate pesticides (Demeton-S-Methyl, Diazinon, Dimethoate, Fenamiphos, Fenthion, Malathion and Parathion), Polychlorinated biphenyls (PCB), Atrazine, BTEX (benzene, toluene, ethylbenzene, xylene), Total Petroleum Hydrocarbons and Trichloroethylene/Perchloroethylene	mg/L	Six monthly	Spot sample, in accordance with AS/NZS 5667.11

Note 1: In-field non-NATA accredited analysis permitted.

Condition No.	Condition Requirement	Evidence of Compliance
25	The works approval holder must submit to the CEO a report on the time limited operations within 30 calendar days of the completion date of time limited operations or 30 calendar days before the expiration date of the works approval, whichever is the sooner.	The report on time limited operations of Cell 12A will be submitted to DWER within 30 calendar days after the completion date of time limited operations.
26	The works approval holder must ensure the report required by condition 25 includes the following: (a). a summary of the time limited operations, including timeframes and amount waste received, disposed of on the premises and the amount of waste taken off the premises; (b). a summary of the environmental performance of cell 12A and stormwater retention ponds and pipework for cell 9 and 10. (c). a review of performance and compliance against the conditions of the works approval; and (d). where the manufacturer's design specifications and the conditions of this works approval have not been met, what measures will the works approval holder take to meet them, and what timeframes will be required to implement those measures.	
27	The works approval holder must maintain and implement the Leachate Plan Version PS130251-003-R-R-Rev0, dated 31 March 2022, consistent with the conditions of Licence L8904/2015/1.	The works approval condition is consistent with that in the licence. The 2024 AACR for the premises indicates ongoing compliance with this condition.

4. Changes to the Design of Cell 12A

During the construction of Cell 12A, there some design changes to accommodate on-site circumstances that deviated from the construction conditions in Works Approval W6855/2023/1. All these changes were minor in nature and did not impact the environmental performance of Cell 12A (iwProjects, 2025), as follows:

- The northern and western cell perimeter bunds were brought in by 10 m to accommodate gas pipes located on the outside of the new cell. Consequently, the height of the perimeter bund was increased by 2.5 m to suit the cell top of waste filling plan. These changes reduced the size of the overall landfill cell.
- Following an independent review of the design of Cell 12A (WSP, 2024), the southeast corner and southern edge of the cell was raised to ensure no waste in the underlying old cells was intercepted during excavation works. Consequently, to maintain the original 1 (Vertical) in 3 (Horizontal) side slope, the southern earthworks batter was extended further into Cell 12A, which again reduced the size of the cell.
- At the Leachate Collection Sump, an additional 300 mm of soil was excavated from the floor of the landfill due to the subgrade being too moist because of recent rain. The Leachate Collection Sump internal batters were maintained at 1 (V) in 3 (H).
- The leachate extraction riser pipes were changed from the original 355 mm diameter to 450 mm diameter to facilitate easier access to the sump when inserting the leachate pump. Consequently, the concrete headwall structure was made slightly larger to accommodate the larger pipe dimeters.

5. Other Proposed Amendments to Licence L8904/2015/1

Table 3 outlines proposed changes to Licence L8904/2015/1 that Cleanaway anticipates are required to operate Cell 12A. Other proposed amendments to the licence, unrelated to Cell 12A, are included in Table 4.

Table 3: Proposed amendment to Licence L8904/2015/1 to operate Cell 12A

Condition no.	Condition requirement	Proposed amendment
5, Table 4: Solid waste processing	*The Licence Holder must ensure that the waste types specified in Table 4 are only subjected to the corresponding processes, subject to the corresponding process limits and/or specifications.*	As outlined in Table 2 above, the corresponding waste processing table in Works Approval W6855/2023/1 (Table 11) has the following process limit/ specification: *(a) Only Contaminated solid waste that demonstrates compliance with the Acceptance Criteria for Class II landfills must be disposed of in the area of Cell 12A that overlaps Cell 1 or Cell 2.* DWER has confirmed in correspondence that Class III waste can be accepted into the entirety of Cell 12A and, therefore, Cleanaway is requesting that the works approval specification is not included in the amended licence.

Condition no.	Condition requirement	Proposed amendment
Condition 10, Table 7: Solid waste containment infrastructure	*The Licence Holder must ensure that the solid waste containment infrastructure specified in Table 7 meets or exceeds the specifications in Table 7 for the corresponding infrastructure.*	• Table 7, Row 1, Column 1 – Infrastructure: Include Cell 12A. • Table 7, Row 3, Column 1 – Infrastructure: Include Cell 12A.
Condition 15(d) Landfill gas management infrastructure	*The Licence Holder must:* *(d) install landfill gas extraction wells and collection infrastructure in Cell 8 and connect this infrastructure to the active landfill gas management system (flare) within 12 months of reaching final waste contours in these Cells.*	Include Cell 12A.
Condition 20(e)(ii) Final capping	*The Licence Holder must prepare and submit to the CEO by 31 March 2022, an updated Rehabilitation and Closure Plan for all Landfill Cells. The updated Rehabilitation and Closure Plan must include as a minimum:* *(e) A capping schedule that ensures that:* *(ii) Cells 7 and 8 are capped within 18 months of reaching final waste contours in each cell.*	Include Cell 12A.
Table 28 Definitions	*Active Landfill Area: An area defined as an active Special Waste Type 1 and 2 disposal areas, Cell 7, Cell 8 and any part of adjoining cells (excluding Cell 1 and Cell 2) where waste is required to be deposited to achieve final waste contours.*	Include Cell 12A.
	New definition for Cell 12A	Means the cell marked as 'Cell 12A' in Figure 1, Schedule 1
Schedule 1, Figure 1: Premises map	*The Premises is shown in the map below. The red line depicts the Premises boundary with excised extractive industries operations defined by the coordinates in Schedule 2.*	Include an updated Figure 1 in Schedule 1 that includes Cell 12A (refer to Appendix C for an updated Premises map).

Table 4: Other proposed amendments to Licence L8904/2015/1

Condition No.	Condition Requirement	Proposed Amendment
Condition 78, Table 24, Row 2: Notification requirements	*Details of any works proposed for the expansion of the landfill gas collection and management system as depicted in Plan 3 of Schedule 3 in the Licence, at least 6 months prior to any expansion occurring.*	Request that this requirement is deleted. Conditions 14 and 15 of the licence provide the specifications for the landfill gas collection and management system and installation requirements for Cell 8 and Cell 12A (if amended as proposed in Table 3). The requirement to notify DWER at least six months ahead of any changes to the landfill gas collection and management system is not practical in that the design of any expansion of the system is carried out iteratively prior to installation and can change frequently due to many influencing factors. The current requirement presents an unnecessary administrative burden.

Condition No.	Condition Requirement	Proposed Amendment
		Any significant changes to the system would require a licence amendment application, through which DWER would be able assess the potential environmental impact associated with the changes. Should DWER require regular updates on the progress and expansion of the system, Condition 75 (Table 23, Row 5) of the licence already requires the Annual Environment Report to contain a summary of landfill gas collection and management system, including infrastructure installed during the reporting year and a map of the spatial coverage of the system.
Condition 86 Construction works – Landfill gas flare station	The Licence Holder must not commission or operate the infrastructure or equipment required by condition 83 until the Environmental Compliance Report specified in condition 84 has been submitted.	Request that the restriction for no commissioning to occur until the Environmental Compliance Report (ECR) required by condition 84 has been submitted be deleted. The ECR (as per condition 85) must confirm that the gas infrastructure has been constructed in accordance with, and has met, the design and construction/installation requirements specified in condition 83 (Table 26). Some of these requirements need the infrastructure to be 'commissioned' (i.e., connected) to demonstrate that they have been met, e.g., no leakage of gas. This is relevant to the installation of the gas collection infrastructure (gas transfer pipelines, laterals and headers) which is an ongoing activity and not a discrete, one-off event.

6. References

iwProjects (2025). *Banksia Road Landfill – Licence Amendment Application - Response to DWER Queries*. Letter prepared for Cleanaway Solid Waste by IW Projects, 11 June 2025.

WSP (2024). *Peer review of the residual interface shear parameters for Landfill Cell 12A*. Memo prepared for Cleanaway Solid Waste by WSP, 23 February 2024.

Appendix A Critical Containment Infrastructure Report

Government of Western Australia
Department of Water and Environmental Regulation

Your ref: W6855/2023/1
Our ref: DER2021/000183
Enquiries: [redacted]
Phone: 08 6364 7639
Email: info@dwer.wa.gov.au

[redacted]
Cleanaway Solid Waste Pty Ltd
72 Hyne Road,
South Guildford WA 6055

via email [redacted]

Attn: [redacted]

Dear [redacted]

WORKS APPROVAL (W6855/2023/1) CRITICAL CONTAINMENT INFRASTRUCTURE REPORTS REVIEW – COMPLIANCE DEMONSTRATED

I refer to your submission of the Cell 12A Critical Containment Infrastructure Report (CCIR) stage 1, 2 and 3 report required in accordance with conditions in works approval W6855/2023/1 granted under Part V Division 3 of the *Environmental Protection Act 1986*, at Lot 2 on Deposited Plan 65861, Crooked Brook for the construction of Cell 12A.

DWER has reviewed the CCIR and determined that the provided information meets the requirements of works approval W6855/2023/1.

You may commence time limited operations for the critical containment infrastructure, being Cell 12A, once the amendment application for works approval W6855/2023/1 to authorise time limited operations is granted. Prior to commencement, please ensure that you are familiar with the time limited operations requirements of works approval W6855/2023/1.

If you have any queries regarding the above information, please contact the Environmental Officer listed above.

Yours sincerely

[redacted]
A/MANAGER, WASTE INDUSTRIES – REGULATORY SERVICES
Officer delegated under section 20 of the Environmental Protection Act 1986

14 August 2024

BANKSIA ROAD LANDFILL, DARDANUP

CELL 12A CONSTRUCTION

CRITICAL CONTAINMENT INFRASTRUCTURE REPORT – STAGE 1, 2 & 3 (FINAL)

VIEW OF COMPLETED CELL 12A - AERIAL VIEW

Prepared for

CLEANAWAY SOLID WASTE PTY LTD

IW Projects Pty Ltd

6 Anembo Close, DUNCRAIG, WA 6023
Mobile: [redacted] email: [redacted]

Revision: Stage 1, 2 & 3
Date of Issue: 1 Aug 2024

Table of Contents

[redacted]

Copyright and Disclaimer

1. Introduction

Cleanaway Solid Waste Pty Ltd (Cleanaway) has completed the construction of Cell 12A at the Banksia Road Landfill located at part Lot 2, Banksia Road, Crooked Brook, WA 6236. The facility was constructed under Works Approval WA6855/2023/1, issued by the Department of Water and Environmental Regulation (DWER).

The Works Approval is for the construction of Landfill Cells 9, 10 and 12A, being the next three landfill cells that Cleanaway would progressively develop. Cell 12A being the first of the three cells to be constructed.

The Works Approval requires Cleanaway to provide compliance certification and critical containment infrastructure reporting from a suitably qualified civil engineer, confirming each item of infrastructure or component of infrastructure had been constructed in accordance with the requirements specified within the Works Approval.

Ian Watkins of *IW Projects* was appointed by Cleanaway to undertake the necessary review and inspections associated with the construction activities and to provide the compliance certification and reporting for submission to the DWER. Ian Watkins was also the designer of Cells 9, 10 and 12A.

Based on the structure of the Works Approval, the only Environmental Compliance Reporting requirements relate to the stormwater retention ponds and pipework associated with Cells 9 and 10. Hence, with this report only covering the construction of Cell 12A, there are no Environmental Compliance Reporting requirements, and as such, this is report is only a Critical Containment Infrastructure Report.

Due to the urgency to commence landfilling in Cell 12A, Cleanaway obtained agreement from the DWER that the Works Approval certification reporting could occur in stages, as the various components of the works were completed. Consequently, Cleanaway has previously submitted to the DWER the Stage 1 & 2 Critical Containment Infrastructure Report (a single report).

This report includes the Stage 3 component of the works and is the final Critical Containment Infrastructure Report for the Cell 12A construction, submitted in accordance with the relevant requirements of the Works Approval.

Due to the sequential structure of this report, the Stage 1 & 2 construction works are also included and hence, this final report covers all works associated with the construction of Cell 12A and, as such, the previous Stage 1 & 2 report is superseded by this final report.

2. Works Staging

The Critical Containment Infrastructure Report has been developed in a staged manner, based on the progress of construction on site and the ability to provide the DWER will progressive Critical Containment Infrastructure Reports.

The reporting stages include the flowing:

- Critical Containment Infrastructure Report:
  - Stage 1 – Completion of all earthworks (this report);
  - Stage 2 – CQA testing of liner materials and synthetic liner installation;
  - Stage 3 – Completion of leachate pipework, aggregate installation, liner integrity testing and installation of the separation geotextile.
- Groundwater Monitoring Well Construction and Monitoring – Separate reporting; and,
- Water Balance Assessment – Separate reporting.

The groundwater and water balance related activities and reporting have occurred concurrently to the Cell 12A construction activities.

This Stage 3 Critical Containment Infrastructure Report is the final document being submitted for the Cell 12A construction.

3. Project Documentation

3.1. Environmental Approval

The DWER issued Works Approval WA6855/2023/1 on 23 February 2024, with an expiry date of 22 February 2030, providing environmental approval for the related landfill construction and other associated works for the construction of Cells 9, 10 and 12A.

Cell 12A is the first landfill cell to be constructed under this Works Approval.

All works, for this Critical Containment Infrastructure Report were carried out in accordance with the requirements of the Works Approval. Where there were changes to the approved works, these have been detailed below.

3.2. Environmental Reporting

The Works Approval requires numerous different environmental reports to be provided, including:

- Environmental Compliance Report;
- Critical Containment Infrastructure Report;
- Construction Quality Assurance (CQA) Validation Report, which is an appendix to the Critical Containment Infrastructure Report;
- Groundwater Well Construction Report;
- Groundwater Monitoring Report; and,
- Water Balance Report.

Each of these reports have different compliance conditions within the Works Approval; however, as described above, this report only covers the Critical Containment Infrastructure Reporting associated with the construction of Cell 12A, incorporating the Stage 1, 2 & 3 works, which also includes the staged CQA Validation Reports.

3.3. Construction Quality Assurance Validation Reports

The Construction Quality Assurance (CQA) Validation Reports from each stage of the construction works were provided by an independent third-party, covering extensive material and workmanship testing and validation that occurred during the construction activities.

This Critical Containment Infrastructure Report makes extensive reference to the CQA Validation Reports as and where relevant and does not repeat the content of the CQA Validation Reports.

With the staged environmental reporting, the CQA Validation Reporting also follows the above staged reporting process.

For completeness and to provide a single Critical Containment Infrastructure Report for all of the Cell 12A works, a copy of the Stage 1, Stage 2 and Stage 3 CQA Validation Reports are provided as appendices to this Critical Containment Infrastructure Report.

3.4. Groundwater Monitoring Network Expansion

The Works Approval contains a requirement to expand the site groundwater monitoring network, including subsequent monitoring. This is a separate project from the Cell 12A construction works. Cleanaway has appointed a specialist hydrogeological consultant to arrange and report on the groundwater monitoring network expansion and subsequent monitoring.

The groundwater monitoring network expansion and monitoring works commenced on site in early June 2024. Work is still ongoing and once completed, the specialist hydrogeological consultant will undertake the environmental reporting on the groundwater monitoring network expansion and subsequent monitoring.

This Critical Containment Infrastructure Report does not cover any of the groundwater related works.

3.5. Water Balance Assessment

The Works Approval contains a requirement to undertake a water balance assessment across the site. Again, this is a separate project from the Cell 12A construction works. Cleanaway has appointed a specialist leachate modelling consultant to undertake and report on the site water balance.

The water balance assessment works commenced in April 2024. Work is still ongoing and once completed, the specialist consultant will undertake the environmental reporting on the water balance assessment.

This Critical Containment Infrastructure Report does not cover any of the water balance assessment works.

3.6. Construction Documentation

The Cell 12A construction documentation consisted of the following relevant documents:

- Drawings;
- Technical Specification:
- CQA Plan; and,
- Works Approval.

3.7. Design Changes

During the construction of Cell 12A, there were a few minor design changes to accommodate on-site circumstances. All of these changes were minor in nature and did not impact on the environmental performance of Cell 12A or impact on the local community.

Where minor changes were made during construction, these have been documented in the CQA Validation Reports or mentioned in this Critical Containment Infrastructure Report.

4. Project Structure

The project structure consisted of the following participants:

- Cleanaway Solid Waste – Site lessee, Site Operator, Principal, Superintendent and Works Approval holder;
- IW Projects – Designer;
- Geographe Civil – Contractor;
- Fabtech – Liner installation sub-contractor;
- Terra Firma - Geotechnical Inspection and Testing Authority (GITA) and Liner Installation CQA Consultant; and,
- IW Projects – Compliance and Critical Containment Inspection and Reporting.

5. Works Approval Compliance

The Works Approval contains a number of conditions relating to the construction and compliance of the landfill infrastructure that required compliance certification.

The Works Approval includes the construction of three landfill cells (Cells 9, 10 & 12A). This Critical Containment Infrastructure Report only covers the conditions relevant to the Cell 12A construction works.

These conditions are quoted below, with relevant comment provided on the compliance thereof.

Text in *italics* are direct extracts from the Works Approval.

5.1. Condition 1

The Works Approval Holder must:

(a) construct and/or install the infrastructure and/or equipment;

(b) in accordance with the corresponding design and construction/installation requirements; and

(c) at the corresponding infrastructure location;

As set out in Table 1.

Table 1: Design and Construction/Installation Requirements covers the design and construction requirements for the Cells 9 and 10 stormwater retention pond and pipework related activities. These are unrelated to the Cell 12A construction works and hence, are not relevant to this Critical Containment Infrastructure Report.

5.2. Condition 2

The Works Approval Holder must:

(a) construct the critical containment infrastructure;

(b) in accordance with the corresponding design and construction requirements; and

(c) at the corresponding infrastructure location;

As set out in Table 2.

Table 2: Critical Containment Infrastructure Design and Construction Requirements is referenced below, with compliance comments provided against each item.

Table 2: Critical Containment Infrastructure Design and Construction Requirements

Infrastructure	Design and Construction Requirements	Infrastructure Location	Compliance Comment

Cell 12A	*Constructed to the specifications depicted in Figure 15, Figure 16, Figure 17, Figure 18, Figure 19, Figure 20 and Figure 21 of Schedule 1*	*As depicted by Figure 2 of Schedule 1*	Cell 12A was constructed to the specifications depicted in Figure 15, Figure 16, Figure 17, Figure 18, Figure 19, Figure 20 and Figure 21 of Schedule 1, with the following changes:
			• Stage 1 Works – Earthworks:
			  • The northern and western cell perimeter bunds were brought in by 10 m to accommodate gas pipes located on the outside of the new cell. As a consequence, the height of the perimeter bund was increased by 2.5 m to suit the cell top of waste filling plan. These changes reduced the size of the overall landfill cell.
			  • Following the WSP review of the Cell 12A design, the southeast corner and southern edge of the cell was raised to ensure that not waste was intercepted during excavation works. Consequently, to maintain the original 1 (V) in 3 (H) side slope, the southern earthworks batter was extended further into Cell 12A, which again reduced the size of the cell.
			  • At the Leachate Collection Sump, an additional 300mm was excavated due to the soft material of the subgrade as a result of recent rains. The Leachate Collection Sump internal batters were maintained at 1 in 3.
			Stage 1 CQA Validation Report (CQAVR) Section 2.2 Variations from Specification covers these changes in design and construction.
			• Stage 3 Works – Leachate Pipework
			  • The leachate extraction riser pipes were changed from the original 355 mm diameter to 450 mm diameter to facilitate easier access to the sump when inserting the leachate pump.

Infrastructure	Design and Construction Requirements	Infrastructure Location	Compliance Comment
			As a consequence, the concrete headwall structure was made slightly larger to accommodate the larger pipe dimeters. Stage 3 CQA Validation Report (CQAVR) Section 2.2 Variations from Specification covers these changes in design and construction. Cell 12A was constructed in the location as identified in Figure 2 of Schedule 1. Refer to **Appendix 1.1 - Site Plan**, which indicates the location of Cell 12A. This condition was complied with.
	Piggyback liner must not extend horizontally over Cells 1 and 2 by a minimum of 15 m		It is assumed that this condition "a minimum of" should be "less than", as is stated two conditions below. The design included a 20 m wide piggyback liner extending over Cells 1 & 2. The as-constructed drawings indicate that the works have been constructed in accordance with the design drawings; hence, the piggyback liner has been constructed 20 m over Cells 1 & 2. Refer to **Appendix No. 1.3 – Anchor Trench Plan** that indicates the constructed perimeter anchor trench and also the design perimeter anchor trench to confirm that the works were constructed in accordance with the design drawings. This condition was complied with.
	Anchor trenches constructed over Cells 1 and 2 for the Cell 12A piggyback liner must be a minimum of 0.5 m deep and must not intercept the underlying waste mass		Stage 1 CQAVR Section 2.4 Construction Methodology – Subgrade Construction confirms that there was no waste intercepted during construction. This includes in the excavation of the anchor trenches. Stage 2 CQAVR Section 8 Anchor Trenches confirms that all anchor trenches were excavated to 1 m deep. This condition was complied with.
	Piggyback liner must not extend		The design included a minimum 20 m wide apron extending over

Infrastructure	Design and Construction Requirements	Infrastructure Location	Compliance Comment
	horizontally over Cell 4B by less than 5 m		Cells 1 & 2 and a portion of Cell 4B. With the amendment to the southeast corner design, the piggyback liner extends slightly more than 20 m over Cell 4B. The as-constructed drawings indicate that the works have been constructed in accordance with the design drawings; hence, the piggyback liner has been constructed a minimum 5 m over Cell 4B. Refer to **Appendix No. 1.3 – Anchor Trench Plan** that indicates the constructed perimeter anchor trench and also the design perimeter anchor trench to confirm that the works were constructed in accordance with the design drawings. This condition was complied with.
	Liner tie in to existing liners for Cells 12 and 4B must terminate in an independent anchor trench of a minimum of 1 m deep		The as-constructed drawings indicate the location of the perimeter anchor trench, which goes all the way around Cell 4B and Cell 12; hence, there is an independent anchor trench between the new works and the existing landfill cell liners. Refer to **Appendix No. 1.3 – Anchor Trench Plan** that indicates the constructed perimeter trench around Cell 12A. This condition was complied with.
	A Geosynthetic Clay Liner must be placed in the gap between existing Cell 12 and Cell 4B anchor trenches and the new Cell 12A anchor trench with a minimum overlap of 500 mm onto each of the adjoining cell liners		Refer to Section 5.2 of the Stage 2 CQAVR. This condition was complied with.
	A 2mm thick High Density Polyethylene capping strip must be placed over the Geosynthetic Clay Liner between anchor trenches		Refer to Section 6.2 of the Stage 2 CQAVR. This condition was complied with.

Infrastructure	Design and Construction Requirements	Infrastructure Location	Compliance Comment
Layer 1 – subsoil	*No excavation of waste from Cells 1 and 2 is to occur to facilitate reprofiling*	*Cell 12A to be located as depicted by Figure 2 of Schedule 1* *Liner configuration within Cell 12A depicted by Figure 11 and Figure 12 of Schedule 1* *Piggyback liner configuration within Cell 12A depicted by Figure 17 of Schedule 1*	Refer to Section 2.4 of the Stage 1 CQAVR. This condition was complied with.
	All excavation around existing liner material must be conducted in a manner that does not damage the existing liner		Refer to Section 2.4 of the Stage 1 CQAVR. This condition was complied with.
	All excavation areas must be managed to direct stormwater into the stormwater retention network at the premises		Refer to Section 2.4 of the Stage 1 CQAVR. This condition was complied with.
	Fill material used to create the subsoil layer must be free of debris and deleterious material with a maximum particle size of 40mm		Refer to Section 2.3 of the Stage 1 CQAVR. This condition was complied with.
	Fill material must be placed, levelled and compacted to not less than 95% of the Standard Maximum Dry Density determined in accordance with AS 1289.5.1.1		Refer to Section 2.4 of the Stage 1 CQAVR. This condition was complied with.
	Fill material must be moisture condition to +/- 2% of optimum in accordance with AS 1289.5.1.1		Refer to Section 2.4 of the Stage 1 CQAVR. This condition was complied with.
	All areas of fill must be a minimum of 100mm thick		Refer to Section 2.4 of the Stage 1 CQAVR. This condition was complied with.
	The subsoil layer must be steel drum rolled to provide a smooth surface and have no irregularities in excess of 10 mm deep over a straightedge length of 20 mm		Refer to Section 2.4 of the Stage 1 CQAVR. This condition was complied with.
	The subsoil layer must attain a minimum		Refer to Section 2.4 of the Stage 1 CQAVR.

[redacted]

Infrastructure	Design and Construction Requirements	Infrastructure Location	Compliance Comment
	gradient of 1% along the valley drain and 3% into the valley drain		This condition was complied with. Refer to **Appendix No. 1.2 – Earthworks Final Surface**
Layer 2 – Geosynthetic clay liner (GCL)	*Must not be installed in the presence of water*	*Cell 12A to be located as depicted by Figure 2 of Schedule 1* *Liner configuration within Cell 12A depicted by Figure 11 and Figure 12 of Schedule 1* *Piggyback liner configuration within Cell 12A depicted by Figure 17 of Schedule 1*	Refer to Section 5.2 of the Stage 2 CQAVR. This condition was complied with.
	Must be installed in a manner to prevent damage to the GCL and prevent wrinkles in the liner layer		Refer to Section 5.2 of the Stage 2 CQAVR. This condition was complied with.
	The minimum overlaps for joins must be as follows: • *Longitudinal ends – 300mm* • *Roll end joins on the landfill base – 500mm* • *Roll end joins on the landfill side slope – 1.5 m (with anchor trench)*		Refer to Section 5.2 of the Stage 2 CQAVR. This condition was complied with.
	The overlap zone must be kept clear of debris		Refer to Section 5.2 of the Stage 2 CQAVR. This condition was complied with.
	The leachate sump must contain a double GCL layer		Refer to Section 5.2 of the Stage 2 CQAVR. This condition was complied with.
	GCL installed on landfill side slopes must be fixed in anchor trenches, with the trench backfilled and compacted with suitable fill after GCL placement		Refer to Section 5.2 of the Stage 2 CQAVR. This condition was complied with.
	Must be covered by the geomembrane layer to prevent water damage within 12hrs of placement		Refer to Section 5.2 of the Stage 2 CQAVR. This condition was complied with.
Layer 3 – Geomembrane	*Must consist of 2mm thick High Density Polyethylene (HDPE)*	*Cell 12A to be located as depicted*	Refer to Appendix 1 – Geosynthetic Liner CQA Assessment Report of the Stage 2 CQAVR, Section 2.2 of this appendix confirms that the

Infrastructure	Design and Construction Requirements	Infrastructure Location	Compliance Comment
		by Figure 2 of Schedule 1 *Liner configuration within Cell 12A depicted by Figure 11 and Figure 12 of Schedule 1* *Piggyback liner configuration within Cell 12A depicted by Figure 17 of Schedule 1*	HDPE material meets the acceptance criteria in the project specification. Attachment 4 – Geomembrane CQA provides a summary of the test results, which confirms that the liner material is 2 mm thick HDPE. This condition was complied with.
	Must not be installed in the presence of water		Refer to Section 6.2 of the Stage 2 CQAVR. This condition was complied with.
	Must be installed in a manner to prevent damage to the HDPE and prevent wrinkles in the liner layer		Refer to Section 6.2 of the Stage 2 CQAVR. This condition was complied with.
	The minimum overlap for welds must be 75 mm		Refer to Section 6.2 of the Stage 2 CQAVR. This condition was complied with.
Layer 4 – protection geotextile	*Must consist of 100 % polyester or polypropylene material*	*Cell 12A to be located as depicted by Figure 2 of Schedule 1* *Liner configuration within Cell 12A depicted by Figure11 and Figure 12 of Schedule 1* *Piggyback liner configuration within Cell 12A depicted by Figure 17 of Schedule 1*	Refer to Appendix 1 – Geosynthetic Liner CQA Assessment Report of the Stage 2 CQAVR, Section 2.4 of this appendix confirms that the geotextile material meets the acceptance criteria in the project specification. Attachment 5 – Cushion Geotextile MQA provides a Geofabrics MQA Certificate of Conformance – Level 3 – Bidim A84NFBF which states "*Certified Product Characteristics: Polyester non-woven needle punched (both sides) continuous filament needle free protection geotextile*". This condition was complied with.
	Must not be installed during heavy rain or winds		Refer to Section 7.2 of the Stage 2 CQAVR. This condition was complied with.
	Must be installed in a manner to prevent damage to the geotextile and prevent wrinkles in the liner layer		Refer to Section 7.2 of the Stage 2 CQAVR. This condition was complied with.
	The minimum overlap for all longitudinal		Refer to Section 7.2 of the Stage 2 CQAVR. Overlaps were 200 mm,

Infrastructure	Design and Construction Requirements	Infrastructure Location	Compliance Comment
	joins and roll end joins on the floor of the cell must be 150 mm		which is in excess of the Condition requirement. This condition was complied with.
	A minimum of 1 m roll end overlap must be present on the landfill side slopes		Refer to Section 7.2 of the Stage 2 CQAVR. This section confirms that there were no roll end joins/overlaps on the slope. This condition was complied with.
	Geotextiles installed on the landfill side slopes must be fixed in anchor trenches, where the trench is backfilled and compacted with low hydraulic conductivity soils after geotextile placement		Refer to Section 7.2 of the Stage 2 CQAVR. This condition was complied with.
	A leak detection survey must be undertaken after placement of the leachate aggregate layer and before the placement of the separation geotextile		A leak detection survey was undertaken after the installation of the aggregate layer and before the installation of the separation geotextile. Refer to Section 4 of the Stage 3 CQAVR. This section confirms that the leak detection survey was undertaken. This condition was complied with.
Layer 5 – Leachate collection	*Leachate Collection Pipework:*	*Cell 12A to be located as depicted by Figure 2 of Schedule 1* *Liner configuration within Cell 12A depicted by Figure 11 and Figure 12 of Schedule 1* *Piggyback liner configuration within*	
	• *Polyethylene pipes must be welded so no leaks are present*		Refer to Section 3.1 of the Stage 3 CQAVR. This section confirms that the pipe welds were leak tight. In most circumstances, this is an irrelevant requirement, as the vast majority of the leachate pipes are drilled to allow leachate to collect within the pipe. This condition was complied with.
	• *No drilling of pipework is to be undertaken within lined areas of the landfill cell*		Refer to Section 3.2 of the Stage 3 CQAVR. This section confirms that pipe drilling was undertaken off-site. This condition was complied with.
	• *Must be installed in a manner to prevent damage to the geotextile liner*		Refer to Section 3.4 of the Stage 3 CQAVR. This section confirms that the pipes were carefully laid so as not to damage the underlying

Infrastructure	Design and Construction Requirements	Infrastructure Location	Compliance Comment
		Cell 12A depicted by Figure 17 of Schedule 1 *Leachate collection infrastructure configuration within Cell 12A depicted by Figure 13 and Figure 14 of Schedule 1*	geotextile. This condition was complied with.
	Leachate Drainage Aggregate:		
	• *Material must consist of blue metal aggregate free of organic manner, fine grained material and deleterious material*		Refer to Section 3.5 of the Stage 3 CQAVR. This section confirms that the aggregate was blue metal and free of organic matter, fine grained material and deleterious material. This condition was complied with.
	• *Maximum particle size must be no more than 37.5 mm*		Refer to Section 3.5 of the Stage 3 CQAVR. This section confirms that the maximum aggregate particle size was 35.5 mm. This condition was complied with.
	• *Installation must be completed within 2 weeks of the installation of any GCL*		Refer to Section 3.5 of the Stage 3 CQAVR. This section confirms that the vast majority of the lined area was covered with aggregate within two weeks; however, there were small areas that took longer to cover (up to four weeks). The delay in aggregate installation was unavoidable and would have minimal impact on the GCL hydration, and consequently permeability, as the soil base consisted of low permeability clay, which would have only slowly released moisture to hydrate the GCL. <u>This condition was not fully complied with.</u>
	• *Layer must be a minimum of 300 mm thick*		Refer to Section 3.5 of the Stage 3 CQAVR. This section confirms that the aggregate layer was a minimum of 300 mm thick. This condition was complied with.
	• *Layer must be placed up the landfill side slopes to a maximum vertical height of 4.5 m above the toe of the side slope*		Refer to Section 3.5 of the Stage 3 CQAVR. This section confirms that the aggregate layer was installed to a maximum of 4.5 m vertically up the side slopes. This condition was complied with.
	Leachate Collection Sump:		

[redacted]

Infrastructure	Design and Construction Requirements	Infrastructure Location	Compliance Comment
	• *Installation must include a double GCL lined base and a HDPE rub sheet down the side wall batter and into the sump*		Refer to Section 5.2 (double layer of GCL) and Section 6.2 (HDPE rub sheet) of the Stage 2 CQAVR. This condition was complied with.
	• *All pipework leading to the sump must be secured by a concrete headwall at the leachate extraction point*		Refer to Section 3.4 of the Stage 3 CQAVR. This section confirms that a concrete headwall secured the 450 mm diameter pipework leading to the sump. This condition was complied with.
Layer 6 – separation geotextile	*Must consist of 100 % polyester or polypropylene material*	*Cell 12A to be located as depicted by Figure 2 of Schedule 1* *Liner configuration within Cell 12A depicted by Figure 11 and Figure 12 of Schedule 1* *Piggyback liner configuration within Cell 12A depicted by Figure 17 of Schedule 1*	Refer to Appendix 1 – Geosynthetic Liner CQA Assessment Report of the Stage 2 CQAVR, Section 5.3 of this appendix confirms that the geotextile material meets the acceptance criteria in the project specification. Attachment 8 – Separation Geotextile MQA provides a Geofabrics MQA Certificate of Conformance – Level 3 – Bidim A24MNFBR which states "*Certified Product Characteristics: Polyester non-woven needle punched (both sides) continuous filament needle free separation geotextile*". This condition was complied with.
	Must not be installed during heavy rain or winds		Refer to Section 5.2 of the Stage 3 CQAVR. This condition was complied with.
	Must be installed in a manner to prevent damage to the geotextile and prevent wrinkles in the liner layer		Refer to Section 5.2 of the Stage 3 CQAVR. This condition was complied with.
	The minimum overlap for all longitudinal joins and roll end joins on the floor of the cell must be 150 mm		Refer to Section 5.2 of the Stage 3 CQAVR. This condition was complied with.
	A minimum of 1 m roll end overlap must be present on the landfill side slopes		Refer to Section 5.2 of the Stage 3 CQAVR. This condition was complied with.

[redacted]

Infrastructure	Design and Construction Requirements	Infrastructure Location	Compliance Comment
	Geotextiles installed on the landfill side slopes must be heat bonded to the cushion geotextile beyond the aggregate layer		Refer to Section 5.2 of the Stage 3 CQAVR. This condition was complied with.
	No vehicles are to be driven over this layer		Refer to Section 5.2 of the Stage 3 CQAVR. This condition was complied with.

Note: CQAVR refers to the Construction Quality Assurance Validation Report

[redacted]

5.3. Condition 3

The works approval holder must ensure that no visible dust generated from the primary activities crosses the boundary of the premises.

The site has an active dust management program covering site operations.

The contractor was responsible for all construction related dust management throughout the construction period.

During the period of construction, there were two dust complaints received on site (2/3/24 & 3/4/24). These related to strong winds generating dust in the general area of the site and not specifically only the landfill site. None of these complaints related to the Cell 12A construction works.

5.4. Condition 4

The works approval holder must undertake construction quality assurance (CQA) testing for the geosynthetic clay liner installed within cells 12A, in accordance with the specifications outlined in Table 3.

Table 3: Geosynthetic Clay Liner (GCL) CQA Requirements is referenced below, with compliance comments provided against each item.

Table 3: Geosynthetic Clay Liner (GCL) CQA Requirements

Item	Property	Standards	Frequency	Compliance Comment
Conformance Quality Control testing (sampled at the point of manufacture or on site, as determined by the Superintendent)	*Composite layer Thickness (dry)*	*ASTM D1777*	*1 sample every 3rd roll*	Refer to Appendix 1 – Geosynthetic Liner CQA Assessment Report of the Stage 2 CQAVR, Section 2.1 of this appendix confirms that the GCL material meets the acceptance criteria in the project specification. Attachment 2 – GCL CQA provides a summary of the test results, which confirms that the liner material passed CQA testing. There were 185 rolls of liner, with 63 rolls tested equating to a test every 2.9 rolls. This condition was complied with.
	Mass per unit area of GCL	*ASTM D5993*	*1 sample per 1,000 m^2*	Refer to Appendix 1 – Geosynthetic Liner CQA Assessment Report of the Stage 2 CQAVR, Section 2.1 of this appendix confirms that the GCL material meets the acceptance criteria in the project specification. Attachment 2 – GCL CQA provides a summary of the test results, which confirms that the liner material passed CQA testing. There was a total of 39,127.5 m^2 of liner, with 42 rolls tested equating to a test every 932 m^2. This condition was complied with.
	Mass per unit area of	*ASTM D5993*	*1 sample per 2,500 m^2*	Refer to Appendix 1 – Geosynthetic

Item	Property	Standards	Frequency	Compliance Comment
	Bentonite			Liner CQA Assessment Report of the Stage 2 CQAVR, Section 2.1 of this appendix confirms that the GCL material meets the acceptance criteria in the project specification. Attachment 2 – GCL CQA provides a summary of the test results, which confirms that the liner material passed CQA testing. There was a total of 39,127 m^2 of liner, with 17 rolls tested equating to a test every 2,302 m^2. rolls. This condition was complied with.
	Mass per unit area of Bentonite in overlaps	*ASTM D5993*	*1 sample every 3rd roll*	Refer to Appendix 1 – Geosynthetic Liner CQA Assessment Report of the Stage 2 CQAVR, Section 2.1 of this appendix confirms that the GCL material meets the acceptance criteria in the project specification. Attachment 2 – GCL CQA provides a summary of the test results, which confirms that the liner material passed CQA testing. There were 185 rolls of liner, with 63 rolls tested equating to a test every 2.9 rolls. This condition was complied with.
	Montmorillonite content	*XRD (X-ray diffraction) Quantitative Mineralogy Analysis*	*1 sample per 10,000 m^2*	Refer to Appendix 1 – Geosynthetic Liner CQA Assessment Report of the Stage 2 CQAVR, Section 2.1 of this appendix confirms that the GCL

Item	Property	Standards	Frequency	Compliance Comment
				material meets the acceptance criteria in the project specification. Attachment 2 – GCL CQA provides a summary of the test results, which confirms that the liner material passed CQA testing. There was a total of 39,127.5 m^2 of liner, with 5 rolls tested equating to a test every 7,826 m^2. This condition was complied with.
	Cation exchange capacity of bentonite (Bentonite CEC)	*Methylene blue method*	*1 sample per 1,500 m^2*	Refer to Appendix 1 – Geosynthetic Liner CQA Assessment Report of the Stage 2 CQAVR, Section 2.1 of this appendix confirms that the GCL material meets the acceptance criteria in the project specification. Attachment 2 – GCL CQA provides a summary of the test results, which confirms that the liner material passed CQA testing. There was a total of 39,127.5 m^2 of liner, with 28 rolls tested equating to a test every 1,398 m^2. This condition was complied with.
	Moisture content of bentonite	*ASTM D5993* *AS 1289.2.1.1*	*1 sample per 2,500 m^2*	Refer to Appendix 1 – Geosynthetic Liner CQA Assessment Report of the Stage 2 CQAVR, Section 2.1 of this appendix confirms that the GCL material meets the acceptance criteria in the project specification. Attachment 2 – GCL CQA provides a summary of

Item	Property	Standards	Frequency	Compliance Comment
				the test results, which confirms that the liner material passed CQA testing. There was a total of 39,127.5 m^2 of liner, with 17 rolls tested equating to a test every 2,302 m^2. This condition was complied with.
	Swell index/free swell of clay	*ASTM D5890*	*1 sample per 1,500 m^2*	Refer to Appendix 1 – Geosynthetic Liner CQA Assessment Report of the Stage 2 CQAVR, Section 2.1 of this appendix confirms that the GCL material meets the acceptance criteria in the project specification. Attachment 2 – GCL CQA provides a summary of the test results, which confirms that the liner material passed CQA testing. There was a total of 39,127.5 m^2 of liner, with 28 rolls tested equating to a test every 1,398 m^2. This condition was complied with.
	Water absorption (Fluid loss)	*ASTM D5891*	*1 sample per 1,500 m^2*	
	Peel strength (for needle-punched products only)	*ASTM D6496*	*1 sample every 3rd roll*	Refer to Appendix 1 – Geosynthetic Liner CQA Assessment Report of the Stage 2 CQAVR, Section 2.1 of this appendix confirms that the GCL material meets the acceptance criteria in the project specification. Attachment 2 – GCL CQA provides a summary of the test results, which confirms that the liner material passed CQA testing. There were 185 rolls of liner, with 63

[redacted]

Item	Property	Standards	Frequency	Compliance Comment
				rolls tested equating to a test every 2.9 rolls. This condition was complied with.
	Tensile strength	*ASTM D6768*	*1 sample per 10,000 m^2*	Refer to Appendix 1 – Geosynthetic Liner CQA Assessment Report of the Stage 2 CQAVR, Section 2.1 of this appendix confirms that the GCL material meets the acceptance criteria in the project specification. Attachment 2 – GCL CQA provides a summary of the test results, which confirms that the liner material passed CQA testing. There was a total of 39,127.5 m^2 of liner, with 5 rolls tested equating to a test every 7,826 m^2. This condition was complied with.
	Index flux	*ASTM D5887*	*1 sample per 10,000 m^2*	
	Permeability	*ASTM D5887*	*1 sample per 10,000 m^2*	
Visual inspection of GCL	*Colour, thickness, needle punching, presence of needles or broken needles and sewing density or other faults in the material*	*N/A*	*Every roll*	Refer to Section 5.2 of the Stage 2 CQAVR. This condition was complied with.
Thickness of GCL and overlap (i.e. uniformity of bentonite distribution) and apparent variations in the as placed moisture distribution.	*On-site*	*N/A*	*Each roll during placement. If thickness appears to be variable a check of the variability of the mass per unit area shall be conducted*	Refer to Section 5.2 of the Stage 2 CQAVR. This condition was complied with.

Note: CQAVR refers to the Construction Quality Assurance Validation Report

5.5. Condition 5

The works approval holder must undertake CQA testing for the geomembrane layer installed within cells 12A, in accordance with the specifications outlined in Table 4.

Table 4: Geomembrane CQA Requirements is referenced below, with compliance comments provided against each item.

[redacted]

Table 4: Geomembrane CQA Requirements

Item	Property	Standards	Frequency	Compliance Comment
Conformance Quality Control testing (sampled at the point of manufacture or on site, as determined by the Superintendent)	*Thickness*	*ASTM D5994*	*Every roll*	Refer to Appendix 1 – Geosynthetic Liner CQA Assessment Report of the Stage 2 CQAVR, Section 2.2 of this appendix confirms that the HDPE material meets the acceptance criteria in the project specification. Attachment 4 – Geomembrane CQA provides a summary of the test results, which confirms that the liner material passed CQA testing. There were 64 rolls of liner, with 64 rolls tested equating to a test every roll. This condition was complied with.
	Asperity height	*ASTM D7466*	*One sample per 5,000 m^2, or every five rolls delivered to Site whichever is the greatest number of tests*	Refer to Appendix 1 – Geosynthetic Liner CQA Assessment Report of the Stage 2 CQAVR, Section 2.2 of this appendix confirms that the HDPE material meets the acceptance criteria in the project specification. Attachment 4 – Geomembrane CQA provides a summary of the test results, which confirms that the liner material passed CQA testing. There was 38,400 m^2 of liner, with 32 rolls tested equating to a test every 1,200 m^2, which is more than required. This condition was complied with.

Item	Property	Standards	Frequency	Compliance Comment
	Density	*ASTM D1505* *ASTM D792*		Refer to Appendix 1 – Geosynthetic Liner CQA Assessment Report of the Stage 2 CQAVR, Section 2.2 of this appendix confirms that the HDPE material meets the acceptance criteria in the project specification. Attachment 4 – Geomembrane CQA provides a summary of the test results, which confirms that the liner material passed CQA testing. There was 38,400 m^2 of liner, with 14 rolls tested equating to a test every 2,743 m^2, which is more than required. This condition was complied with.
	Tensile properties (yield and break stress, yield and break elongation)	*ASTM D6693 type IV*		
	Puncture resistance	*ASTM D4833*		
	Tear resistance	*ASTM D1004*		
	Carbon black content	*ASTM D4218*		
	Carbon black dispersion	*ASTM D5596*		
	Stress crack resistance	*ASTM D5397*	*One sample every 10,000 m^2, or resin type or manufacturing run*	Refer to Appendix 1 – Geosynthetic Liner CQA Assessment Report of the Stage 2 CQAVR, Section 2.2 of this appendix confirms that the HDPE material meets the acceptance criteria in the project specification. Attachment 4 – Geomembrane CQA provides a summary of the test results, which confirms that the liner material passed CQA testing. There was 38,400 m^2 of liner, with 5 rolls tested equating to a test every 7,680 m^2, which is more than required. This condition was complied with.
	Geomembrane Oxidative induction time	*ASTM D8117* *ASTM D5885*		
Start-up test weld	*Welding equipment*	*N/A*	*Checked daily at start of*	Refer to Section 6.2.1 of the Stage 2

[redacted]

Item	Property	Standards	Frequency	Compliance Comment
			Works, and whenever the welding equipment is shut-off for more than one hour. Also, after significant changes in weather conditions	CQAVR. This condition was complied with.
	Weld conditions	*N/A*	*Test weld strips will be required whenever personnel or equipment are changed and/or wide temperature fluctuations are experienced. Minimum 1.5 m continuous seam*	Refer to Section 6.2.1 of the Stage 2 CQAVR. This condition was complied with.
Destructive weld testing	*On-Site, hand tensiometer in peel and shear*	*ASTM D6392*	*Every 150 m (if fusion weld)* *Every 120 m (if extrusion weld)*	Refer to Section 6.2.3 of the Stage 2 CQAVR. This condition was complied with.
	Off-Site — weld seam strength in peel and shear	*ASTM D6392*	*Every 150 m (if fusion weld)* *Every 120 m (if extrusion weld)*	Refer to Section 6.2.3 of the Stage 2 CQAVR. These tests were done on-site by the CQA Consultant in accordance with NATA requirements. This condition was complied with.
Non-destructive weld testing	*N/A*	*Air pressure test ASTM D5820 Vacuum box test ASTM D5641*	*All seams over full length*	Refer to Section 6.2.2 of the Stage 2 CQAVR. This condition was complied with.
Visual inspection of geomembrane	*Smooth edges on both sides, tears, punctures, abrasions,*	*N/A*	*Every roll*	Refer to Section 6.2 of the Stage 2 CQAVR.

Item	Property	Standards	Frequency	Compliance Comment
	cracks, indentations, thin spots, or other faults in the material			This condition was complied with.
Thickness of geomembrane	*On-site*	*N/A*	*Five per 100 m, 20 m apart, taken at the edge of the sheet*	Refer to Section 6.2 of the Stage 2 CQAVR. This condition was complied with.

Note: CQAVR refers to the Construction Quality Assurance Validation Report

5.6. Condition 6

The works approval holder must undertake CQA testing for the geotextiles (layer 4 and layer 6) installed within cells 12A, in accordance with the specifications outlined in Table 5.

Table 5: Geotextile CQA Requirements is referenced below, with compliance comments provided against each item for the protection geotextile.

Separation geotextile compliance will be responded to in the Stage 3 Reporting.

Table 5: Geotextile CQA Requirements

Item	Property	Standards	Frequency	Compliance Comment
Conformance Quality Control testing (sampled at the point of manufacture or on site, as determined by the Superintendent)	*Wide Strip Tensile Strength*	*AS 3706–2*	*1 sample per 5,000 m^2*	Refer to Appendix 1 – Geosynthetic Liner CQA Assessment Report of the Stage 2 CQAVR, Section 2.4 of this appendix confirms that the geotextile material meets the acceptance criteria in the project specification. Attachment 7 – Cushion Geotextile CQA and Attachment 9 – Separation Geotextile CQA provide summaries of the test results, which confirms that the liner material passed CQA testing. There was 36,720 m^2 of cushion geotextile liner and 24,150 m^2 of separation geotextile line. There were 9 rolls of cushion geotextile liner tested equating to a test every 4,080 m^2 and 6 rolls of separation geotextile liner tested equating to a test every 4,025 m^2, which is more than required. This condition was complied with.
	Grab Tensile Strength	*AS 3706–2*		
	Trapezoidal Tear Strength	*AS 3706–3*		
	CBR Burst Strength	*AS 3706–4*		
	UV Stability	*ASTM D7238*	*Review of MQC data*	Refer to Appendix 1 – Geosynthetic Liner CQA Assessment Report of the Stage 2 CQAVR, Section 2.4 of this appendix confirms that the geotextile material meets the acceptance criteria in the project specification. Attachment 5 – Cushion Geotextile MQA and Attachment 8 – Separation Geotextile

Item	Property	Standards	Frequency	Compliance Comment
				MQA provide Geofabrics Certificate of Conformance – UV Stability, which confirms that the cushion geotextile retained strength after 500 hour test duration is >70% and the separation geotextile retained strength after 500 hour test duration is >50%, which is in accordance with the project specification. This condition was complied with.
Destructive tests	*Tensile tests for joints*	*AS 3706–6*	*As required*	There were no destructive tests required. This condition was complied with.
Visual inspection of geotextile	*Colour, thickness, tears, holes, punctures, needle-punching, presence of needles or broken needles, and other faults in the material*	*N/A*	*Each roll during placement*	Refer to Section 7.2 of the Stage 2 CQAVR. This condition was complied with.

Note: CQAVR refers to the Construction Quality Assurance Validation Report

[redacted]

5.7. Condition 7

The works approval holder must within 60 calendar days of an item of infrastructure or equipment required by condition 1 being constructed and/or installed:

(a) undertake an audit of their compliance with the requirements of condition 1; and

(b) prepare and submit to the CEO an Environmental Compliance Report on that compliance.

Condition 1 relates only to the construction of the stormwater retention pond and pipework relating to Cells 9 and 10. None of this is relevant to the construction of Cell 12A; hence, Condition 7 is not relevant to this Critical Containment Infrastructure Report.

5.8. Condition 8

The Environmental Compliance Report required by condition 7, must include as a minimum the following:

(a) certification by a suitably qualified civil or structural engineer that the items of infrastructure or component(s) thereof, as specified in condition 1, have been constructed in accordance with the relevant requirements specified in condition 1;

(b) as constructed plans and a detailed site plan for each item of infrastructure or component of infrastructure specified in condition 1; and

(c) be signed by a person authorised to represent the works approval holder and contains the printed name and position of that person.

As mentioned above, Condition 1 is not relevant to Cell 12A works; however, the intent of Condition 1, 7 and 8 have been interpreted as being also related to the Cell 12A works.

5.9. Condition 9

The works approval holder must within 60 calendar days of the Critical Containment Infrastructure identified by condition 2 being constructed:

(a) undertake an audit of their compliance with the requirements of condition 2; and

(b) prepare and submit to the CEO a Critical Containment Infrastructure Report on that compliance.

The Stage 1, 2 & 3 works include all of the works associated with the cell construction.

The Cell 12A construction works reached Practical Completion on Saturday 27 July 2024; hence, the report was submitted within the required 60 calendar days.

5.10. Condition 10

The Critical Containment Infrastructure Report required by condition 9 must include as a minimum the following:

(a) a CQA Validation Report certified and written by the independent third party civil or structural engineer professional engineer that completed the CQA that includes, but is not limited to;

(i) certification that each item of critical containment infrastructure or component thereof, as specified in condition 2, has been built and installed in accordance with the requirements specified in condition 2;

(ii) documentation of the quality of the completed works;

(iii) certification that each item of critical containment infrastructure or component thereof, has complied with the relevant construction quality assurance requirements detailed in conditions 4, 5 and 6;

(iv) an assessment of test results against minimum values in conditions 4,5 and 6 as relevant; and

(v) documentation of all repairs to subgrade and resulting from non-destructive weld testing;

(b) as constructed plans and a detailed site plan showing the location and dimensions for each item of critical containment infrastructure or component thereof, as specified in condition 2;

(c) photographic evidence of the installation of the infrastructure; and

(d) be signed by a person authorised to represent the works approval holder and contains the printed name and position of that person.

Appendix No. 2 – Stage 1 CQA Validation Report, **Appendix No. 3 – Stage 2 CQA Validation Report** and **Appendix No. 4 – Stage 3 CQA Validation Report** provide copies of the CQA Validation Reports

Terra Firma was the independent third-party, that undertook the Geotechnical Inspection and Testing Authority (GITA) and Liner Installation CQA Consultant activities during construction and compiled the CQA Validation Report.

Sachin De Silva is a CQA Technician and was the on-site CQA Consultant from *Terra Firma.* Ashan Peiris is a qualified Civil Engineer and was the Terra Firma Project Manager, and occasionally attended the site. Sachin and Ashan compiled the CQA Validation Reports, with Ashan signing the final reports.

The CQA Validation Reports certify that each item of critical containment infrastructure or component thereof, as specified in Condition 2, has been built and installed in accordance with the requirements specified in Condition 2. Refer to Section 4 of the Stage 1 CQAVR, Section 9 of the Stage 2 CQAVR and Section 7 of the Stage 3 CQAVR;

The CQA Validation Reports includes:

- Documentation of the quality of the completed works;
- Certification that each item of critical containment infrastructure or component thereof, has complied with the relevant construction quality assurance requirements detailed in Conditions 4, 5 and 6. Refer to Section 3.2 of the Stage 2 CQAVR;
- An assessment of test results against minimum values in Conditions 4, 5 and 6 as relevant. Refer to Appendix 1 – Geosynthetic Liner CQA Assessment Report of the Stage 2 CQAVR;
- Documentation of all repairs to subgrade and resulting from non-destructive weld testing. There were only very minor and localised repairs to the subgrade of typically 100 mm deep gullies eroded into the surface, none of these repairs warranted special documentation. Section 4.2 of the Stage 2 CQAVR refers to a weld Repair Register;
- As-constructed plans and a detailed site plan showing the location and dimensions for each item of critical containment infrastructure or component thereof, as specified in Condition 2. Refer to Appendix 1.1, 1.2 and 1.3 of this Critical Containment Infrastructure Report; and,
- Photographic evidence of the installation of the infrastructure. Refer to Appendix 3 of the Stage 1 CQAVR, Appendix 6 of the Stage 2 CQAVR and Appendix 6 of the Stage 3 CQAVR.

The CQA Validation Report has been signed by [redacted], who is authorised to represent Cleanaway, the Works Approval holder.

In addition, the CQA Validation Report, which forms part of this Critical Containment Infrastructure Report, has been reviewed and approved by Cleanaway and Cleanaway has submitted the report to the DWER in compliance with the requirements of the Works Approval.

[redacted] of *IW Projects* undertook the review and inspections associated with the auditing of the construction activities and compiled this Critical Containment Infrastructure Report.

[redacted] is a qualified professional Civil Engineer and a specialist Waste Management Consultant who has +25 years' experience in the West Australian waste management industry, including having designed Cells 9, 10 & 12A and many other lined landfill cells across the State, undertaken CQA quality control inspections, construction superintendent and having certified the construction of a wide range of waste management infrastructure. [redacted] is deemed to be suitably qualified to undertake these works.

In addition to the as-constructed plans provided in the CQA Validation Reports, as-constructed plans and a detailed site plan for each Stage of works has been provided in **Appendix No. 1 – As-Constructed Plans**:

- **Appendix No. 1.1 – Site Plan**
- **Appendix No. 1.2 – Earthworks Final Surface**
- **Appendix No. 1.3 – Anchor Trench Plan**.

This Critical Containment Infrastructure Report has been signed by Ian Watkins, who is authorised to represent Cleanaway, the Works Approval holder. In addition, the Critical Containment Infrastructure Report has been reviewed and approved by Cleanaway and Cleanaway has submitted the report to the DWER in compliance with the requirements of the Works Approval.

5.11. Condition 11 to 15

These conditions relate to the groundwater monitoring well construction and monitoring requirements and are not related to this Critical Containment Infrastructure Report.

5.12. Condition 16 to 17

These conditions relate to the water balance assessment requirements and are not related to this Critical Containment Infrastructure Report.

6. Certification

It is hereby certified that Stage 1, 2 & 3 of the construction of Cell 12A at the Banksia Road Landfill in Dardanup has been constructed in accordance with the appropriate conditions of the Works Approval requirements and where there were minor departures from the Works Approval requirements, these have been explained above.

This Critical Containment Infrastructure Report has been signed by Ian Watkins, who is authorised to represent Cleanaway, the Works Approval holder. In addition, the Critical Containment Infrastructure Report has been reviewed and approved by Cleanaway and Cleanaway has submitted the report to the DWER in compliance with the requirements of the Works Approval.

Appendices

Appendix No. 1 – As-Constructed Drawings:

- **Appendix No. 1.1 – Site Plan**
- **Appendix No. 1.2 – Earthworks Final Surface**
- **Appendix No. 1.3 – Anchor Trench Plan**

Appendix No. 2 – Stage 1 Construction Quality Assurance Validation Report – Text Only (due to file size, full report provided as a separate file)

Appendix No. 3 – Stage 2 Construction Quality Assurance Validation Report – Text Only (due to file size, full report provided as a separate file)

Appendix No. 4 – Stage 3 Construction Quality Assurance Validation Report – Text Only (due to file size, full report provided as a separate file)

Appendix No. 1 – As-Constructed Drawings

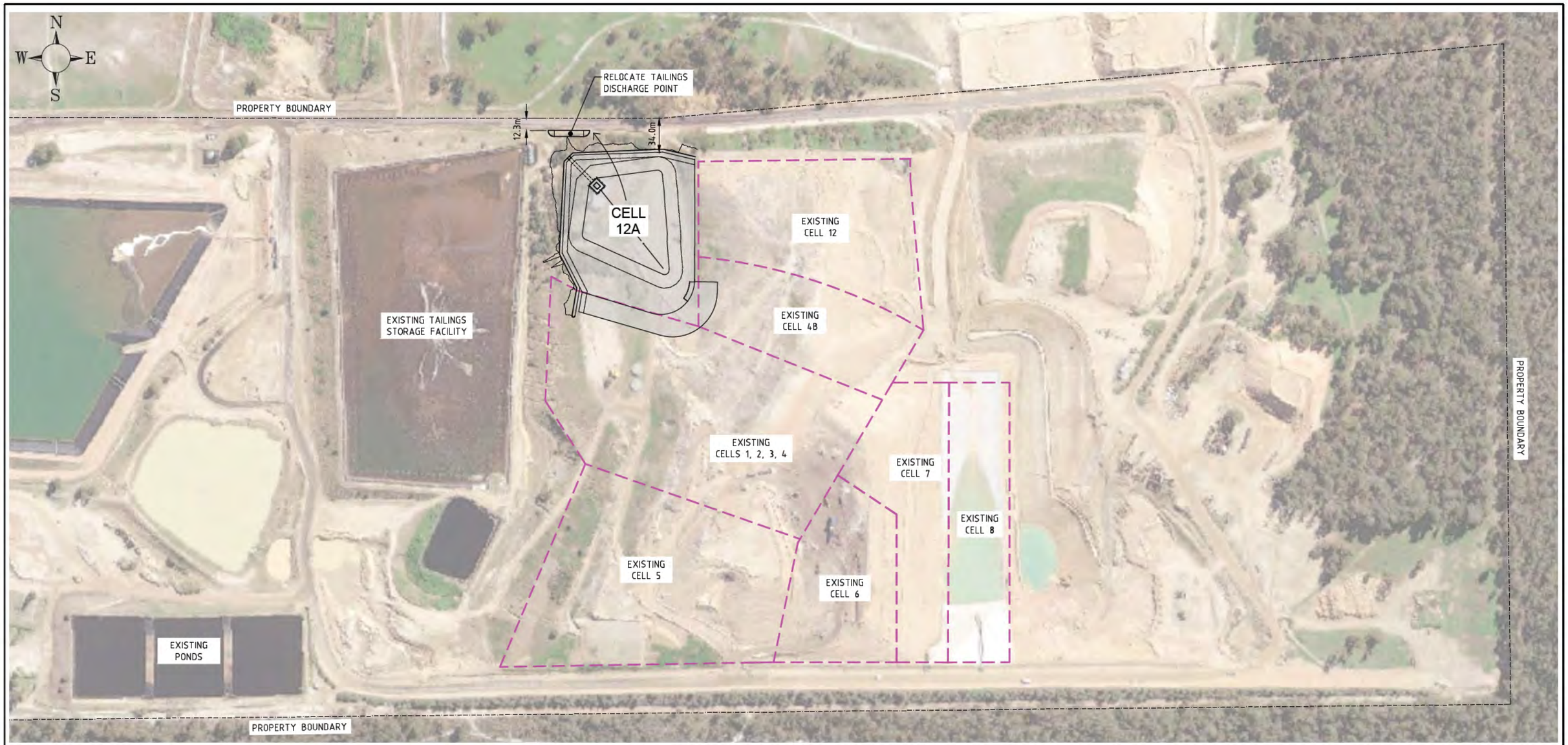
This page is intentionally left blank

[redacted]

Appendix No. 1.1 – Site Plan

This page is intentionally left blank

[redacted]



SITE PLAN

SCALE 1 : 2,000 (A1)

NOTE - UNDERGROUND SERVICES

UNDERGROUND SERVICE LOCATIONS SHOWN ON THIS PLAN HAVE BEEN DETERMINED BY FIELD SURVEY AND/OR OFFICE RECORDS, AND MAY NOT REPRESENT ALL SERVICES OR EXACT LOCATIONS. THE CONTRACTOR MUST ACCURATELY LOCATE AND DEPTH ALL SERVICES LIKELY TO BE ENCOUNTERED DURING CONSTRUCTION, PRIOR TO COMMENCING ANY EXCAVATION WORKS. VERY IMPORTANT TO CHECK BEFORE STARTING CONSTRUCTION. ANY CLASHES MUST BE REPORTED TO ENGINEER ASAP.

FOR CONSTRUCTION

20 FEBRUARY 2024

40 0 40 80 120 160 200m

SCALE 1:2000 @ A1 SCALE 1:4000 @ A3

GENERAL NOTES:

1. ALL WORKS SHALL BE IN ACCORDANCE WITH CURRENT LOCAL AUTHORITY SPECIFICATIONS AND STANDARD DRAWINGS. IT IS THE CONTRACTORS RESPONSIBILITY TO COMPLY WITH ALL RELEVANT LEGISLATION.
2. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO MAINTAIN THE STABILITY OF ANY TEMPORARY WORKS ON THE SITE.
3. ALL DIMENSIONS ARE IN METERS UNLESS NOTED OTHERWISE. DO NOT SCALE FROM DRAWINGS.
4. EXISTING INFRASTRUCTURE WITHIN WORKS AREA WILL BE REMOVED BY THE PRINCIPAL PRIOR TO WORKS COMMENCING.
5. DESIGN LEVELS HAVE BEEN BASED ON SURVEY DATA PROVIDED BY CLIENT. SINCE THIS DATE WORKS WITHIN THE AREA OCCURRED SO IT IS NECESSARY TO CONFIRM ALL SET OUT AND LEVELS WITH THE SUPERINTENDENT PRIOR TO COMMENCING CONSTRUCTION. BEFORE PROCEEDING WITH THE WORK ANY DISCREPANCIES IN THE CONTRACT DOCUMENTS SHALL BE REFERRED FOR DECISION TO THE ENGINEER/SUPERINTENDENT.
6. ANY VARIATIONS FROM THE DRAWINGS TO BE DISCUSSED WITH THE SUPERINTENDENT.
8. ALL VOLUMES OF CUT AND FILL TO BE VERIFIED WITH RECONFIRMED SURVEY LEVELS DUE TO ACCURACY OF SURVEY USED.
9. NOTES ON DRAWINGS SHALL BE CROSS REFERENCED TO THE SPECIFICATIONS WHICH HAS FURTHER DETAILS OF THE REQUIREMENTS. IF THE DRAWING NOTES AND THE SPECIFICATIONS ARE NOT CONSISTENT THE SPECIFICATIONS TAKES PRECEDENCE.
10. SURVEY DATUM: MGA ZONE 50. VERTICAL HEIGHT DATUM IS AHD.
11. LOCATION AND LEVEL OF EXISTING SERVICES AND STRUCTURES HAS BEEN PLOTTED FROM AVAILABLE RECORDS AND IS INDICATIVE ONLY. THE CONTRACTOR SHALL ACCURATELY LOCATE THESE ON SITE PRIOR TO COMMENCING WORKS AND SHALL PROTECT ALL EXISTING SERVICES DURING CONSTRUCTION. ANY DAMAGE TO EXISTING SERVICES SHALL BE REPAIRED AT THE CONTRACTOR'S EXPENSE.

REVISIONS

No.	BY	DATE	DESCRIPTION
H	S.B.Y	20/02/24	LEACHATE & SUMP DETAILS AMENDED
G	S.B.Y	07/02/24	EARTHWORKS AMENDED
F	G.T	22/12/23	ISSUED FOR APPROVAL
E	S.B.Y.	23/11/23	LINER DETAILS AMENDED

		DATE
DRG. FILE		
DESIGN	[redacted]	08/23
DRAWN		08/23
DES. CHK.		
DWG. CHK.		

TECHNICALLY APPROVED:

iw Projects

Email –
Mobile –
Address – 6 Anembo Close Duncraig 6023

CLEANAWAY SOLID WASTE

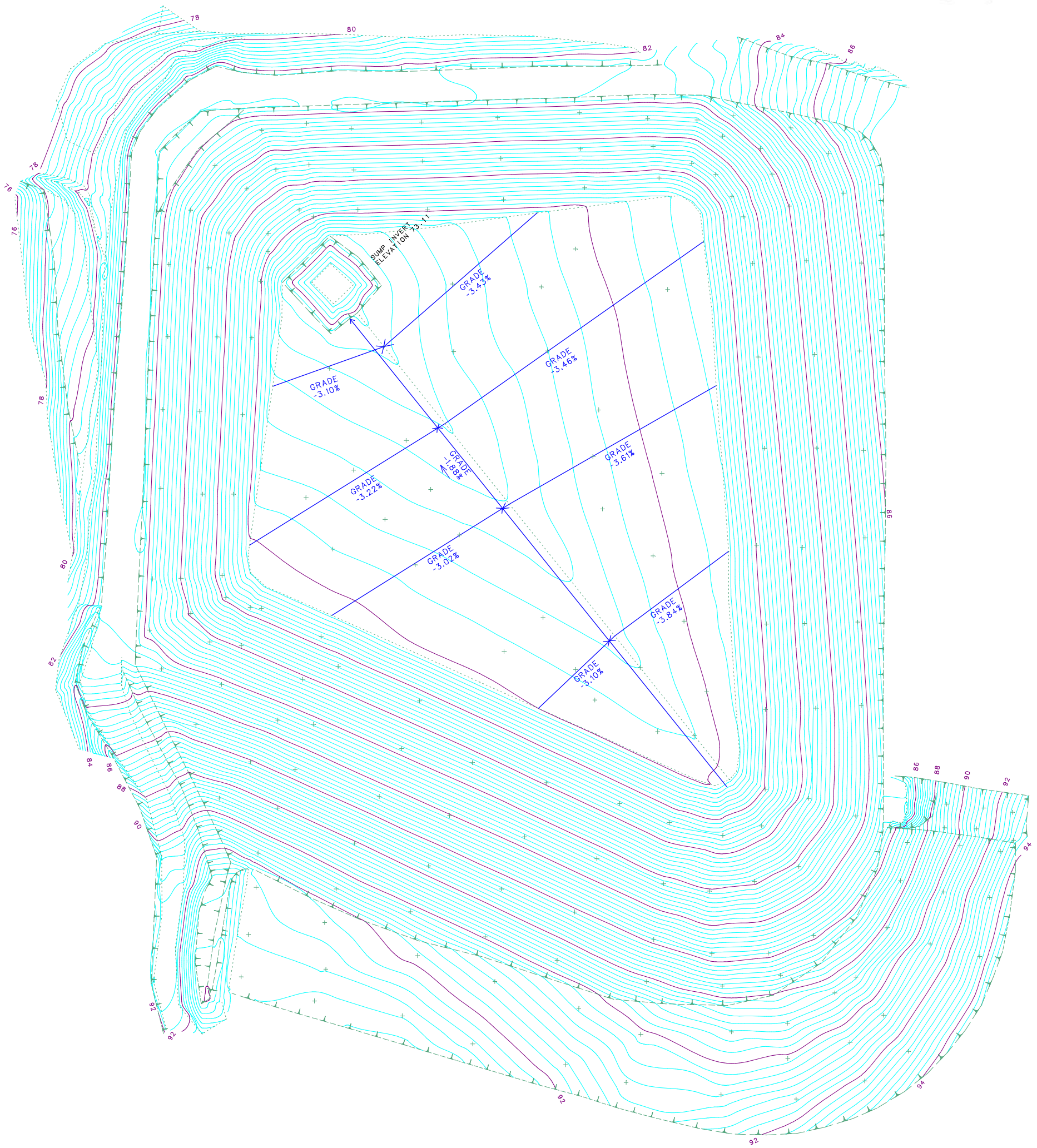
BANKSIA ROAD LANDFILL FACILITY, DARDANUP WA
CELL 12A DEVELOPMENT
SITE PLAN

SCALE	AS SHOWN
SHEET	
DRG No.	REVISION H BANK–502

Appendix No. 1.2 – Earthworks Final Surface

This page is intentionally left blank

[redacted]



SCALE 1:750

0 10 20 30 40

GEOGRAPHE CIVIL Pty Ltd
11 Hensen Street. Davenport. WA 6230
T: 08 9725 7077
E: admin@geographecivil.com.au

REV	DATE	DETAILS
A	26/06/24	Original Issue

Surveyed	14/06/24
Drawn	26/06/24
Checked	26/06/24
Datum	MGA 94 AHD
Drawing	CELL12A-01D
Cad File	CELL12A-01B
Client	CLEANAWAY

Description

ASCONSTRUCTED SURVEY CELL12A BANKSIA ROAD LANDFILL DARDANUP

Appendix No. 1.3 – Anchor Trench Plan

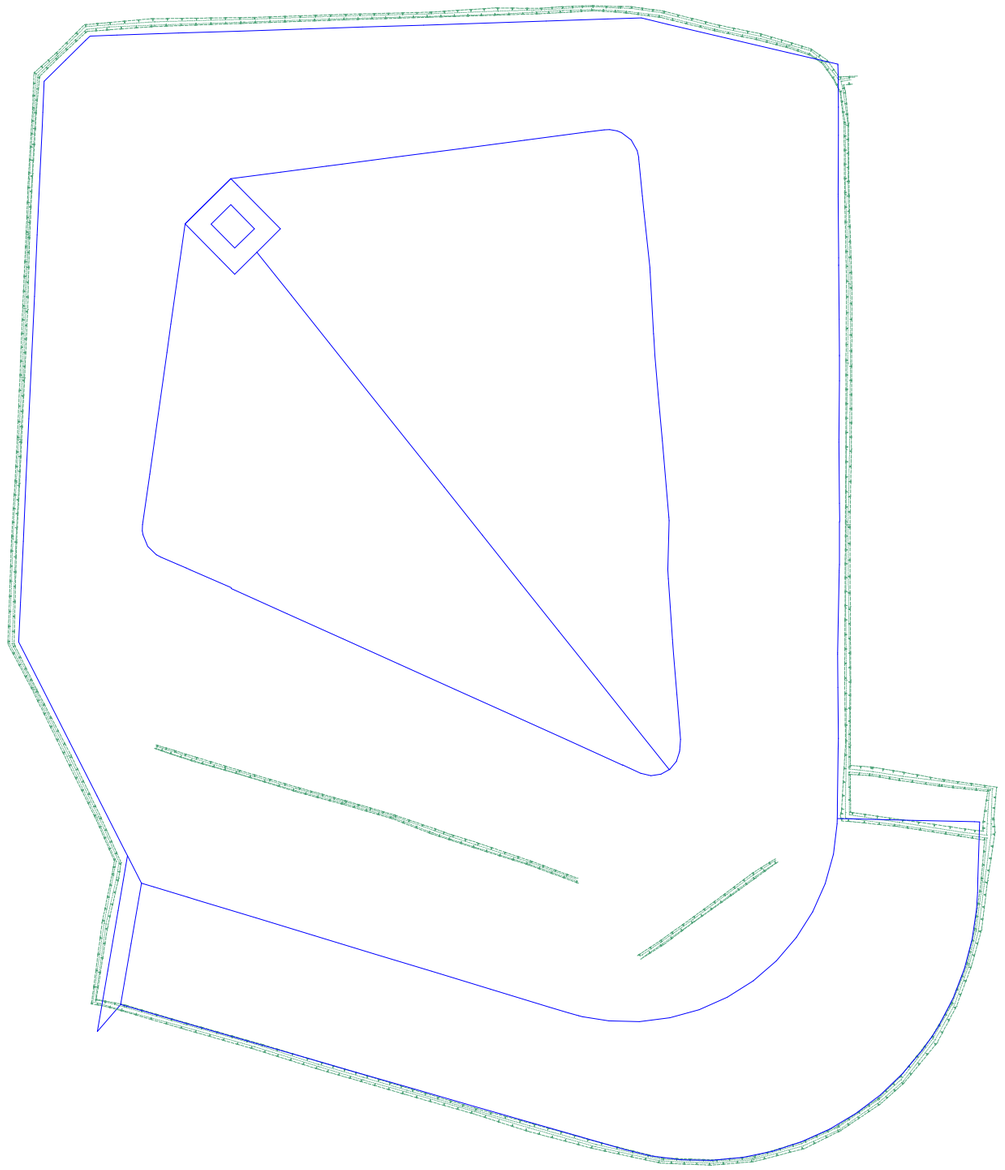
This page is intentionally left blank

[redacted]

LEGEND

ANCHOR TRENCH

CELL DESIGN



SCALE 1:1000

0 10 20 30 40 50

GEOGRAPHE CIVIL Pty Ltd

11 Hensen Street, Davenport. WA 6230
T: 08 9725 7077
E: admin@geographecivil.com.au

REV	DATE	DETAILS
A	04/07/24	Original Issue

Surveyed	26/06/24
Drawn	04/07/24
Checked	04/07/24
Datum	MGA 94 AHD
Drawing	ANCHORTRENCH-01A
Cad File	ANCHORTRENCH-01A
Client	CLEANAWAY

Description

ASCONSTRUCTED SURVEY
ANCHOR TRENCHES
CELL12A
BANKSIA ROAD
DARDANUP

Appendix No. 2 – Stage 1 Construction Quality Assurance Validation Report

Due to file size, this appendix only contains the CQA Validation Report text. The full report, including all appendices, has been provided as a separate file.

This page is intentionally left blank

[redacted]

Banksia Rd Landfill- Cell 12A
Cleanaway Solid Waste
Construction Quality Assurance (CQA) Report

Stage 1
Completion of All Earthworks And CQA Testing of Construction Materials

Prepared For:	Cleanaway Solid Waste Pty Ltd
Report Reference	BL23638- CQA (Rev2)
Version-Release Date	4 July 2024
Report Released By	[redacted]
Title	
Signature	

Table of Contents

Appendices

1 Introduction

Terra Firma Laboratories, acting as the Construction Quality Assurance (CQA) Consultant for Cell 12A at the Banksia Road Landfill construction, was engaged by *Cleanaway Solid Waste Pty Ltd*, the Principal. This role entailed ensuring that all construction activities met the project's Works Approval, and specifications and adhered to the DWER-approved technical specification and CQA plan.

This Stage 1 report is a comprehensive documentation of the verification process for the construction activities at Cell 12A, focusing on the completion of all earthworks and CQA testing of construction materials. Terra Firma Laboratories meticulously inspected and verified each stage of the construction process, ensuring that the work was carried out in compliance with the specified requirements. The report serves as a testament to the commitment to quality and adherence to regulations demonstrated by all parties involved in the Banksia Road Landfill Cell 12A construction project.

2 Documentation

2.1 Specification

All inspections and testings of Cell 12A at the Banksia Road Landfill construction were undertaken by the following project technical documentation:

- Works Approval WA6855/2023/1
- Banksia Road Cell 12A IFC Specification Rev 3 20 Feb 24
- Banksia Road Cell 12A CQA Plan Rev 3 23 Nov 23
- Banksia Landfill Cell 12A IFC Drawings 20-02-24

2.2 Variations from the Specification

Three variations were accepted by the designer during the project stage 1 reporting portion.

- The northern and western cell perimeter bunds were brought in by 10 m to accommodate gas pipes located on the outside of the new cell. As a consequence, the height of the perimeter bunds was increased by 2.5 m to suit the cell top of waste filling plan. These changes reduced the side of the overall landfill cell.

- Following the WSP review of the Cell 12A design, the southeast corner and southern edge of the cell was raised to ensure that not waste was intercepted during excavation works. Consequently, to maintain the original 1 (V) in 3 (H) side slope, the southern earthworks batter was extended further into Cell 12A, which again reduced the size of the cell.

- At the Leachate Collection Sump, an additional 300mm was excavated due to the soft material of the subgrade. Leachate Collection Sump batter was maintained at 1 in 3 after the major floor adjustment excluding a gradual transition.

2.3 Prequalification of subgrade fill material

As CQA, *Terra Firma Laboratories* managed all required pre-compliance testing, which comprised visual inspections and analysis undertaken at a NATA-accredited laboratory in accordance with the frequencies and standards detailed in Section 1.20.7.2 of the specification. Samples taken were representative of the whole material source and were evenly distributed across the material source.

The subgrade fill material was visually confirmed to not contain any unsuitable material and was free of debris and deleterious material with a maximum particle dimension no larger than 40 mm.

2.4 Construction Methodology – Subgrade construction

The earthworks, being excavation and fill placement, were executed by *Geographe Civil*, the principal construction contractor, under *Terra Firma Laboratories'* supervision. As the Construction Quality Assurance (CQA) Consultant, *Terra Firma Laboratories* observed the earthworks during specific phases and monitored the density testing procedures.

There was approximately 95,000 m^3 of excavation to get down to the design levels. During excavation, no waste was intercepted and excavation around Cell 12 and Cell 4B liners did not damage the existing liner material. In addition, external surface water was diverted around the construction works and into the existing on-site stormwater retention system.

Before the commencement of the earthworks fill construction, the Superintendent inspected the foundation to confirm the works conform to the Specifications as described in Section 1.20.9.1. Proof rolling was witnessed by the CQA Consultant to observe any deformation or deflection before placing the initial Fill layer.

Filling works were undertaken according to Section 1.20.9 of the technical specifications to construct the subgrade to the Design levels and grades shown in the drawings. All fill material was

placed, spread, mixed, watered and compacted in accordance with the Specification. The Fill material was blended, and moisture conditioned at the stockpile to achieve a homogenous material of consistent moisture content. Leachate or impacted water was not utilised for moisture conditioning of the Fill material. Fill Material was placed in lifts with a maximum compacted lift thickness of 300 mm and minimum of 100 mm. Each lift was spread evenly and thoroughly mixed to obtain a near-uniform condition in each lift. The surface was sealed (by smooth drum rolling) at the end of each day to minimize the penetration of water. Any desiccations, cracks, or inconsistencies in the subgrade were remediated as directed by the CQA Consultant.

Each layer of the subgrade was moisture conditioned to +/- 2 % of optimum and compacted to not less than 95% of the Standard Maximum Dry Density (SMDD) determined in accordance with AS 1289.5.2.1. Each layer worked was kept mostly parallel to the final surface and, where possible, extended across the entire width of the embankment or fill at that level. When wet material was observed, it was removed and replaced with compacted dry fill before compaction.

2.4.1 Subgrade proof roll

A final proof roll was conducted over the finished surface prior to acceptance using a mechanical self-propelled smooth drum roller as required by the specifications, Section 1.20.9.3; Surface Preparation.
During the final proof rolling of the prepared subgrade, the surface did not exhibit visible deformation, rutting, yielding, and/or show signs of distress or instability. The final Subgrade surface was inspected by the CQA Consultant (Appendix 3: Photo Library) and was approved by the Superintendent.

The subgrade's completed surface demonstrated the following characteristics.

- The Subgrade was smooth, flat, firm, and unyielding to the satisfaction of the CQA Consultant.
- Required number of construction compliance testing was completed before the surface is finally trimmed to design levels and grades.
- The surface did not exhibit visible deformation, rutting, yielding and/or show signs of distress or instability during final proof rolling.
- The Subgrade surface was free of debris, roots, angular material (such as sharp rocks), desiccation cracks and sudden changes in grade.
- The surface promoted drainage and excessive water was not allowed to accumulate on the surface.
- The integrity and moisture content of the Subgrade was maintained within the requirements of Section 1.20.9.3 until the construction of the overlying layer. Any areas of the subgrade that were identified to have excessively deteriorated, desiccated, or become affected by

excessive moisture, were rectified by the Contractor to the satisfaction of the CQA Consultant.

- Prior to rolling, the surface was inspected to ensure that no irregularities exceeding 40 mm over a span of 3 m were present. Following rolling, it was confirmed that no irregularities exceeding 10 mm in depth over a 20 mm straightedge length (addressing small sharp irregularities) were observed.
- No groundwater seepage was noticed by the CQA during subgrade preparation works.

2.4.2 As-constructed Survey of the Fill placement

Following the completion of proof rolling and preparation of the final Subgrade surface, the Contractor arranged for the Surveyor to survey the top of the prepared Subgrade surface in accordance with the requirements specified in Section 1.20.8.

Required lines and levels of the subgrade were achieved within the allowable tolerances as confirmed by the surveyor. The survey was used to produce the as-constructed survey which is attached in Appendix 2.

The as-constructed survey confirms that the final earthworks surface achieved a minimum gradient of 1.8% along the valley drain and minimum of 3.0% into the valley drain.

3 Construction Verification testing

3.1 Fill Placement

Construction compliance testing was carried out during construction to verify compliance of the as-built subgrade with the frequencies and requirements detailed in Section 1.20.9.4 of the Specification.

All materials testing and density testing were undertaken in accordance with the AS 1289 – Methods for Testing Soils for Engineering Purposes, by *Tera Firma Laboratories* and *Construction Sciences*, which holds NATA accreditation.

The CQA Consultant managed and selected the location of all construction compliance testing and ensured that the testing was evenly distributed throughout the full depth and area of the subgrade fill. Subgrade construction verification testing is documented in Appendix 1 and the as-constructed survey is included in Appendix 2.

If the dry density ratio of the Fill Material is less than 95% of SMDD or not moisture conditioned to +/- 2 % of optimum, the affected area was reworked by applying additional compaction effort to

increase the density of the layer until testing indicates that the area complies with the density requirements. The Contractor placed the Fill Material in a manner that ensured the area representative of testing was uniformly compacted.

If the moisture content of the Fill Material was outside the required moisture range, the affected area was reworked in situ by thoroughly scarifying the Fill Material to the full depth of the layer to aid drying or to aid absorption of additional water into the material. The Contractor reworked the Fill Material in a manner that achieved a homogeneous moisture content throughout the full depth of the layer and area. Once the moisture content of the Fill Material was rectified, the layer was re-compacted and retested. The CQA Consultant continuously inspected all areas of the works to verify the suitability and stability of the Subgrade for the construction of subsequent layers. If an area of the works was identified as presenting potential stability issues for the construction of subsequent layers, the area was corrected in accordance with the recommendations of the CQA Consultant. The CQA Consultant ensured that the full extent of the layer, which the failing test was representative of, was reworked and retested.

There were twenty-two (22) subgrade construction compliance density tests were performed under CQA Consultant supervision. Two (2) tests failed, and re-tests were taken for them to verify the compliance of the area. CQA achieved twenty (20) passed tests for the subgrade which falls well within the required frequency of the technical specifications. For a volume of 4382 m^3, with twenty (20) passed tests, the test frequency was 1 test per approximately 219.1 m^3

The CQA Consultant provided the Superintendent with a recommendation that the conditions of final acceptance had been met, including all density test results showing compliance with the requirements of this Specification.

4 Conclusion

This report is submitted to *Cleanaway Solid Waste* for the construction verification of the Banksia Rd Landfill - Cell 12A as Stage 1 reporting, encompassing the completion of all earthworks and Construction Quality Assurance (CQA) testing of construction materials. The scope included prequalification of construction materials, compaction control testing, and verification of compliance with the Specification. Through precise observation and documentation, it was found that all construction materials used were prequalified and met specifications, compaction levels met or exceeded criteria, and construction processes adhered to the Specification. In conclusion, the earthworks and construction quality assurance testing for Cell 12A complied with the Specification, ensuring the integrity and stability of the landfill cell.

It is confirmed that:

- Each item of critical containment infrastructure or component thereof, as specified in Condition 2 of the Works Approval, has been built and installed in accordance with the requirements specified in Condition 2.
- Each item of critical containment infrastructure or component thereof, has complied with the relevant construction quality assurance requirements detailed in Conditions 4, 5 and 6 of the Works Approval.

Appendix No. 3 – Stage 2 Construction Quality Assurance Validation Report

Due to file size, this appendix only contains the CQA Validation Report text. The full report, including all appendices, has been provided as a separate file.

This page is intentionally left blank

Banksia Rd Landfill- Cell 12A
Cleanaway Solid Waste
Construction Quality Assurance (CQA) Validation Report

Stage 2
Synthetic Liner CQA Assessment and Installation

Prepared For:	Cleanaway Solid Waste Pty Ltd
Report Reference	BL23638- CQA (Rev1)
Version-Release Date	10 July 2024
Report Released By	[redacted]
Title	
Signature	

Table of Contents

Appendices

Appendix 1 – Geosynthetic Liner CQA Assessment Report

Appendix 2 - Work Method Statements & Calibration Records

Appendix 3 - Approved Panel Layout

Appendix 4 - CQA Third Party Records

Appendix 4A - GCL Installation Third-Party Records
Appendix 4B - Geomembrane Installation Third-Party Records
Appendix 4C - Cushion Geotextile Installation Third-Party Records

Appendix 5- Geomembrane Destructive Testing Lab Test Certificates

Appendix 6- Photo Library

Appendix 7- Daily Site Notes

1 Introduction

Terra Firma Laboratories, acting as the Construction Quality Assurance (CQA) Consultant for Cell 12A at the Banksia Road Landfill construction, was engaged by *Cleanaway Solid Waste Pty Ltd*, the Principal. This role entailed ensuring that all construction materials and activities met the project's Works Approval, and specifications and adhered to the DWER-approved technical specification and CQA plan.

This Stage 2 report is a comprehensive documentation of the verification process for the construction materials and activities at Cell 12A, focusing on the completion of the Synthetic Liner Installation. Terra Firma Laboratories meticulously inspected and verified all materials and each stage of the construction process, ensuring that the work was carried out in compliance with the specified requirements. The report serves as a testament to the commitment to quality and adherence to regulations demonstrated by all parties involved in the Banksia Road Landfill Cell 12A construction project.

2 Documentation

2.1 Specification

All inspections and testings of Cell 12A at the Banksia Road Landfill construction were undertaken by the following project technical documentation:

- Works Approval WA6855/2023/1
- Banksia Road Cell 12A IFC Specification Rev 3 20 Feb 24
- Banksia Road Cell 12A CQA Plan Rev 3 23 Nov 23
- Banksia Landfill Cell 12A IFC Drawings 20-02-24

2.2 Variations from the Specification

No variations were issued during the synthetic liner installation portion of the project.

3 Geosynthetic Liner Material CQA Assessment

3.1 Introduction

All liner materials were supplied by the Principal, with the procurement of these materials being completed prior to the awarding of the construction contract. The Principal took the initiative to ensure that all necessary Construction Quality Assurance (CQA) sampling and testing were arranged in advance. To facilitate this process, the Principal collaborated closely with the CQA Consultant, who accepted the sampling regime according to Tables 2, 5 & 7 in the technical specification.

The CQA Consultant was responsible for assisting in the coordination of these efforts, ensuring that samples were collected in accordance with the established protocols. Additionally, the CQA Consultant meticulously reviewed the Geosynthetics materials' independent testing results, verifying that they met the required specifications and standards before proceeding with the construction.

3.2 CQA Assessment Results

Following the CQA test results assessment, the CQA Consultant provided the principal with a report, dated 13 February 2024, summarising the outcome of the geosynthetic material CQA assessment. Appendix 1 - Geosynthetic Liner CQA Assessment Report provides a summary of the test results and all laboratory certificates.

In summary, the CQA assessment has confirmed that:

- All X2000HCHP-OTHER GCL samples met the MQA and independent testing acceptance criteria, test methods and frequencies outlined in Table 1 and Table 2 of the Specification (refer to Attachments 1 & 2) with one non-conforming exception (details provided below):
- The manufacturer has tested 14 rolls for Mass per unit Area of Bentonite in overlaps (min. average), but according to the technical specification, the requirement is 16 samples (Table 1- section 1.21.4). However, the CQA testing was performed for sixty-three samples, conforming to the technical requirement.
- Sixty-four (64) double-textured HDPE geomembrane rolls manufactured by *Atarfil* were supplied (refer to Attachment 3), which the CQA Consultant reviewed to confirm the material conformed to the requirements of the Specification. Independent testing was undertaken by a nominated independent NATA-accredited geosynthetics laboratory (TRI Australasia) (refer to Attachment 4):

- It is noted that the geomembrane is manufactured of new, first-quality resin and is compounded and continuously manufactured specifically for this work. The resin manufacturer has certified each batch for acceptance criteria as listed in Table 3 of the Specification (Section 1.22.5- HDPE Geomembrane Material Specifications).
- Based on the similar resin properties of the geomembrane and the extrudate rod the CQA Consultant is satisfied that that the extrudate meets the design intent.
- All A84 Cushion geotextile rolls met the MQA and Independent testing criteria, test methods and frequencies outlined in Table 6 and Table 7 of the Specification.
- All A24 Separation geotextile samples met the MQA and Independent testing criteria, test methods and frequencies outlined in Table 6 and Table 7 of the Project Specification.
- In summary, the CQA assessment has determined that all liner material conforms with the project specification and the requirements detailed in Conditions 4, 5 and 6 of the Works Approval.

4 Geosynthetic Liner Installation

4.1 The Construction Timeframe

Between April 29, 2024, and June 24, 2024, the lining contractor at Cell 12A of the Banksia Road Landfill performed the deployment of the Geosynthetic Clay Liner (GCL) and HDPE Geomembrane concurrently, followed by the installation of Cushion Geotextile panels.

Geosynthetic liner installation of the capping strip at the tie-in between Cell 12 and Cell 12A was done subsequently on the first week of July 2024 while the Leachate aggregate placement was conducted at the cell 12A.

Despite encountering adverse wet weather conditions, the contractor undertook comprehensive reworking of the earthworks to attain an optimal surface condition for the liner deployment, as outlined in Section 1.21.2.2 (Surface Preparation) of the technical specification.

4.2 Documentation

The installer, *Fabtech Australia Pty Ltd*, provided panel layout plans for the installation of GCL, Geomembrane and Protection Geotextile and Separation Geotextile. The plans were confirmed to meet the intent of the section 1.21.2.3, 1.22.3.3 and 1.23.5 of the technical specification showing the location of the panels and expected seams, connections and penetrations and the order of panel layout and installation. (Appendix 2 - Approved Panel Layout). Also, equipment Calibration records were provided by the Installer (Appendix 1).

The CQA inspector documented all testing and inspection records in daily site notes, CQA Installation Records and information registers completed on-site including for each material as applicable:

- Panel Placement
- Trial Weld Register for Geomembrane
- Seam Register
- Records of non-destructive and destructive testing for Geomembrane
- Repair Register.

As-built layout plans have been presented diagrammatically to show the location of panels and repairs of the Geosynthetics installed. Photographs were also taken daily as supportive evidence of the installation, inspection and testing activities taking place on-site for each material.

4.3 General Observations of Geosynthetic Installation

- Following acceptable liner CQA sampling, testing and assessment, all liner material was approved prior to the commencement of the installation works.
- Geomembrane panels were systematically deployed to cover the GCL panels installed daily, effectively mitigating any potential hydration of the GCL panels due to weather events.
- Only Geomembrane panels that could be anchored and seamed together on the same day were deployed.
- The installation contractor's personnel were all observed to wear suitable apparel including footwear that did not damage the geosynthetic materials.
- No smoking was permitted or observed in the vicinity of the geosynthetic materials.
- Panel installation was undertaken only under satisfactory weather conditions – work did not commence or continue in the event of rain high wind conditions, or high daily temperatures impacted the sheet temperature for the Geomembrane.
- The geosynthetic panels were adequately secured with the assistance of sandbags to prevent displacement.
- No equipment was observed to be used in a manner that would cause damage to the Geomembrane, the GCL or the geotextile by handling, trafficking, or other means.

5 Geosynthetic Clay Liners (GCL) Installation

5.1 GCL Installation Records

The CQA consultant documented the panel placement and repairs for the GCL in the daily site notes and information registers, completed on-site including:

Appendix 3A - GCL Installation Third-Party Records

- GCL Panel Layout – Panels, Seams & Repairs information
- GCL Panel Installation Register
- GCL Repairs Register

As-built diagrams have been presented to provide a schematic of the location of panels and repairs for GCL. Refer to Appendix 3A: GCL CQA Installation Records and Panel Layout Plan supported by photographic evidence (Appendix 5).

5.2 GCL Installation Verification

GCL panel installation was conducted according to section 1.21.2 (Installation) of the technical specification. GCL was not placed when there was standing water, when it was raining, or when there were strong winds.

Before the GCL liner was installed, the surface that was required to be lined was inspected for uniformity and clarity of any sharp or angular items that might damage the GCL. The Contractor remedied any subgrade surface damage produced by construction equipment that was considered unsuitable before the GCL was placed. Before using the GCL, the CQA consultant examined the area to ensure it was appropriate for the next deployment section.

Regarding the deployment and installation of the GCL, the CQA consultant observed:

- GCL rolls were transported to the installation location just before the placement using a telescopic handler with a spreader bar attachment. The rolls were observed to be handled carefully by the installer and no damage to any of the rolls as a result of this handling method was observed.
- The protective plastic covering was removed from each roll before unrolling the panel.
- The GCL was deployed in a controlled manner and laid flat without folds.
- GCL was placed over the full surface of prepared earthworks.
- Where the slope length was greater than the GCL roll lengths, the GCL panels were joined using an anchor trench and appropriate roll end overlap, with the anchor trench being backfilled and compacted before the upper roll was installed.
- A double layer of GCL was installed in the leachate sump.

- GCL was placed to allow intimate contact with the subgrade, with no bridging over voids or low areas, as required by Section 1.21.2.3 (GCL Placement) of the Technical Specification.
- Each panel was secured into position with the placement of sandbags when required.
- The overlap of the GCL between panels was a minimum of 300 mm for longitudinal joins and 500 mm for roll end joins on the landfill base and 1.5 m, including an anchor trench for joins on the side walls. Roll end joins had additional bentonite applied to the seal the join.
- The overlap zone was observed to be kept clean, free of any debris and without folds or wrinkles.
- The deployment of GCL on the batters progressed from the top to the bottom which was a downslope with roof tile overlaps and no cross seams were observed on side slopes.
- GCL was installed only in dry weather and was immediately covered with geomembrane panels.
- Every panel was inspected as it was deployed and confirmed that bentonite distribution, including in the overlap zone, and quality (visual observation of consistency in colour, thickness, needle punching and sewing density, presence of needles or broken needles or other faults and moisture distribution) was satisfactory. All installed material was found to be of suitable quality.
- The final surface of the GCL was observed to be clean and free of folds and wrinkles, without damage and all seams were continuous prior to placement of geomembrane. No panels were observed to be prematurely hydrated without confinement.
- The GCL was observed to have been protected from damage and premature hydration due to precipitation, wind, or other environmental conditions.
- The GCL was not placed during precipitation, during hail, during periods of excessive fog, in standing water, on excessively wet surfaces, in the presence of excess moisture (such as dew and/or ponded water) and/or under any other conditions which were at risk of causing premature hydration.
- Following the installation of the Cell 12A liner (GCL and geomembrane), the capping strip was installed between the new works and Cell 4B and Cell 12. This capping strip incorporated a GCL strip placed in the gap between the existing cell liner anchor trenches and the new liner anchor trench. The GCL strip had a minimum 0.5 m overlap onto each of the adjoining cell liners, as required in the project drawings.

6 Geomembrane Installation

6.1 Geomembrane Installation Records

The CQA inspector documented all testing and inspection records in daily site notes and information registers completed on-site including:

Appendix 3B- Geomembrane Installation Third-Party Records

- Geomembrane Panel Layout – Panels, Seams & Repairs information
- Geomembrane Panel Seam and Air Pressure Testing Information
- Geomembrane Trial Weld Information
- Geomembrane Repair Register and Vacuum Box Testing Information

Appendix 4- Geomembrane Destructive Testing Lab Test Certificates

As-built diagrams have been presented to provide a schematic of the location of panels and repairs for Geomembrane installation. Photographs were also taken daily as supportive evidence of the installation, inspection and testing activities taking place on-site. Please refer to Appendix 5: Photo Library.

6.2 Geomembrane Installation Verification

After the deployment of GCL, Geomembrane panels were deployed using a spreader bar attached to a telescopic handler and pulled by hand from the top down the slope on the bund walls and/or across the cell floor. The deployment method was observed to adequately move the rolls without damage and the rolls were handled carefully to avoid any damage during deployment.

The geomembrane was placed in accordance with the following:

- The Geomembrane was placed and seamed following section 1.22.6 (HDPE Geomembrane Weld Properties) of the technical specification and in line with the technical drawings and the approved work method statement
- Only double sided textured geomembrane panels were used for the cell 12A construction.
- The geomembrane was cut from each roll with an approved hook blade knife with flat zones on each end.
- No Geomembrane was installed where the welding could not be completed by the end of each day's shift.
- Installation was progressed from the highest elevations to the lowest in roof tile fashion and anchored at the crest and no horizontal overlaps on the batters or cross seams on slopes were observed.

- The geomembrane rolls were placed in an orderly fashion that minimises or prevents surface water from flowing below previously installed geomembrane
- No geomembrane placement was allowed to bridge over voids or low areas. The placed geomembrane was observed to have made intimate contact with the underlying GCL surface
- Panels ran down the sidewalls and overlapped the base by 1.5 metres onto the floor from the toe of the batters.
- The geomembrane was installed without undergoing excessive buckling, wrinkling or tensioning.
- Every panel was inspected as it was deployed to confirm the quality of the installed material (visual observation of consistency in material surface texture and smooth edges and to identify any tears, punctures, abrasions, cracks, indentations, thin spots, or other faults). All installed material was found to be of suitable quality.
- Sandbags were used to temporarily hold the geomembrane in position and prevent uplift by wind. In case of high winds, continuous loading was placed along the edges of panels to minimise the wind-lift.
- The geomembrane rolls were freely suspended during the placement
- The method used to unroll the geomembrane did not cause scores, scratches or crimps.
- The geomembrane was only placed or seamed in conditions where no impact from dirt or moisture on proper underlying surface preparation, panel placement or panel seaming was observed. No panel placement or seam was undertaken during precipitation or other wet weather conditions.
- No seaming was permitted in standing water, on excessively wet surfaces or in the presence of excess moisture (such as dew and/or pond water).
- No panel placement or seaming was undertaken during periods of excessive winds (>30 kph) when gusting wind conditions interfere with handling operations or during periods of excessive dust.
- Sheet temperatures were monitored by the Installer to ensure they remained within the range of 0-60°C.
- An additional rub sheet layer of HDPE was installed down the side batter and into the leachate sump.
- Following the installation of the Cell 12A liner (GCL and geomembrane), the capping strip was installed between the new works and Cell 4B and Cell 12. This capping strip incorporated a GCL strip placed in the gap between the existing cell liner anchor trenches and the new liner anchor trench. A 2 mm HDPE capping strip was then installed over the GCL capping strip and extrusion welded to the two adjacent cell liners, as required in the project drawings.

The geomembrane welding was done following two methods: dual hot wedge fusion welding and extrusion welding as per section 1.22.3.4 (Seaming Procedures) of the technical specification. Dual hot wedge fusion welding was used for length between adjacent Geomembrane panels, and extrusion welding was used for patch repairs, any less than 5m seam repairs and air pressure test needle repairs.

It was performed using the split head wedge fusion weld method, fusing the upper and lower overlapped Geomembrane panels. Extrusion welding was only used for minor faults, wrinkles and repair works.

In regard to welding and seaming, the following procedures were undertaken:

- The fusion welding equipment was fit for purpose – it was capable of continuously monitoring and controlling the temperature in the zone of contact and formed two contact fusion areas of a minimum of 15mm with a 5 mm void between the two welds.
- For fusion welding, the welding equipment settings for temperature and speed were monitored and documented and trial welds verified that the equipment was in good working condition.
- Both fusion and extrusion welding were only conducted by welding equipment and personnel that had achieved a passing trial weld.
- All seams had roof tile fashion arrangements to promote runoff and welding was undertaken in one direction only for each seam section.
- Prior to welding, the prepared weld surfaces were properly cleaned to optimise good quality welding, if free moisture was located in the weld area, it was wiped thoroughly using dry clothes and dried before seaming.
- Before extrusion welding the area to be joined was ground with a hand-held grinder to enhance the weld. All area of the grind was covered with the weld join.
- All cross seams offset were at least 500 mm from the cross seam of the adjacent panel.
- All fusion welds used to connect panel ends to sheets formed T-joints. It was ensured that these T-connections had a distance of at least 0.5m between other T-joins. The welding seams of the geomembrane did not cross (no cruciform connections).
- All the seams had a minimum finished overlap of 125 mm for dual hot wedge fusion welding and 75 mm for extrusion welding.
- Air pressure testing was undertaken across every fusion welded seam to confirm it was acceptable.
- The extrusion rod used for extrusion welding (HD rod) was made of the same resin as the geomembrane seamed and the weld rod data was reviewed and accepted by the CQA as per section 1.22.3.4 (Seaming Procedures).
- The minimum width of the surface extruded bead was 30mm.
- Prior to welding, oxidation by-products were removed from the weld area by grinding and grind marks were not deeper than 10% of the geomembrane thickness, less than 30mm in width and undertaken within 30 minutes prior to the welding.
- Prior to welding, the extruder was purged until all the heat-degraded extrudate was removed.
- Vacuum box testing for all extrusion welded beads and patches was undertaken to identify leaks in the weld.

- All seams were identified by a number and numbers were recorded in the panel seam installation, air pressure testing information register to record the applicable panels joined by the seam, the length and type of seam, temperature of weld, the date and time of welding, the welding personnel and equipment that completed the work.
- Destructive test samples were taken from the fusion and extrusion welded seams to verify the quality of the seams.
- Field welding was undertaken within the geomembrane surface temperature range of (5 to 60°C).
- Refuelling of machinery was undertaken away from the liner area so no spills occurred on the liner.
- Extrusion welds were allowed to cool to ambient temperature without inducing a temperature drop.

6.2.1 Trial Weld Verification

Trial weld records were documented by the CQA inspector. In line with section 1.22.7 (HDPE CQA Testing) of the Technical Specification, the following procedures were undertaken for trial weld verification:

- Trial welds were conducted for each welding apparatus, welding technician and welding condition prior to the commencement of Geomembrane seaming on any day and in the presence of the CQA inspector, and were retested after any break of more than one hour and at an interval of four hours from the previous trial weld.
- The trial weld register recorded the date and time of the test, ambient temperature, initials of the welder and identification of the welding machine. The speed and temperature setting for fusion welding and the pre-heat and barrel temperature for extrusion welding were also recorded in the trial weld register.
- The trial weld samples were a minimum of 1000mm by 300mm with the seam centred.
- In total four coupons for each sample were tested (2 for peel and 2 for shear) and prior to testing all coupons were cooled down to ambient temperature without artificial cooling methods.
- Trial weld information recorded the results of the outside track first, followed by the inside track.
- The trial welds were considered as pass when they met the criterion provided in Table 4 of section (1.22.6 HDPE Geomembrane Weld Properties) of the technical specification as given below and results were recorded in geomembrane trial weld information:
    - Exhibited film tear bond (FTB) failure.
    - Less than 15% incursion into the weld in relation to the initial area of the weld.
    - The shear and peel strength for fusion welds exceed 700 N/25mm and 530 N/25mm respectively
    - The shear and peel strength for extrusion welds exceed 700 N/25mm and 455 N/25mm
    - Both tracks of fusion weld passed.

6.2.2 Seams Verification - Non-destructive testing

Air pressure testing was completed on every length of fusion welded seams. Testing was done by pressurised air using an air pump (210-250 kPa for a 25mm channel) after sealing both sides of seam. Pressure drop ≤10 kPa after a minimum of three minutes (All air pressure tests typically tested for 5 minutes) was considered a pass. The air channel was cut after the test and the pressure drop in the gauge was observed to confirm no obstruction in the weld. The results are summarised in the Panel Seam and Air Pressure Testing Register. The air pressure test results were also recorded next to the applicable seam on the geomembrane in the field.

If the air pressure testing failed in a seam, the hole in the seam was to be found, re-blocked and re-repaired with a patch. The leak was located by sealing the air channel halfway along the seam, and testing was repeated until the defect was found. Air pressure testing was conducted again to check the integrity of the seam. In this way, the initial failed air pressure test seam complied with section 1.22.3.5 (Field Seam Non-destructive Testing) of the Technical Specification.

6.2.3 Seams Verification – Destructive Testing

Destructive test samples were required to be taken every 150 linear metres for fusion weld, and every 120 linear metres for extrusion weld for the Geomembrane as a minimum. A total of 29 Destructive Tests were completed for Cell 12A for a total fusion weld seam length of 4166m achieving a test frequency of 1 test per 150m. One DT was tested from the extrusion weld seam at the Cell 12A and Cell 12 interface achieving a test frequency of 1 test per 120m.

Due to the remote nature of the site and associated potential turn-around time delays in receiving destructive testing laboratory results, the CQA Consultant set up an on-site testing laboratory. This on-site testing laboratory was in accordance with NATA requirements.

Samples for destructive testing were selected and marked on the seams by the CQA inspector for the installer to cut out. Samples were approximately 1.5m in length and 300mm in width with seam centred. The sample was cut into three sections (500 mm x 300 mm): the first samples set were tested in the field (5 specimens tested for shear and 5 specimens tested for peel), the second set of samples was tested in the on-site NATA lab (5 specimens tested for shear and 5 specimens for peel) and the third set of samples was retained by the CQA inspector for archiving.

The acceptance criteria for destructive seam testing were based on Table 4 (Minimum Average Weld Properties) for the technical specification. Samples were field tested by the Installer in the presence of the CQA personnel, and the results were recorded on the Destructive Test Register (Appendix 4B - Geomembrane Installation Third-Party Records.

Independent Laboratory test results are summarised in the Destructive Test Register – Laboratory Results (Appendix 4). Shear strength and peel strength for tests for independent laboratory tests were assessed in line with the compliance requirements detailed in GRI – Geomembrane 19 but assessed against the acceptance criteria detailed in Table 4 in the Technical Specification.

DT samples were selected from the range of seam types across the full extent of cell 12A and the interface between Cell 12A and Cell 12. Both fusion welded seams and extrusion welded seams had destructive tests completed on them. All DTs passed the Table 4 (Minimum Average Weld Properties) requirements of the technical specifications and there were no failed DTs in Cell 12A and Cell 12A-Cell 12 interface geomembrane liner works.

6.2.4 Seam Repairs

Repairs were completed for all defects identified by the CQA inspector and labelled with a number ID on the geomembrane surface or seam. Various repair methods were employed on site namely patching, capping, and extruding. Geomembrane Repair Register (Appendix 3B) provides a summary of the repairs undertaken on site and any vacuum box testing records completed on the repairs. This data is also supported by a range of photos of the patches located in the field (Appendix 5).

All the patches used for seam repair were seamed with extrusion welding according to Technical Specification 1.22.3.4 (Seaming Procedures) and vacuum box testing was done as per section 1.22.3.5 (Field Quality Control) to confirm sealing. All the needle holes created for air pressure testing were grounded and repaired by extrusion bead as per technical specifications. All patches were compliant with the requirements of the specification with the patches extending a minimum of 100mm beyond the edge of the defect. Patches were typically circular in shape, or with rounded corners and extended a minimum of 125mm from the outer edge of any defect. No patch was placed over a previously placed patch.

6.2.5 Vacuum Box Testing

Non-destructive testing of extrusion seams was conducted using a vacuum pumping device with a minimum 35 kPa (5 psig) negative pressure for at least 15 seconds in accordance with section 1.22.3.5 (Field Quality Control) of the specification. To perform the test, a section of the seam was wetted with a foaming agent, placed vacuum box over the wetted area, a seal between the box and geomembrane, and evacuated air from the vacuum box to the required pressure for the specified period. Furthermore, observations were done on the seam through the viewing window for the presence of soap bubbles emitting from the seam. The test was considered successful if no bubbles were observed.

The results of vacuum box testing were recorded next to the repair works on the geomembrane in the field and the test details are summarised in the Geomembrane Repairs Register (Appendix 3B)

6.2.6 Final Surface for Geomembrane

The final inspection of the surface of the geomembrane was completed progressively by the CQA consultant, and it was confirmed that before placement of the protection geotextile, the geomembrane was:

- Free of irregular stressing, folds, and excessive wrinkles
- No damage was left without repair.
- Seams were continuous.
- The surface was clean.
- No tears, punctures, abrasions, indentations, or other faults were left without repair.

7 Protection Geotextile Installation

7.1 Documentation

The CQA inspector documented the panel placement for the Geotextile in the daily site notes and information registers completed on-site, refer to Appendix 3C: Protection Geotextile Panel Layout and Installation Records, including:

- Geotextile Panel Layout Diagram
- Installation Register – Panel Placement
- Geotextile Repairs Register

As-built diagrams have been presented to provide a schematic of the location of panels for Geotextile supported by photographic evidence (Appendix 5).

7.2 Protection Geotextile Installation Verification

Based on the CQA inspector's daily observations and in conjunction with the inspections and checks documented in the field records, it was confirmed that regarding panel placement and the seams connecting the panels:

- The geotextile was placed in a controlled manner, freely suspended during placement and with panels deployed manually over the geomembrane to ensure that the geomembrane was not damaged, and the geotextile was not damaged or any wrinkles in the liner layer. No dragging of panels across an unprepared surface was observed.
- The geomembrane surface was dry, smooth, and free of damage and clean of any debris that may have damaged the geotextile.
- The geotextile deployment and seaming were undertaken only in favourable weather conditions i.e., low wind conditions for panel deployment and dry conditions for seaming.
- The geotextile was weighted with sandbags once it was deployed to prevent it from shifting and sandbags remained in place until they were anchored securely.
- The geotextile installed on the side slopes was secured in an anchor trench, with the anchor backfilled and compacted with low-permeability soil after geotextile placement.
- Every panel was inspected as it was deployed to confirm the quality of the installed material (visual observation of consistency in colour, thickness, tears, holes, punctures, presence of needles or broken needles or other faults). All installed material was found to be of suitable quality.
- No equipment placed on the geotextile was observed to cause damage.
- No vehicle trafficking on the geotextile was observed.
- The panels were heat bonded with a leister gun and welder (Temperature:350 /Speed:9.9) with a minimum 200mm overlap on side panels as per Section 10.6.5 of the specification with no horizontal overlaps on the slopes. The CQA Inspector observed the heat bonding method and

confirmed that no damage to the underlying geomembrane from this seaming method was observed.

- Only geotextile rolls that can be seamed or permanently anchored on at least two sides on the same day were placed daily.
- The arrangement of the geotextile panels was generally in accordance with the panel placement drawings.
- The geotextile was placed to allow intimate contact with the underlying geomembrane – no bridging was observed.

The finished protection geotextile surface was inspected by the CQA inspector who confirmed it had no damage and no foreign objects that may damage the liner. The seams were observed to be continuous, and the surface of the geotextile was clean with no discolouration, tears, punctures, or faults.

8 Anchor Trenches

Anchor trenches excavation, backfill, and compaction were completed to the line and grades shown on the Drawings for anchoring of the geosynthetics. Anchor trenches were constructed progressively as per the liner installation plan to secure the geosynthetics. The anchor trench construction was inspected to confirm a depth of 1000mm and a width of 500mm. The distance from the crest of the batters as per the construction drawings was 1250 mm according to the design drawings. The anchor trenches were constructed with rounded edges and rounded corners to avoid sharp bends in the geosynthetic material as detailed in section 1.21.2.3 (GCL Placement) of the technical specification. The base of the anchor trench was smooth and free from any defects to provide a uniform surface for the geosynthetics.
The construction of the anchor trenches was observed to be in accordance with the design drawings. Photographic evidence is provided in Appendix 5.

9 Conclusion

This report is submitted to *Cleanaway Solid Waste* for the construction verification of the Banksia Road Landfill - Cell 12A as Stage 2 reporting, encompassing the completion of Synthetic Liner Installation. The scope of CQA consultants included construction quality assurance of the installation of the Geosynthetic Clay Liner (GCL), Geomembrane, and Cushion Geotextile composite liner system and quality assurance testing. Through precise observation and documentation, it was found that the composite synthetic liner system installation adhered to the Specification.

In conclusion, the synthetic liner installation and construction quality assurance testing for Cell 12A complied with the Specification, ensuring the integrity and stability of the landfill cell.

It is confirmed that each item of critical containment infrastructure or component thereof, as specified in Condition 2 of the Works Approval, has been built and installed in accordance with the requirements specified in Condition 2.

Appendix No. 4 – Stage 3 Construction Quality Assurance Validation Report

Due to file size, this appendix only contains the CQA Validation Report text. The full report, including all appendices, has been provided as a separate file.

This page is intentionally left blank

[redacted]

Banksia Rd Landfill- Cell 12A
Cleanaway Solid Waste
Construction Quality Assurance (CQA) Validation Report

Stage 3
Completion of Leachate Pipework, Aggregate Installation, Liner Integrity Testing & Separation Geotextile Installation

Prepared For:	Cleanaway Solid Waste Pty Ltd
Report Reference	BL23638- CQA (Rev1)
Version-Release Date	1 August 2024
Report Released By	[redacted]
Title	
Signature	

Table of Contents

Appendices

Appendix 1: MQA Data of Leachate Collection Pipes

Appendix 2: Leachate Collection Pipework Survey

Appendix 3: Leachate Drainage Aggregate Thickness Survey

Appendix 4: Leak Detection Survey Report

Appendix 5: CQA Third Party Records

Appendix 6: Photo Library

Appendix 7: Daily Site Notes

1 Introduction

Terra Firma Laboratories, acting as the Construction Quality Assurance (CQA) Consultant for Cell 12A at the Banksia Road Landfill construction, was engaged by *Cleanaway Solid Waste Pty Ltd*, the Principal. This role entailed ensuring that all construction materials and activities met the project's Works Approval, and specifications and adhered to the DWER-approved technical specification and CQA plan.

This Stage 3 report is a comprehensive documentation of the verification process for the construction activities at Cell 12A, focusing on the completion of Leachate Pipework, Aggregate Installation, Liner Integrity Testing & Separation Geotextile Installation. Terra Firma Laboratories meticulously inspected and verified all activities and each stage of the construction process, ensuring that the work was carried out in compliance with the specified requirements. The report serves as a testament to the commitment to quality and adherence to regulations demonstrated by all parties involved in the Banksia Road Landfill Cell 12A construction project.

2 Documentation

2.1 Specification

All inspections and testings of Cell 12A at the Banksia Road Landfill construction were undertaken by the following project technical documentation:

- Works Approval WA6855/2023/1
- Banksia Road Cell 12A IFC Specification Rev 3 20 Feb 24
- Banksia Road Cell 12A CQA Plan Rev 3 23 Nov 23
- Banksia Landfill Cell 12A IFC Drawings 20-02-24

2.2 Variations from the Specification

The leachate extraction riser pipes were changed from the original 355 mm diameter to 450 mm diameter to facilitate easier access to the sump when inserting the leachate pump. As a consequence, the concrete headwall structure was made slightly larger to accommodate the larger pipe dimeters.

3 Leachate Collection Pipework

3.1 Introduction

Leachate collection pipework installation of Cell 12A was conducted according to section 1.24 of the technical Specifications and Design Drawings. Three types of pipe diameters were utilised for different applications.

- 250mm diameter pipes as leachate collection pipes
- 110mm diameter pipes as leachate collection pipes
- 450mm diameter pipes as leachate extraction pipes

Pipes were joined together using butt welding and electro-fusion welding, both done by technicians with the necessary training. Before any pipe welding started, the Superintendent received proof of appropriate qualification. Bends were standard pipe fittings that were prefabricated and met design specifications. Every welded junction and cut edge was smooth, clean, and orderly, and formed a leak-tight weld.

3.2 Leachate Collection Pipe Prequalification

The contractor provided the pipe manufacturer's quality assurance data and pipes' perforation details, which enumerated the properties of the leachate collection pipes. Once the leachate collection pipes were delivered to the site, the CQA inspector confirmed that:

- Per the design drawings, the pipes had diameters of 250 mm and 110 mm for leachate collection pipes and 450 mm for leachate extraction pipes.
- All connections, and joiners were solid walls with the same pressure class as the pipe.
- All the pipe and fittings had tags with the manufacturer's name.
- All the pipes and fittings were labelled with product information (e.g. pressure class, product identification etc.)
- All the pipes and fittings were marked with standard certification (i.e. AS/NZ 4130).

All perforations were drilled off-site as per the configuration in the design drawings. The floor leachate collection pipes were drilled with 12mm holes at 300mm spacings at 45 degrees offsets and the two leachate extraction pipes were 450mm in diameter.

The contractor submitted the brochures of all the pipes and fittings, and they are included in Appendix 1: MQA Data Leachate Pipes. The Polyethylene pipes were transported, handled and stored as per the manufacturer's recommendations.

250 mm and 110 mm leachate collection pipes were drilled according to the design drawings. Drilling of polyethylene pipes was not undertaken on the lined area of the Works. Drilled pipes were cleaned out of all drill cuttings before being installed in the Works. 450 mm for leachate extraction pipes were solid pipes, without any perforations.

Each leachate pipe and riser pipe were inspected by the CQA inspector who confirmed that the material and perforations were compliant with section 1.24 of the specification and the design drawings (Leachate Collection Pipework).

3.3 Leachate Collection Pipework Installation

3.3.1 The Construction Timeframe

The installation of leachate collection pipework was carried out between June 18 and July 14, with CQA inspections being conducted concurrently with the installation works.

3.3.2 Documentation

The installer, *Geographe Civil Pty Ltd*, provided an as-built survey of the pipe layout for the installation of the Leachate Collection Pipework. The plans were confirmed to meet the intent of section 1.24.3 of the technical specification showing the pipe type, diameter and installed location. (Appendix 2: Leachate Collection Pipework- as-built survey). The brochures for all of the pipes and fittings that the contractor submitted are listed in Appendix 1: MQA Data Leachate Pipes. Photographs were taken as supportive evidence of the installation and inspection activities are recorded in Appendix 7: Daily Site Notes.

3.4 General Observations of Leachate Collection Pipework Installation

The installation of the Leachate Collection Pipework was performed in accordance with Section 1.24.3 of the technical specifications, with CQA observing the following:

- Polyethylene pipes were stored, handled, transported, and installed in line with the manufacturer's specifications. They were not subjected to rough handling, especially during loading and unloading.
- The pipes were adequately protected from scouring by lifting equipment and were properly supported during lifting to prevent distortion or buckling.
- Pipes were gently lifted into position to avoid damage to both the pipes and the landfill liner materials. The pipes were neither dragged nor dropped.
- Each pipe was precisely laid and aligned according to the grade and position specified in the Drawings.
- Leachate collection pipes were placed directly on the cell liner material, in a manner that prevented damage to the geotextile liner below, and the pipe side support material (leachate drainage aggregate) was carefully placed and compacted to provide haunch support without damaging the landfill cell liner materials or displacing the pipes.
- Two leachate extraction pipes were installed along the side slope and was secured in position before the construction of the concrete leachate access platform.
- All foreign materials were removed from the interior surfaces of the pipes prior to installation in the Works.
- The perforations in the leachate collection pipes were drilled off-site by the contractor according to the diameters and spacings specified in the design drawings.

Pictorial evidence of the leachate pipe perforation is presented in Appendix 6: Photo Library. The pipes were connected using butt welding and electro-fusion welding in accordance with the manufacturer's recommendations. The GMB and geosynthetics remained undamaged, and care was taken to ensure that no foreign objects entered the pipework during installation and welding.

3.5 Supply and Installation of Leachate Drainage Aggregate

Prior to delivery to the site, the blue metal Leachate Drainage Aggregate was tested for the following properties as per Table 8 of section 1.25.3 (Leachate Drainage Material) of the technical specification:

- Maximum particle size of 37.5mm.
- Passing the 26.5mm sieve 70-100%
- Passing the 13.75mm sieve < 5%
- Free of organic matter, fine grained material or other deleterious materials such as limestone or calcareous materials.

An independent NATA-accredited laboratory test results confirmed that the material met the requirements of section 1.25.3. This was reported in the stage 1 reporting. The CQA inspector observed the aggregate delivered to the site had no oversize, angular or other deleterious materials visually.

Prior to the placement of the Leachate Drainage Aggregate layer, a trial pad was performed, and an inspection of the membrane was undertaken by the CQA inspector, to confirm that no damage had occurred to the Lining system from the aggregate placement. Trial pad inspection records are included in Appendix 7: Daily Site Notes.

The leachate drainage material was placed in accordance with section 1.25.3.2 of the specification and the CQA inspector observed the following during placement,

- The leachate drainage material was placed in a layer of 300 mm minimum thickness.
- The placement operation was carried out such that no excessive stress is imparted to the underlying liner or substrate works so no damage occurs to any previous works.
- The aggregate layer was installed above the Separation geotextile in the landfill cell to the extent shown in the Drawings. The aggregate layer was placed up the landfill perimeter side slopes to a maximum vertical height of 4.5 m above the toe of the side slope.
- The Contractor placed the aggregate on the liner and did not spill or push the aggregate out onto the liner.
- The drainage material was spread with a Posi-Track with a maximum ground contact pressure of 50 kPa.
- The machine was operated over at least 300 mm thickness of drainage material at all times.
- The machine did not slew or brake suddenly on the 300mm thickness lift areas.
- At the designated temporary haul road or tipping area, the drainage material is maintained at a minimum thickness of 800 mm as measured from the bottom of the deepest ruts in the aggregate to the surface of the geomembrane.

- Vehicles responsible for spreading aggregate did not activate the aggregate on the side slope and only travelled vertically along the slope, avoiding any lateral movement.
- Haulage vehicles remained on designated haulage roads and tipping areas at all times. No haulage vehicles travelled on the side slopes.

Upon completion of the leachate collection aggregate the entire area was surveyed by a licenced surveyor to confirm a minimum thickness of 300mm over the entire surface. Refer to Appendix 3: Leachate Drainage Material Thickness Survey, for verification of the 300mm leachate drainage material thickness.

The specification required that the leachate aggregate be installed within two weeks of the installation of the GCL. The vast majority of the aggregate was installed within the required two weeks; however, there were some smaller liner areas that took longer to cover with aggregate, with the worst case being in the order of four weeks. The delay in aggregate installation was predominantly due to the liner installation being delayed by rain events and the time taken to install the two main leachate extraction pipes in the leachate sump.

4 Leak Detection Survey

Terra Firma Laboratories, as the suitably qualified sub-contractor, performed the leak detection survey of all geomembrane-lined areas following the placement of the leachate drainage material. This survey was conducted in strict accordance with ASTM D7007 Standard Practice for Electrical Method of Locating Leaks in Geomembrane Covered with Water or Earth Materials (Dipole method), as specified in section 1.26 of the technical specifications. Prior to the survey, a work method statement was issued by the Leak Detection Survey Contractor, detailing the requirements and the approach to be undertaken for the activity.

The survey utilized clean, clear, non-silt-laden water to ensure the accuracy and reliability of the results. The leak detection survey was carried out after the geomembrane installation and the placement of the drainage aggregate atop the geomembrane. The comprehensive results of this survey are documented in Appendix 4, within the leak detection survey report.

Upon identification of leaks in the lining system, the lining contractor promptly repaired the identified leaks and Terra Firma re-surveyed these areas to ensure all issues were adequately addressed. Additionally, vacuum box testing was performed to verify the integrity of the welds, confirming that all repairs met the required standards. This meticulous process ensured the reliability and durability of the geomembrane lining system, maintaining the high-quality standards set for the project.

Repair number	Trial weld #	Start time	Repair	Location	Repair type	Reason for repair	Repaired by	Vacuum box test date	QA Sign
196	95	11:45	22/Jul/2024	Panel 80	Patch	Holes identified from the Dipole Survey	[redacted]	22/Jul/2024	[redacted]
197	95	12:00	22/Jul/2024	Panel 80	Patch			23/Jul/2024	
198	95	11:50	22/Jul/2024	Panel 80	Patch			24/Jul/2024	

5 Separation Geotextile Installation

5.1 Documentation

The CQA inspector documented the panel placement for the separation geotextile in the daily site notes and information registers completed on-site, refer to Appendix 5: CQA Third Party Records for the Separation Geotextile Panel Layout and Installation Records, including:

- Separation Geotextile Panel Layout Diagram
- Installation Register – Panel Placement
- Separation Geotextile Repairs Register

As-built diagrams have been presented to provide a schematic of the location of panels for separation geotextile supported by photographic evidence (Appendix 6).

5.2 Separation Geotextile Installation Verification

Based on the CQA inspector's daily observations and in conjunction with the inspections and checks documented in the field records, it was confirmed that regarding panel placement and the seams connecting the panels:

- The geotextile was placed in a controlled manner, freely suspended during placement and with panels deployed manually over the geomembrane to ensure that the geomembrane was not damaged, and the geotextile was not damaged or any wrinkles in the liner layer. No dragging of panels across an unprepared surface was observed.
- The leachate drainage material surface was clean of any debris that may have damaged the geotextile.
- The geotextile deployment and seaming were undertaken only in favourable weather conditions i.e., not during heavy rain and low wind conditions for panel deployment and dry conditions for seaming.
- The geotextile was weighted with sandbags once it was deployed to prevent it from shifting and sandbags remained in place until they were anchored securely.
- Every panel was inspected as it was deployed to confirm the quality of the installed material (visual observation of consistency in colour, thickness, tears, holes, punctures, presence of needles or broken needles or other faults). All installed material was found to be of suitable quality.
- No equipment placed on the geotextile was observed to cause damage.
- No vehicle trafficking on the geotextile was observed.
- The panels were heat bonded with a leister gun along all longitudinal and transvers joins, including to the cushion geotextile on the side slopes.

- Jointing between sheets was formed by overlapping by a minimum of 150 mm for all longitudinal joins and roll-end joins on the floor of the cell. A minimum of 1 m roll end overlap on the slopes, with the lower roll being under the upper roll, was maintained during the separation geotextile installation.
- Only geotextile rolls that can be seamed or permanently anchored on at least two sides on the same day were placed daily.
- The arrangement of the geotextile panels was generally in accordance with the panel placement drawings.

The finished separation geotextile surface was inspected by the CQA inspector who confirmed it had no damage and no foreign objects that may damage the liner. The seams were observed to be continuous, and the surface of the geotextile was clean with no discolouration, tears, punctures, or faults.

6 Permanent Ballast

Sandbags were installed as permanent ballast after completing the separation geotextile installation. A row of approximately 15kg sandbags was secured at approximately 2m centres on geotextile roll edges and 6m centres on geotextile centre line. The sandbags were placed in general accordance with design drawings (BANK-509 & BANK-512).

7 Conclusion

The construction of Cell 12A at the Banksia Road Landfill has been comprehensively documented and verified by Terra Firma Laboratories, serving as the CQA Consultant. The rigorous inspection and documentation processes ensured adherence to the project's Works Approval, technical specifications, and the CQA Plan approved by DWER.

Throughout the construction stages, including the installation of leachate pipework, aggregate, liner integrity testing, and separation geotextile, Terra Firma Laboratories meticulously monitored and verified compliance with all specified requirements. No variations from the specifications were noted, other than the changes in leachate extraction pipe diameter (as documented above), and all materials and installation procedures met the stringent quality standards outlined in the project documentation.

The inclusion of detailed records, as-built diagrams, and a comprehensive photo library further supports the integrity and thoroughness of the verification process.

This report serves as a testament to the high standards maintained during the construction of Cell 12A, ensuring the long-term functionality and environmental safety of the Banksia Road Landfill.

It is confirmed that:

- Each item of critical containment infrastructure or component thereof, as specified in Condition 2 of the Works Approval, has been built and installed in accordance with the requirements specified in Condition 2.
- Each item of critical containment infrastructure or component thereof, has complied with the relevant construction quality assurance requirements detailed in Conditions 4, 5 and 6 of the Works Approval.

Appendix B Groundwater Well Construction Report

Government of Western Australia
Department of Water and Environmental Regulation

Your ref: W6855/2023/1
Our ref: DER2021/000183
Enquiries: [redacted]
Phone: 08 6364 7639
Email: info@dwer.wa.gov.au

[redacted]
Cleanaway Solid Waste Pty Ltd
72 Hyne Road,
South Guildford WA 6055

via email [redacted]

Attn: [redacted]

Dear [redacted]

WORKS APPROVAL COMPLIANCE REPORT – COMPLIANCE DEMONSTRATED

Thank you for your submission of the document Groundwater monitoring well construction report, received by the Department of Water and Environmental Regulation (the department) on 29 August 2024.

The department has assessed the document and determined that it meets the requirements of condition 11 and 12 of works approval W6855/2023/1.

If you have any queries regarding the department's assessment of the document, please contact the Environmental Officer listed above.

Yours sincerely

[redacted]
A/MANAGER, WASTE INDUSTRIES
REGULATORY SERVICES
Officer delegated under section 20
of the Environmental Protection Act 1986

1 October 2024

Drilling of Groundwater Monitoring Wells at Cleanaway Banksia Waste Disposal Site

Banksia Waste Disposal Site

Cleanaway Solid Waste Pty Ltd

171 Camboon Road, Malaga, 6090 WA

Prepared by:

SLR Consulting Australia

SLR Project No.: 675.072487.00001

Client Reference No.: SOW- 6563526875-052024

16 August 2024

Revision: 1

Revision Record

Revision	Date	Prepared By	Checked By	Authorised By
0.0	1 August 2024	[redacted]		
1.0	16 August 2024			

Basis of Report

This report has been prepared by SLR Consulting Australia (SLR) with all reasonable skill, care and diligence, and taking account of the timescale and resources allocated to it by agreement with Cleanaway Solid Waste Pty Ltd which has been accepted in good faith as being accurate and valid.

This report is for the exclusive use of the Client. No warranties or guarantees are expressed or should be inferred by any third parties. This report may not be relied upon by other parties without written consent from SLR.

SLR disclaims any responsibility to the Client and others in respect of any matters outside the agreed scope of the work.

Table of Contents

Appendices

1.0 Introduction

SLR has been commissioned by Cleanaway Solid Waste Pty Ltd (Cleanaway) to install groundwater monitoring wells at Banksia Road Putrescible Landfill, Banksia Road, Crooked Brook, WA 6236 (the site). This was requested as per Condition 12 of Department of Water and Environmental Regulation's (DWER) Works Approval no. W6855/2023/1. This report provides a well installation summary report for the drilling and installation of 9 groundwater monitoring wells at the site as per conditions 11 and 12 of W6855/2023/1. Also reported is the replacement of four other monitoring wells in the sites exiting monitoring well network.

1.1 Project Objectives

The objectives of the project were to undertake the monitoring well installation as per Table 6 (Condition 11) of W6855/2023/1. These conditions are broadly summarised as follows:

- Monitoring wells were required in the locations depicted on Figure 22 of the W6855/2023/1. The screens must target the part, or parts of the aquifer most likely to be affected by contamination.
- Boreholes were required to be logged and records of encountered geology documented in accordance with Australian Standard Geotechnical Site Investigations AS1726.
- Well construction logs are required to be developed.
- New monitoring wells should be developed and also surveyed for top of casing and horizontal position.

1.2 Scope of Works

The following scope of work was conducted to meet the objective above:

- Drilling and installation of 13 groundwater monitoring wells with nine wells to support the works approval (GW12S, GW14S/D, GW15S/D, GW16S/D, GW17S/D). An additional four monitoring wells (GW13S/D, SE4S-R, SE3S-R) were completed to replace a number of lost/damaged wells in the existing site monitoring well network (for compliance monitoring purposes – separate to the works approval).
- Site supervision and soil logging during the advancement of the groundwater monitoring wells.
- Airlift purging of the completed groundwater monitoring wells.
- Preparation of this report.

The locations of the new monitoring wells required by W6855/2023/1 were generally aligned to Figure 22 of the works approval. Final locations were confirmed based on the clearance of underground services, accessibility of the drilling rig and support vehicles and the terrain/site features (refer to appended Figure 1). All proposed locations were also vetted by onsite Cleanaway personal.

2.0 Monitoring Well Installation Details

A summary of the well installation details is provided in Table 1 and environmental borehole logs are included in **Appendix A**. The location of the new monitoring wells is

provided in appended **Figure 1**. A photographic log showing the completed monitoring well heads has been included in **Appendix B**.

Table 1 Summary of well installation program

Component	Description			
General Well Installation Information				
Purpose	Installation of 13 wells to fulfil requirement for the works approval (W6855/2023/1) with 9 of these comprising four nested pairs (given the shallow perched aquifer and underlying Leederville aquifer) and a single well. Installation of three monitoring wells to replace lost/blocked/dry wells from the existing well network to ensure compliance with licence conditions and provide a greater understanding of the hydrogeological site characteristics			
Site Details	**Property Details**	Part of Lot 2 on Deposited Plan 65861 Banksia Road Putrescible Landfill Banksia Road Crooked Brook, WA 6236		
	Local Government Authority	Shire of Dardanup		
	Boundary Coordinates		**NORTHING**	**EASTING**
		North west	6300803	386373
		North east	6300801	387488
		South east	6300211	388347
		South west	6300190	386379
	Total Site Area	121 ha		
	Current Land Use	Class II and III Landfill		
Drilling Dates	Groundwater monitoring wells drilled between 4 June 2024 and 8 July 2024			
Supervising consultants	SLR Consulting – B. Hosie, M. Lori, A. Hughes, and P. Wangdi			
Driller	Precision Drilling Australia			
Drilling Method	Dimond and Mud Rotary Drilling			
Surveyor	BE Surveys			
Hydrogeologic Summary				

General Geologic Description (mbgl)								
Geologic Unit	**GW12S**	**GW13S/ GW13D**	**GW14S/ GW14D**	**GW15S/ GW15D**	**GW16S/ GW16D**	**GW17S/ GW17D**	**SE3S-R**	**SE4S-R**
Bassendean	0-2	-	-	0-1.5	0-1	0-1.5	-	-
Yoganup	~2-38	~0-39	~0-49	~1.5-47	~1-53	~1.5-61.5	1-35	1-34
Leederville	-	~39-46.5	~49 to 67.5	~47 to 85.5	~53 to 67.5	~61.5 to 77.5	-	-

Standing Water Level - Post Development

July 2024	GW12S	GW13S/ GW13D	GW14S/ GW14D	GW15S/ GW15D	GW16S/ GW16D	GW17S/ GW17D	SE3S-R	SE4S-R
Top of casing (TOC) (mAHD)	78.105	76.902/ 77.119	105.77/ 105.817	105.452/1 05.621	110.530/110 .530	119.247/1 18.563	72.391	72.046
SWL (mbgl)	77.308	76.445/ 76.437	105.212 /105.18 8	104.681/1 04.831	109.843/109 .826	118.613/1 19.034	71.824	71.208
GW Elevation (mAHD)	39.313	43.105/ 36.637	55.712/ 38.288	66.481/36. 781	75.243/43.2 21	55.813/54. 863	34.249	35.828

Well Construction

Depth of Hole Drilled

Well depth	GW12S	GW13S/ GW13D	GW14S/ GW14D	GW15S/ GW15D	GW16S/ GW16D	GW17S/ GW17D	SE3S-R	SE4S-R
TOC (mAHD)	78.105	76.902/7 7.119	105.77/105 .817	105.452/10 5.621	110.530/1 10.530	119.247/ 118.563	72.391	72.046
RSL (mAHD)	77.308	76.445/7 6.437	105.212/10 5.188	104.681/10 4.831	109.843/1 09.826	118.613/ 119.034	71.824	71.208
Depth (mAHD)	39.808	37.945/2 9.937	52.212/37. 688	66.681/19.3 31	72.343/42 .326	57.113/4 1.063	31.824	32.208

Well Completion Description (mbgl)

Well Construction	Concrete Plug		Bentonite plug		Gravel Pack		Screen	
GW12S	0-31		31-33		33-38		35-38	
SE3S-R	0-35		35-37		37-40		38-40	
SE4S-R	0-34		34-36		36-39		37-39	
GW13S/ GW13D	0-32.5	0-38.5	32.5-34.5	38.5-40.5	34.5-38.5	40.5-44.5	35.5-38.5	42.5-44.5
GW14S/ GW14D	0-43	0-54	43-45	54-57	45-49	57-67.5	46-49	58.5-67.5
GW15S/ GW15D	0-31	0-64	31-33	64-66	33-38	66-80	35-38	68-80
GW16S/ GW16D	0-30.5	0-60.5	30.5-32.6	60.5-62.5	32.5-37.5	62.5-67.5	34.5-37.5	64.5-67.5
GW17S/ GW17D	0-55.5	0-61	55.5-57.5	61-66.5	57.5-61.5	66.5-77.5	58.5-61.5	68.5-77.5

Component	Description
Casing Type and Diameter	50 mm PVC (PA18)
Screen Type and Dimensions	50 mm machine slotted PVC with 0.5 mm slot thickness
Gravel Pack Material and Size	1.8 mm – 3.6 mm clean graded gravel pack
Class of Pipe and Wall Thickness	Class 18, 4.9 mm wall thickness

Component	Description
Position Within Hole and Headworks	Positioned in centre of hole. Secured and sealed by bentonite and concrete as outlined in the environmental borehole logs **(Appendix A)**. Wells were fitted with yellow steel riser and reflectors.
Survey Data (m AHD)	Survey data is provided in **Appendix C – Survey Report**
Well Development Procedure and Record	All wells were developed with an air lift pump to remove drilling fluids and fines to the extent practicable. The deeper monitoring wells purged estimated volumes of ~25 - 35 L per monitoring well. The shallow monitoring wells purged ~15 – 20 L. In all instances a significant portion of drilling fluids comprised the purged water and the monitoring wells were generally low yielding, often taking ~24 hrs for formation water to properly enter the well screens. It is noted that monitoring of indicators such as water turbidity (which is typically completed to evaluate well development) was difficult due to the low yields encountered and development was limited to the removal of all accumulated waters in the respective wells. Monitoring wells GW14D, GW16S and GW16D were re developed on 18 July 2024 in a subsequent mobilisation to the site due to the identification of muddy waters during gauging/groundwater sampling attempted on 15-16 July 2024. The redevelopment included injecting water, surging of the wells and re-development through air lifting.
Observations	Evidence of contamination such as stained soils or odour were not noted during the installation of any of the monitoring wells. All logging completed in general accordance with Australian Standard for Geotechnical Site Investigations AS1726.

3.0 Summary of results

3.1 Topography

The site slopes from east to west from an elevation of 110 m AHD in the east to 40 m AHD in the west (360 Environmental, 2021). Ground surface elevation at the new monitoring well GW17D on the eastern site boundary was 119 m AHD which is slightly higher then indicated in survey data from previous environmental investigations. The western portion of the property is flatter than the eastern portion which forms a part of the north/south trending Whicher Escarpment (360 Environmental, 2021).

3.2 Review of Encountered Geology

The geology of the site has been previously considered in a number of environmental reports (e.g. Stass Environmental, 2016; Golder, 2015; 360 Environmental, 2021).

The geology of the site is known to be underlain by several formations including the following (in sequence):

- Bassendean sand unit – consisting of white quartz, with mineral sand deposits at its base. This formation is typically only encountered in surface soils of the site.
- Yoganup formation – a sequence of shore-line deposits consisting of leached and ferruginised beach sand.

- Leederville formation – described as bands of clay with some fine, medium, and coarse; white, and beige sand lenses.

The aforementioned reports have confirmed the shallow geology as being generally complex and comprising lens' of sandy clays and clayey sands overlain by a sandy topsoil and laterite (1 m bgl to 2 m bgl). Previous monitoring well installation events have considered the Leederville formation as occurring between 35 m bgl and 40 m bgl (19 m AHD to 31 m AHD) at the site (Stass 2016). The hydrogeology at the site is understood to comprise lens' of perched groundwater within the Yoganup formation and the underlying Leederville aquifer which exhibits sub artesian characteristics (360 Environmental, 2021).

The results of logging the new monitoring wells are broadly summarised as follows:

- There was considered to be limited evidence of Bassendean sands in the eastern site area where the monitoring wells were predominantly commissioned. Soils were primarily sandy clay/sandy clays near surface.
- The profile between approximately 2 - 40 m bgl consisted of interbedded lens' of clayey sand and sandy clay which of which the colour was often mottled (i.e. orange mottled grey or vice versa). The clays varied from low to moderate plasticity. Thin lens' of sandstone were also identified in a number of boreholes through this depth range. There were also several thin layers of stiff grey clays which were interpreted as likely confining layers for perched groundwater. The monitoring wells targeting the perched groundwater of the Yoganup formation were screened based on the identification of these layers.
- The profile between approximately 40 - 70 m bgl consisted of similar interbedded clayey sand/sandy clay layers. A layer of stiff layer clay which was generally grey (but also brown/red) was encountered at approximately 38 m AHD in the central site area (e.g. MW13D) up to 55 m AHD on the eastern site boundary (MW17D) was considered to represent the confining layer separating the Yoganup formation from the underlying Leederville formation. Deeper monitoring wells targeting the Leederville aquifer were screened below this layer with construction specifications ensuring no short circuiting through this clay layer. The level of the confining layer (i.e. m AHD) is higher in the eastern site area then previously considered by Stass (2016) with reference to the central and western site area.

4.0 Conclusions

The monitoring well installation was considered to be in general accordance with Sections 11 and 12 of W6855/2023/1. It should be noted that some of the monitoring wells targeting perched groundwater layers may be low yielding in groundwater, however have been commissioned to meet the objective of enabling monitoring of groundwater which is most likely to be affected by contamination. Any monitoring wells which are low in water or dry should be gauged at every monitoring event to enable sampling of any water which may be present.

The deeper screened monitoring wells targeting the Leederville aquifer have generally identified standing water levels above the screened intervals of the respective wells. This is because the Leederville formation exhibits a pressure head (360 Environmental,

2021). Care should be taken to ensure any collected groundwater samples are representative of formation water.

5.0 References

Geological Survey of Western Australia, 1987, 1:50 000 Environmental Geological series maps –Sheet 2031 III – 2031 II.

Golder Associates (2015) *Desktop Review and Conceptual Site Hydrogeologic Model*, Transpacific Cleanaway, 2015

Stass Environmental (2016) Annual Groundwater Report 2015, Transpacific Waste Management Pty Ltd. Banksia Road Landfill. Dardanup, WA.

WML Consultants (2014). *Hydrogeological Investigation for Proposed Residue Disposal Area Panizza Road Dardanup*. Report for Cristal Pigments Australia Pt Ltd. August 2014. Ref: 5139-G-R-001-A

360 Environmental (2021) Hydrogeological Risk Assessment and Groundwater Program Review, 3823AH_Rev3.

Figure

Legend

- Site Boundary
- Existing Groundwater Monitoring Wells
- Destroyed/Inaccessible Wells
- Newly Installed Groundwater Monitoring Wells (2024)

- CADASTRAL BOUNDARY SOURCED FROM LANDGATE 2024
- AERIAL PHOTOGRAPHY SOURCED FROM NEARMAPS 2024
- NOTE THAT POSITION ERRORS CAN BE >5M IN SOME AREAS

SLR
a Level 1, 500 Hay Street
Subiaco WA 6008
t (+618) 9388 8360
w www.slrconsulting.com

0 100 200 300 400 m
Meters

LOCALITY MAP

PROJECT NO	DATE	REVISION
675.072487	30/07/2024	1
CREATED	CHECKED	APPROVED

Cleanaway Solid Waste Pty Ltd
Lot 2, Banksia Road, Crooked Brook, WA

Drilling of Groundwater Wells

Figure 1

New Groundwater Monitoring Wells

Appendix A Environmental Borehole Logs

Drilling of Groundwater Monitoring Wells at Cleanaway Banksia Waste Disposal Site

Banksia Waste Disposal SiteBanksia Waste Disposal Site

Cleanaway Solid Waste Pty Ltd
171 Camboon Road, Malaga, 6090 WA

SLR Project No.: 675.072487.00001675.072487.00001

GROUNDWATER WELL LOG GW12S

PROJECT NUMBER 675.072487.00001
PROJECT NAME W6855/2023/1 monitoring wells
CLIENT Cleanaway
ADDRESS Banksia Road Crooked Brook WA 6236
DRILLING METHOD Mud rotary

DRILLING DATE 4 - 5 June 2024
TOTAL DEPTH 37.5
DIAMETER 50mm
CASING 35m
SCREEN 3m

COORD SYS MGA94
EASTING 387423.653
NORTHING 6300807.865
SURFACE ELEVATION 77.308
WELL TOC 78.105

COMMENTS

LOGGED BY [redacted]
CHECKED BY

Depth (m)	USCS	Graphic Log	Moisture	Material Description	Well Diagram GW12S	Well Construction	Additional observation / PID
0	gp		M	Gravelly SAND : brown, fine to medium grained, poorly graded, subangular to subrounded		Monument	No observations of staining or odour throughout borehole
2	sc			Clayey SAND : brown, fine to medium grained, poorly graded, subangular to subrounded,			
4				White mottles			
6				Red with white mottles		Grout (5% bentonite powder, 95% cement mix)	
10	cls			Sandy CLAY : white with red mottles, medium plastcity			

Disclaimer This bore log is intended for environmental not geotechnical purposes.
produced by ESlog.ESdat.net on 02 Aug 2024

GROUNDWATER WELL LOG GW12S

Depth (m)	USCS	Graphic Log	Moisture	Material Description	Well Diagram GW12S	Well Construction	Additional observation / PID
14	cl			CLAY : white, medium plasticity, soft			
18	cls			Sandy CLAY : white, low plasticity, soft			
20	sc			Clayey SAND : white, fine to medium grained, poorly graded, subangular to subrounded		Grout (5% bentonite powder, 95% cement mix)	
24	cls			Sandy CLAY : white, low plasticity, soft			

GROUNDWATER WELL LOG GW12S

Depth (m)	USCS	Graphic Log	Moisture	Material Description	Well Diagram GW12S	Well Construction	Additional observation / PID
31							
32						Bentonite (1/4 inch pellets)	
33							
34						Gravel pack (1.8-3.6 mm graded gravels)	
35							
36							
37						Class 18 PVC screen (0.5 mm slots)	0.3 ppm @38m
38				End of hole @ 38m		Bottom cap	
39							
40							
41							
42							
43							
44							
45							
46							
47							

GROUNDWATER WELL LOG GW13S

PROJECT NUMBER 675.072487.00001
PROJECT NAME W6855/2023/1 monitoring wells
CLIENT Cleanaway
ADDRESS Banksia Road Crooked Brook WA 6236
DRILLING METHOD Mud rotary

DRILLING DATE 26 - 27 June 2024
TOTAL DEPTH 38.5
DIAMETER 50mm
CASING 35.5m
SCREEN 3m

COORD SYS MGA94
EASTING 387318.914
NORTHING 6300407.418
SURFACE ELEVATION 76.445
WELL TOC 76.902

COMMENTS

LOGGED BY [redacted]
CHECKED B

Depth (m)	USCS	Graphic Log	Moisture	Material Description	Well Diagram	Well Construction	Additional Observations / PID
0	sc		D	Clayey SAND : dark grey, fine to medium grained, subangular to subrounded, low plasticity clay		Monument	No observations of staining or odour throughout borehole
	cls			Silty sandy CLAY : dark orange mottled pale grey and red, low plasticity, weakly cemented			
1							
	sw-sm			Silty SAND : dark grey, fine to medium grained, subangular to subrounded			Large cobble present @1.5m
2				Orange mottled white			
				Core loss (inferred sand)			
3	sc-sm			Silty clayey SAND : orange mottled pale grey and red, fine to coarse grained, subangular to subrounded, low plasticity clay, traces of gravel			
4				Pale grey with orange/red mottles			
5							
6							Trace roots
7				Orange		Grout (5% bentonite powder, 95% cement mix)	
	cl			CLAY : pale grey, low plasticity, stiff-very stiff			
8	cls			Sandy CLAY : pale grey mottled red and orange, low plasticity, fine to medium grained sand			
9				Fine to coarse grained sand			
10							
	cl			CLAY : pale grey, low plasticity, firm, traces of sand and silt			
11				Core loss			
12	sc			Clayey SAND : dark yellow/orange mottled pale grey and red, fine to coarse grained, subangular to subrounded, well graded, low plasticity clay			
13							
14							

GROUNDWATER WELL LOG GW13S

Depth (m)	USCS	Graphic Log	Moisture	Material Description	Well Diagram	Well Construction	Additional Observations / PID
15	cl			CLAY : pale grey, low plasticity, firm, traces of sand			
16	cls			Sandy CLAY : orange mottled red and pale grey, low plasticity, fine to coarse grained sand			
17				Core loss			
18	cl			CLAY : pale grey with red and orange mottles, low plasticity			
19							
20	cls			Sandy CLAY : grey mottled orange, low plasticity, coarse and well graded sand			
21							
22						Grout (5% bentonite powder, 95% cement mix)	
23	sc			Clayey SAND : orange mottled grey, coarse, well graded			
24				Grey			
25							
26				Orange mottled red-grey Red mottled orange-grey			
27	sw-sm			Silty SAND : red-orange, coarse grained, well graded			
28	cls			Silty CLAY : grey, stiff, low plasticity			
29	sc			Clayey SAND : dark brown mottled orange, coarse grained, well graded			
30	cls			Sandy CLAY : orange-grey, coarse grained and well graded sand			

GROUNDWATER WELL LOG GW13S

Depth (m)	USCS	Graphic Log	Moisture	Material Description	Well Diagram	Well Construction	Additional Observations / PID
31							
32	sc			Clayey SAND : orange mottled grey, coarse grained, well graded			
33						Bentonite (1/4 inch pellets)	
34							
35						Gravel pack (1.8-3.6 mm graded gravels)	
36				Orange mottled brown, poorly graded Core loss			
37						Class 18 PVC screen (0.5 mm slots)	
38						Bottom cap	
39				End of hole @38.5m			
40							
41							
42							
43							
44							
45							
46							
47							

GROUNDWATER WELL LOG GW13D

PROJECT NUMBER 72487
PROJECT NAME W6855/2023/1 monitoring wells
CLIENT Cleanaway
ADDRESS Banksia Road Crooked Brook WA 6236
DRILLING METHOD Diamond tip coring

DRILLING DATE 26 - 27 June 2024
TOTAL DEPTH 46.5m
DIAMETER 50mm
CASING 42.5
SCREEN 2m

COORD SYS MGA94
EASTING 387319.888
NORTHING 6300406.545
SURFACE ELEVATION 76.437
WELL TOC 77.119

COMMENTS

LOGGED BY
CHECKED B

Depth (m)	USCS	Graphic Log	Moisture	Material Description	Well Diagram GW13S	Well Construction	Additional Observations / PID
0	sc		D	Clayey SAND : dark grey, fine to medium grained, subangular to subrounded, low plasticity clay		Monument	No observations of staining or odour throughout borehole
0	cls			Silty sandy CLAY : dark orange mottled pale grey and red, low plasticity, weakly cemented			
1							
2	sw-sm			Silty SAND : dark grey, fine to medium grained, subangular to subrounded			Large cobble present @1.5m
2				Orange mottled white			
3				Core loss (inferred sand)			
3	sc-sm			Silty clayey SAND : orange mottled pale grey and red, fine to coarse grained, subangular to subrounded, low plasticity clay, traces of gravel			
4				Pale grey with orange/red mottles			
5							
6							Trace roots
7						Grout (5% bentonite powder, 95% cement mix)	
7				Orange			
8	cl			CLAY : pale grey, low plasticity, stiff-very stiff			
8	cls			Sandy CLAY : pale grey mottled red and orange, low plasticity, fine to medium grained sand			
9				Fine to coarse grained sand			
10							
11	cl			CLAY : pale grey, low plasticity, firm, traces of sand and silt			
11				Core loss			
12	sc			Clayey SAND : dark yellow/orange mottled pale grey and red, fine to coarse grained, subangular to subrounded, well graded, low plasticity clay			
13							
14							

GROUNDWATER WELL LOG GW13D

Depth (m)	USCS	Graphic Log	Moisture	Material Description	Well Diagram GW13S	Well Construction	Additional Observations / PID
15							
	cl			CLAY : pale grey, low plasticity, firm, traces of sand			
	cls			Sandy CLAY : orange mottled red and pale grey, low plasticity, fine to coarse grained sand			
16							
17				Core loss			
18	cl			CLAY : pale grey with red and orange mottles, low plasticity			
19							
20	cls			Sandy CLAY : grey mottled orange, low plasticity, coarse and well graded sand			
21							
22							
	sc			Clayey SAND : orange mottled grey, coarse, well graded		Grout (5% bentonite powder, 95% cement mix)	
23							
24				Grey			
25							
				Orange mottled red-grey			
26				Red mottled orange-grey			
27	sw-sm			Silty SAND : red-orange, coarse grained, well graded			
28							
	cls			Silty CLAY : grey, stiff, low plasticity			
	sc			Clayey SAND : dark brown mottled orange, coarse grained, well graded			
29							
30	cls			Sandy CLAY : orange-grey, coarse grained and well graded sand			

Disclaimer This bore log is intended for environmental not geotechnical purposes.

produced by ESlog.ESdat.net on 02 Aug 2024

GROUNDWATER WELL LOG GW13D

Depth (m)	USCS	Graphic Log	Moisture	Material Description	Well Diagram GW13S	Well Construction	Additional Observations / PID
31							
	sc			Clayey SAND : orange mottled grey, coarse grained, well graded			
32							
33							
34						Grout (5% bentonite powder, 95% cement mix)	
35							
				Orange mottled brown, poorly graded			
36				Core loss			
37							
38							
39	cl-ml			CLAY : red-brown-grey, stiff, medium plasticity, traces of sand		Bentonite (1/4 inch pellets)	
40	sc			Clayey SAND : grey, coarse, grained, well graded			
41				Grey mottled orange-brown		Gravel pack (1.8-3.6 mm graded gravels)	
42							
43						Class 18 PVC screen (0.5 mm slots)	
				Core loss			
44						Bottom cap	
45	ch			CLAY : brown, stiff, high plasticity			
46						Bentonite (1/4 inch pellets)	
	sc			Clayey SAND : grey, coarse grained, well graded			
				End of hole @46.5m			
47							

Disclaimer This bore log is intended for environmental not geotechnical purposes.

produced by ESlog.ESdat.net on 02 Aug 2024

GROUNDWATER WELL LOG GW14S

PROJECT NUMBER 675.072487.00001
PROJECT NAME W6855/2023/1 monitoring wells
CLIENT Cleanaway
ADDRESS Banksia Road Crooked Brook WA 6236
DRILLING METHOD Mud rotary

DRILLING DATE 2 - 5 July 2024
TOTAL DEPTH 49m
DIAMETER 50mm
CASING 46m
SCREEN 3m

COORD SYS MGA94
EASTING 388028.552
NORTHING 6300568.306
SURFACE ELEVATION 105.212
WELL TOC 105.770

COMMENTS

LOGGED BY [redacted]
CHECKED BY

Depth (m)	USCS	Graphic Log	Moisture	Material Description	Well Diagram	Well Construction	Additional Observations / PID
0	cls		M	Sandy CLAY : orange mottled grey, meidum grained and well graded sand		Monument	No observations of staining or odour throughout borehole
0.5	bgs-snd			SANDSTONE, brown-orange, slightly weathered			
0.5	cls			Sandy CLAY : orange, medium grained and well graded sand, with clay lenses			
5				Grey mottled red			
5.5	sc			Clayey SAND : grey mottled red-orange, coarse grained, well graded			
7	bgl-snd			High weathered SANDSTONE , orange-brown		Grout (5% bentonite powder, 95% cement mix)	
7	sc			Clayey SAND : grey mottled orange, coarse grained, well graded			
10				Grey			
12	bgl-snd			High weathered SANDSTONE , orange			
12	sc			Clayey SAND : grey, coarse grained, well graded			
13	bgl-snd			High weathered SANDSTONE, orange			
13	sc			Clayey SAND : grey mottled orange, coarse grained, well graded			

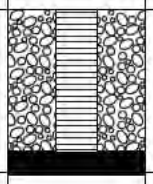
GROUNDWATER WELL LOG GW14S

Depth (m)	USCS	Graphic Log	Moisture	Material Description	Well Diagram	Well Construction	Additional Observations / PID
15							
16							
17				Orange mottled grey			
18				Grey mottled orange			
19							
20							
21	cl			CLAY : grey-brown, soft , low plasticity			
22	sw			SAND : orange-red, coarse grained, well graded, traces of clay		Grout (5% bentonite powder, 95% cement mix)	
23	bgl-snd			High weathered SANDSTONE, red-brown			
24	sw			SAND : orange mottled brown, coarse grained, well graded, with traces of clay			
25	bgl-snd			High weathered SANDSTONE with clay lenses			
26	sc			Clayey SAND : grey mottles red-orange, coarse grained, well graded			
27				Grey			
28							
29				Core loss			
30				Grey-orange			

GROUNDWATER WELL LOG GW14S

Depth (m)	USCS	Graphic Log	Moisture	Material Description	Well Diagram	Well Construction	Additional Observations / PID
31							
32							
33							
34				Sandy CLAY : pale grey, uniform, fine grained with silt			
	cls			Core loss		Grout (5% bentonite powder, 95% cement mix)	
35							
36	sc			Clayey SAND : grey, coarse grained, well graded			
37							
				Core loss			
38							
39	sc			Clayey SAND : grey mottled orange, coarse grained, well graded			
40				Grey			
41							
42				Orange mottled grey			
43				Grey mottled orange		Bentonite (1/4 inch pellets)	
44							
45						Gravel pack (1.8-3.6 mm graded gravels)	
46							
47						Class 18 PVC screen (0.5 mm slots)	

GROUNDWATER WELL LOG GW14S

Depth (m)	USCS	Graphic Log	Moisture	Material Description	Well Diagram	Well Construction	Additional Observations / PID
48							
49				End of hole @49m		Bottom cap	
50							
51							
52							
53							
54							
55							
56							
57							
58							
59							
60							
61							
62							
63							
64							

GROUNDWATER WELL LOG GW14D

PROJECT NUMBER 675.072487.00001
PROJECT NAME W6855/2023/1 monitoring wells
CLIENT Cleanaway
ADDRESS Banksia Road Crooked Brook WA 6236
DRILLING METHOD Diamond tip coring

DRILLING DATE 2 - 5 July 2024
TOTAL DEPTH 67.5m
DIAMETER 50mm
CASING 58.5m
SCREEN 9m

COORD SYS MGA94
EASTING 388032.382
NORTHING 6300567.471
SURFACE ELEVATION 105.188
WELL TOC 105.817

COMMENTS

LOGGED BY [redacted]
CHECKED BY

Depth (m)	USCS	Graphic Log	Moisture	Material Description	Well Diagram	Well Construction	Additional Observations / PID
0	cls		M	Sandy CLAY : orange mottled grey, meidum grained and well graded sand		Monument	No observations of staining or odour throughout borehole
0.5	bgs-snd			SANDSTONE, brown-orange, slightly weathered			
0.5	cls			Sandy CLAY : orange, medium grained and well graded sand, with clay lenses			
5				Grey mottled red			
5.5	sc			Clayey SAND : grey mottled red-orange, coarse grained, well graded			
7						Grout (5% bentonite powder, 95% cement mix)	
7	bgl-snd			High weathered SANDSTONE , orange-brown			
7.5	sc			Clayey SAND : grey mottled orange, coarse grained, well graded			
10				Grey			
11.8	bgl-snd			High weathered SANDSTONE , orange			
12	sc			Clayey SAND : grey, coarse grained, well graded			
12.8	bgl-snd			High weathered SANDSTONE, orange			
13	sc			Clayey SAND : grey mottled orange, coarse grained, well graded			

Disclaimer This bore log is intended for environmental not geotechnical purposes.
produced by ESlog.ESdat.net on 02 Aug 2024

GROUNDWATER WELL LOG GW14D

Depth (m)	USCS	Graphic Log	Moisture	Material Description	Well Diagram	Well Construction	Additional Observations / PID
15							
16							
17				Orange mottled grey			
18				Grey mottled orange			
19							
20							
21	cl			CLAY : grey-brown, soft , low plasticity		Grout (5% bentonite powder, 95% cement mix)	
22	sw			SAND : orange-red, coarse grained, well graded, traces of clay			
23	bgl-snd			High weathered SANDSTONE, red-brown			
24	sw			SAND : orange mottled brown, coarse grained, well graded, with traces of clay			
25	bgl-snd			High weathered SANDSTONE with clay lenses			
26	sc			Clayey SAND : grey mottles red-orange, coarse grained, well graded			
27				Grey			
28							
29				Core loss			
30				Grey-orange			

GROUNDWATER WELL LOG GW14D

Depth (m)	USCS	Graphic Log	Moisture	Material Description	Well Diagram	Well Construction	Additional Observations / PID
31							
32							
33							
34				Sandy CLAY : pale grey, uniform, fine grained with silt			
	cls			Core loss			
35							
36	sc			Clayey SAND : grey, coarse grained, well graded			
37						Grout (5% bentonite powder, 95% cement mix)	
38				Core loss			
39	sc			Clayey SAND : grey mottled orange, coarse grained, well graded			
40				Grey			
41							
42				Orange mottled grey			
43				Grey mottled orange			
44							
45							
46							
47							

GROUNDWATER WELL LOG GW14D

Depth (m)	USCS	Graphic Log	Moisture	Material Description	Well Diagram	Well Construction	Additional Observations / PID
48						Grout (5% bentonite powder, 95% cement mix)	
49							
	cl-ml			CLAY : grey, soft, medium plasticity, traces of sand			
50				Brown-dark brown, stiff, medium to high plasticity			
	cls			Sandy CLAY : grey-brown, medium plasticity, coarse grained sand			
51	ch			CLAY : brown-dark brown with black mottles, stiff, high plasticity, traces of sand			
52							
				Core loss			
53							
54	sc			Clayey SAND : orange mottles grey, coarse grained, well graded			
				Core loss		Bentonite (1/4 inch pellets)	
55							
	sc			Clayey SAND : grey mottled orange, coarse grained, well graded			
56				Core loss			
57	ch			CLAY : dark brown, stiff, high plasticity, with sand lenses			
58						Gravel pack (1.8-3.6 mm graded gravels)	
	sc			Clayey SAND : grey, medium grained, uniform			High moisture
59							
				Core loss			
60	ch			CLAY : dark brown, stiff, high plasticity			
61							
	sc			Clayey SAND : grey, coarse grained, well graded		Class 18 PVC screen (0 5 mm slots)	
62							
63	cls			Sandy CLAY : grey-brown, low-medium plasticity, medium grained sand			
	cl-ml			CLAY : brown, medium plasticity, traces of sand			
64							

GROUNDWATER WELL LOG GW14D

Depth (m)	USCS	Graphic Log	Moisture	Material Description	Well Diagram	Well Construction	Additional Observations / PID
65	sc			Clayey SAND : grey, coarse grained, well graded			
	ch			CLAY : red-brown, stiff, high plasticity, traces of sand			
66	sc			Clayey SAND : grey mottled orange, coarse, well graded			
67						Bottom cap	
				End of hole @67.5m			
68							
69							
70							
71							
72							
73							
74							
75							
76							
77							
78							
79							
80							

GROUNDWATER WELL LOG GW15S

PROJECT NUMBER 675.072487.00001
PROJECT NAME W6855/2023/1 monitoring wells
CLIENT Cleanaway
ADDRESS Banksia Road Crooked Brook WA 6236
DRILLING METHOD Mud rotary

DRILLING DATE 12 - 16 June 2024
TOTAL DEPTH 38 m
DIAMETER 50mm
CASING 35m
SCREEN 3m

COORD SYS MGA94
EASTING 388102.879
NORTHING 6300327.026
SURFACE ELEVATION 104.681
WELL TOC 105.452

COMMENTS

LOGGED BY [redacted]
CHECKED BY

Depth (m)	USCS	Graphic Log	Moisture	Material Description	Well Diagram	Well Construction	PID	Additional observations
0	sc		M	Clayey SAND : brown, medium grained, poorly graded		Monument	1.6 ppm	No observations of staining or odour throughout borehole
0.5	cls			Sandy CLAY : brown with orange mottles, low to medium plasticity, traces of gravel			0.8 ppm	
1				Pale brown/grey			0.1 ppm	
1.2				Grey, fine grained sand			0.2 ppm	
1.5	cl			CLAY : grey, medium to high plasticity			1.1 ppm	Organics
2				Grey - orange, medium grained sand, silt with sand			0.6 ppm	Organics
2.5	cls			Sandy CLAY : grey, medium plasticity, medium grained			1.2 ppm	
3				Grey - orange, stiff			0.1 ppm	
8	cl			CLAY : grey, medium to high plasticity, stiff, with sand		Grout (5% bentonite powder, 95% cement mix)		
9				Grey - red, high plasticity, traces of sand			0.2 ppm	Core loss
10				Firm - stiff, with silt				
11				Pale red/brown, medium to high plasticity			0.4 ppm	
12				Grey			0.1 ppm	
13							0.8 ppm	Core loss
13.5	bgs-snd			SANDSTONE : red-brown, weathered, black and orange mottles			0.6 ppm	

Disclaimer This bore log is intended for environmental not geotechnical purposes.
produced by ESlog.ESdat.net on 02 Aug 2024

GROUNDWATER WELL LOG GW15S

Depth (m)	USCS	Graphic Log	Moisture	Material Description	Well Diagram	Well Construction	PID	Additional observations
15	cls			Sandy CLAY : orange-brown, coarse grained sand, low plasticity			1.0 ppm 0.2 ppm	
	bgs-snd			SANDSTONE : red-brown, highly weathered			0.3 ppm	
16	sp-sc			Clayey SAND: grey mottled orange, coarse grained, well graded, low plasticity			1.4 ppm	
17								
18								
19								
20							0.5 ppm	Core loss
21	bgs-snd			SANDSTONE : dark brown, extremely weathered			0.2 ppm	
22						Grout (5% bentonite powder, 95% cement mix)		
23	bgs-slts			Clay/silt inclusions in SANDSTONE, silty sand, red mottled grey, coarse grained, well graded			0.1 ppm	
24	cl			CLAY : brown, medium plasticity, soft, very low plasticity			0.8 ppm	
25	sc			Clayey SAND : grey mottled orange, well graded, coarse grained			1.2 ppm	
26								
27	bgs-snd			Highly weathered SANDSTONE : coarse, orange mottled brown			1.1 ppm	
28	sc			Clayey SAND : grey mottles brown, medium grained, well graded			0.9 ppm	
29								
30	cls			CLAY : brown mottled grey, with sand, stuff, medium plasticity				
	cs			Clayey SAND : grey-orange mottled brown, well graded, coarse grained			0.2 ppm	

GROUNDWATER WELL LOG GW15S

Depth (m)	USCS	Graphic Log	Moisture	Material Description	Well Diagram	Well Construction	PID	Additional observations
31								
32						Bentonite (1/4 inch pellets)		
33				Grey mottled orange			0.8 ppm	
34						Gravel pack (1.8-3.6 mm graded gravels)		
35								
36						Class 18 PVC screen (0.5 mm slots)		
	cls			CLAY : grey mottles brown-orange, stiff, medium to high plasticity with sand			0.1 ppm	
37	sp-sc			Clayey SAND : grey mottles orange, coarse grained, well graded			0.2 ppm	
38						Bottom cap		
				End of hole @38m				
39								
40								
41								
42								
43								
44								
45								
46								
47								

GROUNDWATER WELL LOG GW15D

PROJECT NUMBER 675.072487.00001
PROJECT NAME W6855/2023/1 monitoring wells
CLIENT Cleanaway
ADDRESS Banksia Road Crooked Brook WA 6236
DRILLING METHOD Diamond tip coring

DRILLING DATE 12 - 16 June 2024
TOTAL DEPTH 85.5 m
DIAMETER 50mm
CASING 68m
SCREEN 3m

COORD SYS MGA94
EASTING 388103.382
NORTHING 6300325.436
SURFACE ELEVATION 104.831
WELL TOC 105.621

COMMENTS

LOGGED BY [redacted]
CHECKED B

Depth (m)	USCS	Graphic Log	Moisture	Material Description	Well Diagram	Well Construction	PID	Additional observations
0	sc		M	Clayey SAND : brown, medium grained, poorly graded		Monument	1.6 ppm	No observations of staining or odour throughout borehole
0.5	cls			Sandy CLAY : brown with orange mottles, low to medium plasticity, traces of gravel			0.8 ppm	
1				Pale brown/grey			0.1 ppm	
1.2				Grey, fine grained sand			0.2 ppm	
1.5	cl			CLAY : grey, medium to high plasticity			1.1 ppm	Organics
2				Grey - orange, medium grained sand, silt with sand			0.6 ppm	Organics
2.5	cls			Sandy CLAY : grey, medium plasticity, medium grained			1.2 ppm	
3				Grey - orange, stiff			0.1 ppm	
7						Grout (5% bentonite powder, 95% cement mix)		
8	cl			CLAY : grey, medium to high plasticity, stiff, with sand				
9				Grey - red, high plasticity, traces of sand			0.2 ppm	Core loss
10				Firm - stiff, with silt				
11				Pale red/brown, medium to high plasticity			0.4 ppm	
12								
13				Grey			0.1 ppm	
							0.8 ppm	Core loss
13.5	bgs-snd			SANDSTONE : red-brown, weathered, black and orange mottles			0.6 ppm	

GROUNDWATER WELL LOG GW15D

Depth (m)	USCS	Graphic Log	Moisture	Material Description	Well Diagram	Well Construction	PID	Additional observations
15	cls			Sandy CLAY : orange-brown, coarse grained sand, low plasticity			1.0 ppm 0.2 ppm	
	bgs-snd			SANDSTONE : red-brown, highly weathered			0.3 ppm	
16	sp-sc			Clayey SAND: grey mottled orange, coarse grained, well graded, low plasticity			1.4 ppm	
17								
18								
19								
20							0.5 ppm	Core loss
21	bgs-snd			SANDSTONE : dark brown, extremely weathered			0.2 ppm	
22						Grout (5% bentonite powder, 95% cement mix)		
23	bgs-slts			Clay/silt inclusions in SANDSTONE, silty sand, red mottled grey, coarse grained, well graded			0.1 ppm	
24	cl			CLAY : brown, medium plasticity, soft, very low plasticity			0.8 ppm	
25	sc			Clayey SAND : grey mottled orange, well graded, coarse grained			1.2 ppm	
26								
27	bgs-snd			Highly weathered SANDSTONE : coarse, orange mottled brown			1.1 ppm	
28	sc			Clayey SAND : grey mottles brown, medium grained, well graded			0.9 ppm	
29								
30	cls			CLAY : brown mottled grey, with sand, stuff, medium plasticity				
	cs			Clayey SAND : grey-orange mottled brown, well graded, coarse grained			0.2 ppm	

GROUNDWATER WELL LOG GW15D

Depth (m)	USCS	Graphic Log	Moisture	Material Description	Well Diagram	Well Construction	PID	Additional observations
31								
32								
33				Grey mottled orange			0.8 ppm	
34								
35								
36				CLAY : grey mottles brown-orange, stiff, medium to high plasticity with sand			0.1 ppm	
	cls							
	sp-sc			Clayey SAND : grey mottles orange, coarse grained, well graded		Grout (5% bentonite powder, 95% cement mix)	0.2 ppm	
38								
39	cls			Sandy CLAY : grey mottles brown-orange, soft, low plasticity, coarse sand				
40				SANDSTONE : orange mottled brown, highly weathered				
	bgs-snd							
	sc			Clayey SAND : orange mottled brown, well graded, coarse grained				
41				Grey mottled orange				
42				Orange				
43	cls			Sandy CLAY : orange mottled brown-grey, firm, medium plasticity, coarse sand, well graded				
44				Grey mottled orange				
45								
46								
47	cl-ml			CLAY : brown mottled grey, stiff, medium plasticity, traces of sand				

GROUNDWATER WELL LOG GW15D

Depth (m)	USCS	Graphic Log	Moisture	Material Description	Well Diagram	Well Construction	PID	Additional observations
48				Brown				
49								
	sp-sc			Sandy CLAY : orange mottles brown-grey ,stiff, coarse sand, high plasticity				
50	ch			CLAY : dark grey, stiff, with sand, high plasticity				
				Highly weathered SANDSTONE : brown mottled orange				
51	bgs-sne							
	ch			CLAY : brown, firm, high plasticity, with fine grained sand				
	sc			Clayey SAND : grey mottled orange, coarse grained, well graded				
52								
53								
				CLAY : grey mottled orange, soft, medium plasticity		Grout (5% bentonite powder, 95% cement mix)		
54	cl-ml							
	sc			Clayey SAND : grey mottles red, coarse grained, well graded				
				Orange				
55	ch			CLAY : brown, firm, high plasticity				
	cls			Sandy CLAY : brown, coarse and well graded sand, low plasticity				
	ch			CLAY : brown, firm, high plasticity, with fine sand				
56								
57	sc			Clayey SAND : grey mottled orange, coarse, well graded				
58								
59								
60	cls			Sandy CLAY : grey mottled orange, low plasticity, coarse sand				
	sc			Clayey SAND : grey mottled red-orange, coarse, well graded				
61								
				Grey				
62								
				Grey mottled orange-red				
	ch			CLAY : brown, stiff, high plasticity, with fine sand				
63	cls			Sandy CLAY : grey mottled brown-orange, low plasticity, well graded and medium grained sand				
	ch			CLAY : brown, stiff, high plasticity, traces of sand				
	sc			Clayey SAND : orange mottled grey-brown, coarse, well graded				
64								

GROUNDWATER WELL LOG GW15D

Depth (m)	USCS	Graphic Log	Moisture	Material Description	Well Diagram	Well Construction	PID	Additional observations
65				Grey		Bentonite (1/4 inch pellets)		
	bgs-sne			High weathered SANDSTONE : orange mottled brown				
	sc			Clayey SAND : grey mottled orange, coarse, well graded				
66								
67						Gravel pack (1.8-3.6 mm graded gravels)		
				Core loss				
68								
69	sc			Clayey SAND : grey mottled orange, coarse, well graded				
70	bgs-snd			High weather SANDSTONE, fractured				
	sc			Clayey SAND : orange mottled grey, coarse, well graded				
	ch			CLAY : grey, stiff, high plasticity, with sand				
71				Brown				
	sc			Clayey SAND : grey mottled orange, coarse, well graded		Class 18 PVC screen (0.5 mm slots)		
72								
73				Orange				
				Grey				
74								
75								
				Orange mottled grey				
76				Grey				
				Sandy CLAY : brown, medium plasticity, medium grained sand				
	cls							
77	sc			Clayey SAND : orange mottled red-brown-grey, medium grained and poorly graded sand				
	ch			CLAY : dark brown, stiff, high plasticity				
78								
	cls			Sandy CLAY : grey mottled red, coarse and well graded sand				
				High weathered SANDSTONE : grey mottled orange				
79	bgs-sne							
	sc			Clayey SAND : grey mottled orange-red, medium grained and well graded sand				
80						Bottom cap		
				High weathered SANDSTONE : red mottled				

GROUNDWATER WELL LOG GW15D

Depth (m)	USCS	Graphic Log	Moisture	Material Description	Well Diagram	Well Construction	PID	Additional observations
81	bgs-snd			orange				
	ch			CLAY : dark grey, stiff, high plasticity, traces of fine sand				
82	sc			Clayey SAND : grey, coarse, well graded		Bentonite (1/4 inch pellets)		
	ch			CLAY : dark grey. high plasticity				
	sc			Clayey SAND : orange mottled red, medium grained, well graded				
83	ch			CLAY : dark grey, stiff, high plasticity, traces of sand				
	sc			Clayey SAND : clayey SAND, grey, medium grained, uniform/poorly graded				
84	cl			CLAY : dark grey-brown, low plasticity, firm, traces of sand				
	sc			Clayey SAND : grey mottled orange-red, coarse, well graded				
85								
				End of hole @85.5m				
86								
87								
88								
89								
90								
91								
92								
93								
94								
95								
96								
97								

GROUNDWATER WELL LOG GW16S

PROJECT NUMBER 675.072487.00001
PROJECT NAME W6855/2023/1 monitoring wells
CLIENT Cleanaway
ADDRESS Banksia Road Crooked Brook WA 6236
DRILLING METHOD Mud rotary

DRILLING DATE 9 - 10 June 2024
TOTAL DEPTH 37.5m
DIAMETER 50mm
CASING 34.5m
SCREEN 3m

COORD SYS MGA94
EASTING 388311.745
NORTHING 6300653.680
SURFACE ELEVATION 109.843
WELL TOC 110.534

COMMENTS

LOGGED BY [redacted]
CHECKED BY

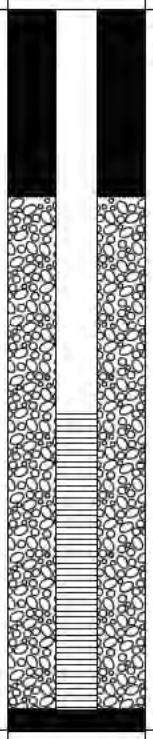
Depth (m)	USCS	Graphic Log	Moisture	Material Description	Well Diagram	Well Construction	Additional Observations / PID
0	sm		M	Silty SAND : dark brown, gravel present, poorly graded, subangular to subrounded		Monument	No observations of staining or odour throughout borehole
				Brown with grey mottles			
4				Light grey			
7						Grout (5% bentonite powder, 95% cement mix)	
9				Clay present			
11	sc			Clayey SAND : light grey with brown bottle, uniform, subangular to subrounded			
12				Light grey to brown			

Disclaimer This bore log is intended for environmental not geotechnical purposes.
produced by ESlog.ESdat.net on 02 Aug 2024

GROUNDWATER WELL LOG GW16S

Depth (m)	USCS	Graphic Log	Moisture	Material Description	Well Diagram	Well Construction	Additional Observations / PID
15							
16							
17							
18				Brown, fine to medium grained			
19							
20							
21							
22						Grout (5% bentonite powder, 95% cement mix)	
23	sm			Silty SAND : brown, fine to medium grained, poorly graded, subangular to subrounded			
24							
25							
26							
27	sc			Clayey SAND : brown, fine to medium grained, poorly graded, subangular to subrounded			
28							
29							
30							

GROUNDWATER WELL LOG GW16S

Depth (m)	USCS	Graphic Log	Moisture	Material Description	Well Diagram	Well Construction	Additional Observations / PID
31						Bentonite (1/4 inch pellets)	
32							
33						Gravel pack (1.8-3.6 mm graded gravels)	
34							
35							
36						Class 18 PVC screen (0.5 mm slots)	
37						Bottom cap	
38				End of hole @ 37.5m			
39							
40							
41							
42							
43							
44							
45							
46							
47							

GROUNDWATER WELL LOG GW16D

PROJECT NUMBER 675.072487.00001
PROJECT NAME W6855/2023/1 monitoring wells
CLIENT Cleanaway
ADDRESS Banksia Road Crooked Brook WA 6236
DRILLING METHOD Diamond Dally

DRILLING DATE 6 - 8 June 2024
TOTAL DEPTH 67.5m
DIAMETER 50mm
CASING 64.5m
SCREEN 3m

COORD SYS MGA94
EASTING 388307.115
NORTHING 6300646.659
SURFACE ELEVATION 109.826
WELL TOC 110.530

COMMENTS

LOGGED BY [redacted]
CHECKED B

Depth (m)	USCS	Graphic Log	Moisture	Material Description	Well Diagram	Well Construction	Additional observations / PID
0	sp-sm		M	Silty SAND : brown, poorly graded, subangular to subrounded, fineto medium grained, fragments of gravel present		Monument	No observations of staining or odour throughout borehole
1	sc			Clayey SAND : grey to dark brown, poorly graded, subangular to subrounded, fine to medium grained			0.2 ppm
				CLAY : white mottled red, stiff, high plasticity			0.3 ppm
2				Clayey SAND : brown, fine grained, uniform, soft			
3				Fine to medium grained, poorly graded, subangular to subrounded			0.2 ppm
4							core loss
				Sandy CLAY : brown, soft, low plasticity			0.2 ppm
5							
6				Clayey SAND : brown, fine to medium grained, poorly graded, subangular to subrounded			0.5 ppm
	sw			SAND : light grey, gravel/stone present, fine to medium grained, poorly graded, subangular to subrounded		Grout (5% bentonite powder, 95% cement mix)	
7				Brown			
8				Clayey SAND : brown, fine to medium grained, poorly graded, subangular to subrounded			0.3 ppm
9				SAND : brown to dark red, fine to medium grained, poorly graded, subangular to subrounded			
10				Light grey			
11							
12				Brown			0.2 ppm
13							
14							

Disclaimer This bore log is intended for environmental not geotechnical purposes.
produced by ESlog.ESdat.net on 02 Aug 2024

GROUNDWATER WELL LOG GW16D

Depth (m)	USCS	Graphic Log	Moisture	Material Description	Well Diagram	Well Construction	Additional observations / PID
15	sc			Sandy CLAY : brown mottle yellow, soft, low plasticity			
16				Brown, sandstone present (~5cm)			0.3 ppm
17	sw			SAND : pale yellow, fine to medium grained, poorly graded, subangular to subrounded			0.1 ppm
18				Brown, ~10cm rock present @ 19.5m			0.3 ppm
19							
20				Light grey			
21							0.6 ppm
22						Grout (5% bentonite powder, 95% cement mix)	
23							
24				Pink mottles Grey & brown mottles			0.3 ppm
25				Light grey			0.5 ppm
26							
27							0.4 ppm
28							
29							
30							

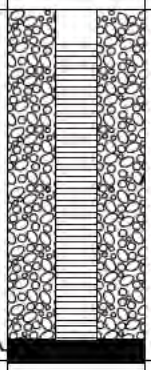
GROUNDWATER WELL LOG GW16D

Depth (m)	USCS	Graphic Log	Moisture	Material Description	Well Diagram	Well Construction	Additional observations / PID
31							
	sc			Clayey SAND l ight grey & yellow mottles, fine to medium grained, poorly graded, subangular to subrounded			0.5 ppm
32							
33							
34							
35							
36	cl			CLAY : grey, orange to brown bands, observed occasionally, gravel fragments present, low to medium plasticity			1.2 ppm
37						Grout (5% bentonite powder, 95% cement mix)	
	sc			Clayey SAND : light grey with occasional yellow bands, fine to medium grained, poorly graded, subangular to subrounded			2.4 ppm
38							
39	sw			SAND : light grey, yellow mottles, fine to medium grained, poorly grained, subangular to subrounded			0.9 ppm
40							
41				Pale yellow			0.5 ppm
42	cls		D	CLAY : grey, occasional pink bands, stiff, low to medium plasticity			0.4 ppm
	sw		M	SAND : pale yellow, fine to medium grained, poorly graded, subangular to subrouded			
43				Light grey with occasional brown bands			
44							
45							
46							
47							

GROUNDWATER WELL LOG GW16D

Depth (m)	USCS	Graphic Log	Moisture	Material Description	Well Diagram	Well Construction	Additional observations / PID
48							
49							
				Orange to yellow			0.2 ppm
50							
51	ch		D	CLAY : purple, stuff, high plasticity			
	sw		M	SAND : yellow, fine to medium grained, poorly graded, subangular to subrounded			0.1 ppm
52							
				Pink mottles			
53	oh			Sandy CLAY : greyish to brown. hard/firm, medium to high plasticity			
54							
55						Grout (5% bentonite powder, 95% cement mix)	
	sw		W	SAND : grey, fine grained, uniform, subangular to subrounded			
56							
57							
58							
				Grey with brown mottles, fine to medium grained, poorly graded			0.2 ppm
59							
60							
61						Bentonite (1/4 inch pellets)	
62							
63						Gravel pack (1.8-3.6 mm graded gravels)	
64							

GROUNDWATER WELL LOG GW16D

Depth (m)	USCS	Graphic Log	Moisture	Material Description	Well Diagram	Well Construction	Additional observations / PID
65						Class 18 PVC screen (0.5 mm slots)	
66							
67	cls		D	Sandy CLAY : grey, soft, low to medium plasticity		Bottom cap	
				End of hole @67.5m			
68							
69							
70							
71							
72							
73							
74							
75							
76							
77							
78							
79							
80							

GROUNDWATER WELL LOG GW17S

PROJECT NUMBER 675.072487.00001
PROJECT NAME W6855/2023/1 monitoring wells
CLIENT Cleanaway
ADDRESS Banksia Road Crooked Brook WA 6236
DRILLING METHOD Mud rotary

DRILLING DATE 18 - 23 June 2024
TOTAL DEPTH 61.5m
DIAMETER 50mm
CASING 58.5m
SCREEN 3m

COORD SYS MGA94
EASTING 388290.209
NORTHING 6300359.665
SURFACE ELEVATION 118.613
WELL TOC 119.247

COMMENTS

LOGGED BY [redacted]
CHECKED BY

Depth (m)	USCS	Graphic Log	Moisture	Material Description	Well Diagram	Well Construction	Additional Observations / PID
0	cls		M	Sandy CLAY : brown mottled grey-orange, medium plasticity, medium grained and poorly graded sand		Monument	No observations of staining or odour throughout borehole
2	sc			Clayey SAND : grey mottles orange-brown, poorly graded, medium grained			
4	cls			Sandy CLAY : grey mottled orange-red, low plasticity, firm, medium grained and uniform sand			
				Brown mottled grey-orange, coarse grained and well graded sand			
5				Core loss			
6	cls			Sandy CLAY : orange mottled grey, soft, coarse grained and well graded sand			
7						Grout (5% bentonite powder, 95% cement mix)	
8				Core loss			
9	sc			Clayey SAND : grey mottled orange-brown, well graded, coarse grained			
				Grey			
10	cls			Sandy CLAY : grey, low plasticity, fine grained and uniform sand			
11				Core loss			
12	cls			Sandy CLAY : grey, low plasticity, uniform sand			
	bgs-sns			High weathered SANDSTONE, brown			
	bgs-sns			Red-brown, firm, medium grained sand			
13	sc			Weathered SANDSTONE, brown			
	core loss			Clayey SAND : grey mottled brown, coarse grained, well graded			
	sc			Core loss			
14				Clayey SAND : grey, coarse grained, well graded			

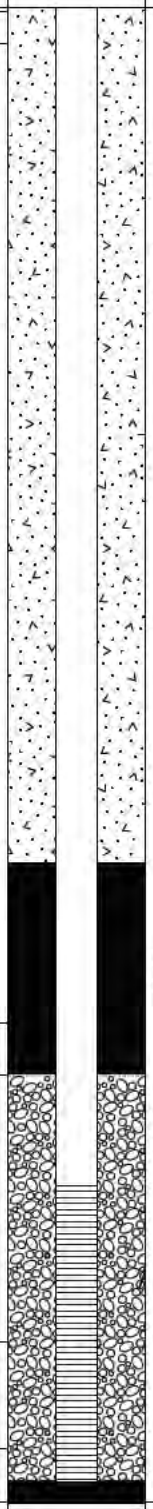
GROUNDWATER WELL LOG GW17S

Depth (m)	USCS	Graphic Log	Moisture	Material Description	Well Diagram	Well Construction	Additional Observations / PID
15				Grey mottled orange			
16							
17				Core loss			
18	cls bgl-snd			Sandy CLAY : grey mottled orange-brown, low plasticity, fine grained sand Weathered SANDSTONE, brown			
19	sc cl cls bgl-snd			Clayey SAND : grey mottled orange, coarse grained, well graded CLAY : grey, low plasticity, with fine sand Sandy CLAY : grey mottled orange, low plasticity High weathered SANDSTONE, brown			
20	sc			Clayey SAND : orange mottled grey, coarse grained, well graded			
21				Core loss			
22						Grout (5% bentonite powder, 95% cement mix)	
23	sc			Clayey SAND : orange mottled grey, coarse grained, well graded			
24							
25							
26							
27				Core loss			
28							
29							
30	sc			Clayey SAND : grey, coarse grained, well graded			

GROUNDWATER WELL LOG GW17S

Depth (m)	USCS	Graphic Log	Moisture	Material Description	Well Diagram	Well Construction	Additional Observations / PID
31							
32							
	cls			Candy CLAY : grey mottled orange, medium grained and uniform sand			
33	sc			Clayey SAND : orange mottled grey-red, coarse grained, well graded			
	sw			SAND : red mottled grey, coarse grained, well graded, traces of clay			
	blg-snds			High weathered SANDSTONE, dark red mottled brown			
34	sw			SAND : red mottled grey, coarse grained, well graded, with clay			
35	sc			Orange mottled red Red mottled grey Clayey SAND : orange mottled red-grey, coarse grained, well graded			
36	cl			CLAY : grey mottled brown-orange, low plasticity, soft, with sand			
				Brown, firm		Grout (5% bentonite powder, 95% cement mix)	
37				Grey mottled orange-brown			
38	cls			Sandy CLAY : grey mottled orange, coarse grained, well graded			
39							
40	bgl-snds			High weathered SANDSTONE, orange mottled brown			
	sc			Clayey SAND : orange mottled red, medium grained, uniform			
41				Grey mottled red-orange, coarse, well graded			
42				Orange			
43				Red mottled grey			
44							
45	cl			CLAY : brown mottled grey, firm,low plasticity, with sand			
				Grey mottled brown			
46	sc			Clayey SAND : orange-grey, coarse grained, well graded			
47							

GROUNDWATER WELL LOG GW17S

Depth (m)	USCS	Graphic Log	Moisture	Material Description	Well Diagram	Well Construction	Additional Observations / PID
				CLAY : grey, soft, low plasticity, with sand			
48	sc			Clayey SAND : grey mottled orange, coarse grained, well graded			
49							
50						Grout (5% bentonite powder, 95% cement mix)	
51							
52							
53							
54							
55							
56						Bentonite (1/4 inch pellets)	
57	cl			CLAY : grey mottled orange, low plasticity, soft, traces of sand			
	sc			Clayey SAND : grey mottled orange, coarse grained, well graded		Gravel pack (1.8-3.6 mm graded gravels)	
58							
59							
60	cls			Sandy CLAY : grey mottled orange, low plasticity, fine grained sand and traces of silt		Class 18 PVC screen (0.5 mm slots)	
61	sp-sc			Clayey SAND : orange, coarse grained, poorly graded, low plasticity clay		Bottom cap	
				End of hole @61.5m			
62							
63							
64							

GROUNDWATER WELL LOG GW17D

PROJECT NUMBER 675.072487.00001
PROJECT NAME W6855/2023/1 monitoring wells
CLIENT Cleanaway
ADDRESS Banksia Road Crooked Brook WA 6236
DRILLING METHOD Diamond tip coring

DRILLING DATE 18 - 23 June 2024
TOTAL DEPTH 77.5m
DIAMETER 50mm
CASING 68.5m
SCREEN 9m

COORD SYS MGA94
EASTING 388290.277
NORTHING 6300361.117
SURFACE ELEVATION 118.563
WELL TOC 119.034

COMMENTS

LOGGED BY [redacted]
CHECKED B

Depth (m)	USCS	Graphic Log	Moisture	Material Description	Well Diagram	Well Construction	Additional Observations / PID
0	cls		M	Sandy CLAY : brown mottled grey-orange, medium plasticity, medium grained and poorly graded sand		Monument	No observations of staining or odour throughout borehole
1							
2	sc			Clayey SAND : grey mottles orange-brown, poorly graded, medium grained			
3							
4	cls			Sandy CLAY : grey mottled orange-red, low plasticity, firm, medium grained and uniform sand			
				Brown mottled grey-orange, coarse grained and well graded sand			
5				Core loss			
6	cls			Sandy CLAY : orange mottled grey, soft, coarse grained and well graded sand			
7						Grout (5% bentonite powder, 95% cement mix)	
8				Core loss			
9	sc			Clayey SAND : grey mottled orange-brown, well graded, coarse grained			
				Grey			
10	cls			Sandy CLAY : grey, low plasticity, fine grained and uniform sand			
11				Core loss			
12	cls			Sandy CLAY : grey, low plasticity, uniform sand			
	bgs-sne			High weathered SANDSTONE, brown			
	bgs-sne			Red-brown, firm, medium grained sand			
13	sc			Weathered SANDSTONE, brown			
				Clayey SAND : grey mottled brown, coarse grained, well graded			
	sc			Core loss			
14				Clayey SAND : grey, coarse grained, well graded			

GROUNDWATER WELL LOG GW17D

Depth (m)	USCS	Graphic Log	Moisture	Material Description	Well Diagram	Well Construction	Additional Observations / PID
				Grey mottled orange			
17				Core loss			
18	cls bgl-snd			Sandy CLAY : grey mottled orange-brown, low plasticity, fine grained sand Weathered SANDSTONE, brown			
19	sc cl cls bgl-snd			Clayey SAND : grey mottled orange, coarse grained, well graded CLAY : grey, low plasticity, with fine sand Sandy CLAY : grey mottled orange, low plasticity High weathered SANDSTONE, brown			
20	sc			Clayey SAND : orange mottled grey, coarse grained, well graded			
21				Core loss		Grout (5% bentonite powder, 95% cement mix)	
23	sc			Clayey SAND : orange mottled grey, coarse grained, well graded			
27				Core loss			
30	sc			Clayey SAND : grey, coarse grained, well graded			

GROUNDWATER WELL LOG GW17D

Depth (m)	USCS	Graphic Log	Moisture	Material Description	Well Diagram	Well Construction	Additional Observations / PID
31							
32							
	cls			Sandy CLAY : grey mottled orange, medium grained and uniform sand			
33	sc			Clayey SAND : orange mottled grey-red, coarse grained, well graded			
	sw			SAND : red mottled grey, coarse grained, well graded, traces of clay			
	blg-snds			High weathered SANDSTONE, dark red mottled brown			
34	sw			SAND : red mottled grey, coarse grained, well graded, with clay			
35	sc			Orange mottled red Red mottled grey			
				Clayey SAND : orange mottled red-grey, coarse grained, well graded			
36	cl			CLAY : grey mottled brown-orange, low plasticity, soft, with sand			
				Brown, firm			
37				Grey mottled orange-brown		Grout (5% bentonite powder, 95% cement mix)	
38	cls			Sandy CLAY : grey mottled orange, coarse grained, well graded			
39							
40	bgl-snds			High weathered SANDSTONE, orange mottled brown			
	sc			Clayey SAND : orange mottled red, medium grained, uniform			
41				Grey mottled red-orange, coarse, well graded			
42				Orange			
43				Red mottled grey			
44							
45	cl			CLAY : brown mottled grey, firm,low plasticity, with sand			
				Grey mottled brown			
46	sc			Clayey SAND : orange-grey, coarse grained, well graded			
47							

GROUNDWATER WELL LOG GW17D

Depth (m)	USCS	Graphic Log	Moisture	Material Description	Well Diagram	Well Construction	Additional Observations / PID
				CLAY : grey, soft, low plasticity, with sand			
48	sc			Clayey SAND : grey mottled orange, coarse grained, well graded			
49							
50							
51							
52							
53						Grout (5% bentonite powder, 95% cement mix)	
54							
55							
56							
57	cl			CLAY : grey mottled orange, low plasticity, soft, traces of sand			
	sc			Clayey SAND : grey mottled orange, coarse grained, well graded			
58							
59							
60	cls			sandy CLAY : grey mottled orange, low plasticity, fine grained sand and traces of silt			
61	sp-sc			Clayey SAND : orange, coarse grained, poorly graded, low plasticity clay			
	ch			CLAY : dark grey mottled red, medium to high plasticity, stiff-very stiff, traces of coarse grained sand			
62	bgl-snd						
	ch			Weathered SANDSTONE, dark red mottled brown, fractured			
	cls					Bentonite (1/4 inch pellets)	
	cl			CLAY : dark grey, very stiff, medium to high plasticity			
63				Sandy CLAY : orange, low plasticity, fine to coarse grained sand, crumbles by hand			
				CLAY : orange mottled grey, low plasticity, very stiff			
64							

GROUNDWATER WELL LOG GW17D

Depth (m)	USCS	Graphic Log	Moisture	Material Description	Well Diagram	Well Construction	Additional Observations / PID
65	sc			Dark grey			
	cl			Red mottled dark grey			
				Clayey SAND : pale grey mottled orange and red, fine to coarse grained, well graded, low plasticity clay			
	sc			CLAY : dark grey-dark brown, low plasticity, very stiff			
66				Pale grey			
	cl			Clayey SAND : red mottled pale grey, fine to medium grained, poorly graded			
	sc			Orange, fine to coarse grained			
67				CLAY : pale yellow, low plasticity, traces of fine grained sand			
				Clayey SAND : pale grey mottled orange, fine to coarse grained, poorly graded, subangular to subrounded, low plasticity clay			
68				Orange to dark orange		Gravel pack (1.8-3.6 mm graded gravels)	
69			W	Core loss (inferred grey, fine to medium grained sand)			
				SAND : pale grey to grey, fine to medium grained, subangular to subrounded, trace to with non plastic fines			
70	sp						
	sc			Clayey SAND : orange, medium to coarse grained, subangular to subrounded, low plasticity clay			
71				Core loss			
72							
73						Class 18 PVC screen (0.5 mm slots)	
74							
75	cl			CLAY : dark grey, low plasticity, stiff			
	sc			Clayey SAND : orange mottled pale red, medium to coarse grained, low plasticity clay			
	sp			SAND : grey, medium to coarse grained, low plasticity clay			
76							
				Core loss			
77	sp			SAND : grey, medium to coarse grained, with low plasticity clay		Bottom cap	
				End of hole @77.5m			
78							
79							
80							

GROUNDWATER WELL LOG SE3S-R

PROJECT NUMBER 675.072487.00001
PROJECT NAME W6855/2023/1 monitoring wells
CLIENT Cleanaway
ADDRESS Banksia Road Crooked Brook WA 6236
DRILLING METHOD Mud rotary

DRILLING DATE 24 June 2024
TOTAL DEPTH 40 m
DIAMETER 50mm
CASING 38 m
SCREEN 2 m

COORD SYS MGA94
EASTING 387241.272
NORTHING 6300395.690
SURFACE ELEVATION 71.824
WELL TOC 72.391

COMMENTS

LOGGED BY [redacted]
CHECKED BY

Depth (m)	USCS	Graphic Log	Moisture	Material Description	Well Diagram	Well Construction	Additional Observations / PID
0	sc		M	Clayey SAND : grey- orange, fine to coarse grained, well graded		Monument	No observations of staining or odour throughout borehole
1							
2							Due to mud rotary drilling, unable to determine soil profile. Refer to adjacent wells for material description.
3							
4							
5							
6							
7						Grout (5% bentonite powder, 95% cement mix)	
8							
9							
10							
11							
12							
13							
14							

GROUNDWATER WELL LOG SE3S-R

Depth (m)	USCS	Graphic Log	Moisture	Material Description	Well Diagram	Well Construction	Additional Observations / PID
15							
16							
17							
18							
19							
20							
21							
22						Grout (5% bentonite powder, 95% cement mix)	
23							
24							
25							
26							
27							
28							
29							
30							

GROUNDWATER WELL LOG SE3S-R

Depth (m)	USCS	Graphic Log	Moisture	Material Description	Well Diagram	Well Construction	Additional Observations / PID
31							
32						Grout (5% bentonite powder, 95% cement mix)	
33							
34							
35	cl			CLAY : red-grey, stiff, low plasticity			
36						Bentonite (1/4 inch pellets)	
37	sw			SAND : grey, coarse grained, well grained, clay present			
38						Gravel pack (1.8-3.6 mm graded gravels)	
39						Class 18 PVC screen (0.5 mm slots)	
40				End of hole @40 m		Bottom cap	
41							
42							
43							
44							
45							
46							
47							

GROUNDWATER WELL LOG SE4S-R

PROJECT NUMBER 675.072487.00001
PROJECT NAME W6855/2023/1 monitoring wells
CLIENT Cleanaway
ADDRESS Banksia Road Crooked Brook WA 6236
DRILLING METHOD Mud rotary

DRILLING DATE 1 July 2024
TOTAL DEPTH 39 m
DIAMETER 50mm
CASING 37 m
SCREEN 2 m

COORD SYS MGA94
EASTING 387145.269
NORTHING 6300233.052
SURFACE ELEVATION 71.208
WELL TOC 72.046

COMMENTS

LOGGED BY [redacted]
CHECKED BY

Depth (m)	USCS	Graphic Log	Moisture	Material Description	Well Diagram	Well Construction	Additional Observations / PID
0	cls		M	Sandy CLAY : grey- orange, coarse grained, well graded		Monument	No observations of staining or odour throughout borehole
1							
2							
3							Due to mud rotary drilling, unable to determine soil profile. Refer to adjacent wells for material description.
4							
5							
6							
7						Grout (5% bentonite powder, 95% cement mix)	
8							
9							
10							
11							
12							
13							
14							

GROUNDWATER WELL LOG SE4S-R

Depth (m)	USCS	Graphic Log	Moisture	Material Description	Well Diagram	Well Construction	Additional Observations / PID
15							
16							
17							
18							
19							
20							
21							
22						Grout (5% bentonite powder, 95% cement mix)	
23							
24							
25							
26							
27							
28							
29							
30							

GROUNDWATER WELL LOG SE4S-R

Depth (m)	USCS	Graphic Log	Moisture	Material Description	Well Diagram	Well Construction	Additional Observations / PID
31							
32							
33							
34	cl			CLAY : grey, soft, medium plasticity, sand present		Bentonite (1/4 inch pellets)	
35							
36	sc			Clayey SAND : grey, coarse grained, well grained		Gravel pack (1.8-3.6 mm graded gravels)	
37							
38						Class 18 PVC screen (0.5 mm slots)	
39				End of hole @39 m		Bottom cap	
40							
41							
42							
43							
44							
45							
46							
47							

Appendix B Photographic log

Groundwater Monitoring Wells at Cleanaway Banksia Waste Disposal Site

Banksia Waste Disposal Site

Cleanaway Solid Waste Pty Ltd
171 Camboon Road, Malaga, 6090 WA

SLR Project No.: 675.072487.00001

	
GW16D	GW16S
Total Depth: 67.5m	Total Depth: 37.5m
Screen: 3m	Screen: 3m
	
GW17S	GW17D
Total Depth: 61.5m	Total Depth: 77.5m
Screen: 3m	Screen: 3m

	
GW15S	GW15D
Total Depth: 38m	Total Depth: 85.5m
Screen: 3m	Screen: 3m
	
GW14D	GW14S
Total Depth: 67.5m	Total Depth: 49m
Screen: 9m	Screen: 3m

	
GW13S	GW13D
Total Depth: 38.5m	Total Depth:46.5
Screen 3m	Screen:2m
	
SE4S-R	SE3S-R
Total Depth:39 m	Total Depth: 40m
Screen:2m	Screen:2m

GW12S
Total Depth: 37.5m
Screen:3m

Appendix C Survey Report

Groundwater Monitoring Wells at Cleanaway Banksia Waste Disposal Site

Banksia Waste Disposal Site

Cleanaway Solid Waste Pty Ltd
171 Camboon Road, Malaga, 6090 WA

SLR Project No.: 675.072487.00001

BUNBURY ENGINEERING SURVEYS COMMITTED TO YOU

MANDURAH
PO Box 2215
MANDURAH WA 6210
Tel: (08) 9535 5833
Email: admin@besurveys.com.au

BUNBURY
PO Box 1148
BUNBURY WA 6230

Website: www.besurveys.com.au

Attention: 15th July 2024
360 Environmental Pty Ltd BE Job: J14014

Monitoring Wells
Banskia Road Landfill in Crooked Brook

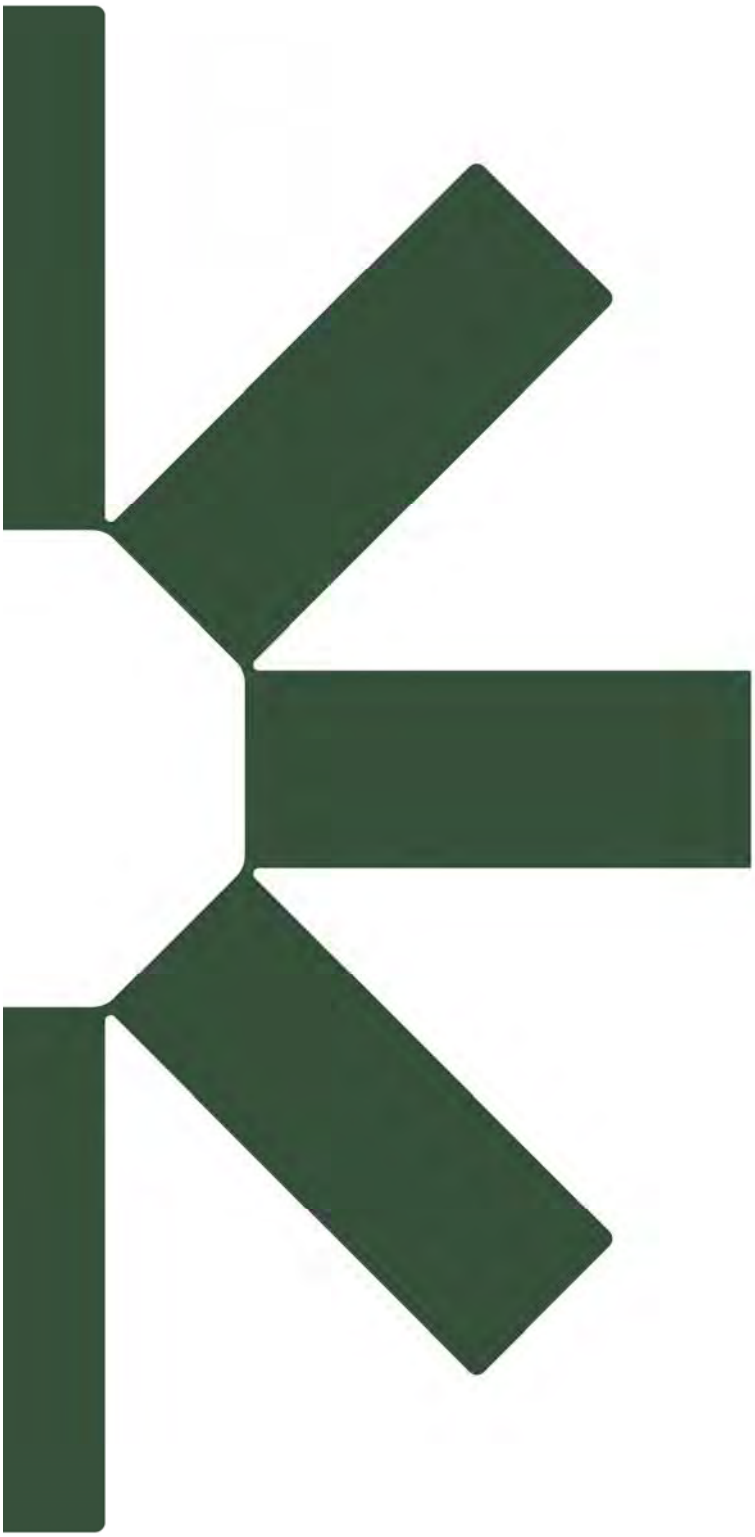
Please see below for a record on the surveyed holes as requested on the 15th of July 2024.

Horizontal Datum: MGA94
Vertical Datum: AHD

Monitoring Well	Easting	Northing	Top PVC	Surface
GW17S	388290.209	6300359.665	119.247	118.613
GW17D	388290.277	6300361.117	119.034	118.563
GW16D	388307.115	6300646.659	110.530	109.826
GW16S	388311.745	6300653.680	110.534	109.843
GW14S	388028.552	6300568.306	105.770	105.212
GW14D	388032.382	6300567.471	105.817	105.188
GW15S	388102.879	6300327.026	105.452	104.681
GW15D	388103.382	6300325.436	105.621	104.831
SE4S	387145.269	6300233.052	72.046	71.208
SE3S	387241.272	6300395.690	72.391	71.824
GW13S	387318.914	6300407.418	76.902	76.445
GW13D	387319.888	6300406.545	77.119	76.437
GW12S	387423.653	6300807.865	78.105	77.308

Kind regards

[redacted]



Making Sustainability Happen

Appendix C Updated Premises Map

Legend

- SITE BOUNDARY
- CELL BOUNDARIES
- EXISTING CELL 7 — EXISTING CELLS
- SEALED AND UNSEALED ROADS (REFER TO TRAFFIC PLAN)

SCALE 1:5,000

50 0 50 100 150 200 250

LENGTHS ARE IN METRES - PAPER SIZE A3

REV	DATE	DRAWN	REV'D	APP'D	REVISION
C9	10.6.25				CELL 12A AND FUTURE CELLS 9 & 10 ADDED
C8	7.09.23				GAS FLARE LOCATION ADDED
C7	15.06.21				AMENDED PER DWER COMMENTS 15.06.21

DRAWING NUMBER	REFERENCE DRAWING TITLE

CLEANAWAY — Making a sustainable future possible

Banksia Road Landfill
Dardanup WA

Lot 2 Banksia Road,
Dardanup WA 6236
Australia

PROJECT: BANKSIA ROAD LANDFILL MASTERPLAN

DRAWN	DRAWING CHECK	REVIEWED	APPROVED
		10.6.25	

TITLE: Premises Map

SCALE	DRAWING No	REV
AS SHOWN	DARD-002	C9

A1

DATE: 10/06/2025 6:29:43 PM LOGIN NAME: FRANK
LOCATION: C:\Users\Frank\Downloads\DARD_Designs 2025\DARD-002-300-310_2025-DWER-C9.dwg

Appendix D Updated Groundwater Monitoring Bore Network Map

Legend

- Site Boundary
- Existing Groundwater Monitoring Wells
- Destroyed/Inaccessible Wells
- Newly Installed Groundwater Monitoring Wells (2024)

- CADASTRAL BOUNDARY SOURCED FROM LANDGATE 2024
- AERIAL PHOTOGRAPHY SOURCED FROM NEARMAPS 2024
- NOTE THAT POSITION ERRORS CAN BE >5M IN SOME AREAS

SLR
a Level 1, 500 Hay Street
Subiaco WA 6008
t (+618) 9388 8360
w www.slrconsulting.com

0 100 200 300 400 m
Meters

LOCALITY MAP

PROJECT NO	DATE	REVISION
675.072487	30/07/2024	1
CREATED	CHECKED	APPROVED

Cleanaway Solid Waste Pty Ltd
Lot 2, Banksia Road, Crooked Brook, WA

Groundwater Monitoring Bore Network

Limitations

Scope of services

This report ("the report") has been prepared by JBS&G in accordance with the scope of services set out in the contract, or as otherwise agreed, between the Cleanaway and JBS&G. In some circumstances, a range of factors such as time, budget, access and/or site disturbance constraints may have limited the scope of services. This report is strictly limited to the matters stated in it and is not to be read as extending, by implication, to any other matter in connection with the matters addressed in it.

Reliance on data

In preparing the report, JBS&G has relied upon data and other information provided by Cleanaway and other individuals and organisations, most of which are referred to in the report ("the data"). Except as otherwise expressly stated in the report, JBS&G has not verified the accuracy or completeness of the data. To the extent that the statements, opinions, facts, information, conclusions and/or recommendations in the report ("conclusions") are based in whole or part on the data, those conclusions are contingent upon the accuracy and completeness of the data. JBS&G has also not attempted to determine whether any material matter has been omitted from the data. JBS&G will not be liable in relation to incorrect conclusions should any data, information or condition be incorrect or have been concealed, withheld, misrepresented or otherwise not fully disclosed to JBS&G. The making of any assumption does not imply that JBS&G has made any enquiry to verify the correctness of that assumption.

The report is based on conditions encountered and information received at the time of preparation of this report or the time that site investigations were carried out. JBS&G disclaims responsibility for any changes that may have occurred after this time. This report and any legal issues arising from it are governed by and construed in accordance with the law as at the date of this report.

Environmental conclusions

Within the limitations imposed by the scope of services, the preparation of this report has been undertaken and performed in a professional manner, in accordance with generally accepted environmental consulting practices. No other warranty, whether express or implied, is made, including to any third parties, and no liability will be accepted for use or interpretation of this report by any third party.

The advice herein relates only to this project and all results conclusions and recommendations made should be reviewed by a competent person with experience in environmental investigations, before being used for any other purpose.

JBS&G accepts no liability for use or interpretation by any person or body other than the Cleanaway who commissioned the works. This report should not be reproduced without prior approval by the Cleanaway, or amended in any way without prior approval by JBS&G or reproduced other than in full, including all attachments as originally provided to the Cleanaway by JBS&G.

Document Distribution

Rev No.	Copies	Recipient	Date
0	Electronic	Cleanaway; [redacted]	29/07/2025

Document Status

Rev No.	Author	Reviewer	Approved for Issue		
		Name	Name	Signature	Date
0	[redacted]		[redacted]	On file	29/07/2025

www.jbsg.com.au

JBS&G

Adelaide
Kaurna Country | 100 Hutt Street,
Adelaide, SA 5000
T: 08 8431 7113

Brisbane
Turrbal/Yuggera Country | Level 37,
123 Eagle Street, Brisbane, QLD 4000
T: 07 3211 5350

Bunbury
Wardandi Country | 177 Spencer Street,
Bunbury, WA 6230
T: 08 9792 4797

Byron Bay
Bundjalung Country | 1/64 Kingsley Street,
Byron Bay NSW 2481
T: 07 3211 5350

Gold Coast
Yugambeh Country | Level 2/14
Edgewater Court, Robina, QLD 4226
T: 07 3211 5350

Hobart
Muwinina Country | Level 2,
137 Liverpool Street, Hobart, TAS 7000
T: 03 6208 3700

Melbourne
Wurundjeri Country | Level 19,
31 Queen Street, Melbourne, VIC 3000
T: 03 9642 0599

Perth
Whadjuk Country | Allendale Square,
Level 9, 77 St Georges Terrace, WA 6000
T: 08 9380 3100

Sydney
Gadigal Country | Level 8,
179 Elizabeth Street, Sydney, NSW 2000
T: 02 8245 0300

Wollongong
Dharawal Country | Level 1,
1 Burelli Street, Wollongong, NSW 2500
T: 02 4225 2647