Cleanaway Solid Waste Pty Ltd

Banksia Road Landfill - New Tailings Storage Cell Works Approval Application Supporting Document

December 2018
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1. Introduction

1.1 Purpose of this document

Cleanaway Solid Waste Pty Ltd (Cleanaway) operates the existing Class III Banksia Road Waste Management Facility (Banksia Road WMF) located at Lot 2 on Plan 65861, Crooked Brook in Western Australia (WA), approximately 3.8 km south-east of the town of Dardanup (Figure 1-1) under approval of the Division 3, Part V of the Environmental Protection Act 1986 (EP Act) Licence L8904/2015/1 (L8904). Cleanaway proposes to accept processed lithium tailings for storage at the Banksia Road WMF and is seeking authorisation (via a works approval application (this document) and a subsequent licence amendment application) to construct and operate a dedicated tailings storage cell for the storage of lithium tailings (the Project).

This document has been prepared by GHD Pty Ltd (GHD) on behalf of Cleanaway to support the Works Approval Application (WAA) for the Project made in accordance with Section 54 of the Environmental Protection Act 1986 (EP Act).

This supporting document, together with the application form, constitutes the WAA and includes technical information relevant to the Project (as described in Section 4). The purpose of the document is to provide information on the proposed works associated with the construction and commissioning of a new tailings storage cell for the storage of lithium processing tailings, the potential impacts to sensitive receptors that may result from the Project, and detail how these impacts will be minimised or adequately controlled. This document has been reviewed and approved by Cleanaway.

Information requested in the Application Form is provided throughout this supporting report. Table 1-1 describes where each requirement can be found in this document.

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<table>
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</tr>
<tr>
<td>Part 2 – Applicant details</td>
<td>Section 2, Table 2-1</td>
</tr>
<tr>
<td>Attachment 1A – Proof of occupier status</td>
<td>Appendix A</td>
</tr>
<tr>
<td>Attachment 1B – Company extract</td>
<td>Not Applicable, the works approval is for an existing licensee at an existing premises.</td>
</tr>
<tr>
<td>Part 3 – Premises details</td>
<td>Section 3</td>
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<tr>
<td>Part 5 - Index of Biodiversity Surveys for Assessments</td>
<td>NA</td>
</tr>
<tr>
<td>Part 6 – Other DWER approvals</td>
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<tr>
<td>Part 7 – Other approvals and consultation</td>
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<tr>
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<td>Section 5</td>
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<td>Part 8 – Fit and competent operator</td>
<td>Application Form</td>
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<tr>
<td>Part 9 – Emissions, discharges and waste</td>
<td>Section 6</td>
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<tr>
<td>Attachment 6A – Emissions and discharges</td>
<td>Section 6</td>
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<td>Attachment 6B – Waste acceptance</td>
<td>Section 6</td>
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<tr>
<td>Part 10 – Siting and location</td>
<td>Section 3</td>
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<td>Attachment 7 – Siting and location</td>
<td>Section 3</td>
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<tr>
<td>Part 11 – Submission of any other relevant information</td>
<td>This supporting report and appendices</td>
</tr>
<tr>
<td>Attachment 8 – Other relevant information</td>
<td>This supporting report and appendices</td>
</tr>
<tr>
<td>Part 12 – Proposed fee calculation</td>
<td>Section 8</td>
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<tr>
<td>Part 13 – Submission of application</td>
<td>Application Form</td>
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<tr>
<td>Part 14 – Declaration and signature</td>
<td>Application Form</td>
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<tr>
<td>Attachment 10 – Request for exemption from publication</td>
<td>NA</td>
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1.2 Background

Lithium tailings are the residue produced from secondary processing of spodumene concentrate (approximately 6% Li2O), through pyrometallurgical and hydrometallurgical processes, to produce lithium hydroxide monohydrate. Lithium hydroxide monohydrate is used in the manufacture of rechargeable lithium ion batteries, industrial lubricants and dyes. Lithium processing tailings are an inert, non-toxic material comprised of alumina-silicates, approximately 15% gypsum, residual salts, trace elements and oxides from spodumene ore, and approximately 30% water.

There are currently no proven sustainable markets within Australia for reuse of the large volumes of tailings which are expected to be produced through the production of lithium hydroxide monohydrate in WA. A reliable and feasible option to safely contain lithium tailings within the immediate term is required to provide operational and commercial certainty to the lithium processing industry in WA.

The Banksia Road WMF has been selected as a suitable location for storage of lithium tailings. The landfill is suitably sited, well above the superficial aquifer (30-40 m below ground surface) and typically within colluvium laterite. Cleanaway is currently authorised to accept and store tailings from processing of titanium dioxide for storage within defined cells at the Banksia Road WMF and therefore has experience with tailings management.

It is anticipated, that by storing the tailings within a dedicated storage cell at the Banksia Road Landfill, in the event a sustainable market for reuse of the tailings material is developed in the future, the material could be recovered.

1.3 Prescribed Premises Category

The new tailings storage cell is expected to meet the definition and design capacity threshold for the prescribed premises Category 5 – Processing or beneficiation as detailed in Table 1-2.

Table 1-2 Prescribed premises category

<table>
<thead>
<tr>
<th>Prescribed premise Category</th>
<th>Category Description</th>
<th>Category Production or Design Capacity</th>
<th>Proposed Premises or Design Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Category 5</td>
<td>Processing or beneficiation of metallic or non-metallic ore: premises on which -</td>
<td>50,000 tonnes per year or more</td>
<td>NA</td>
</tr>
<tr>
<td></td>
<td>a. Metallic or non-metallic ore is crushed, ground, milled or otherwise processed; or</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>b. Tailings from metallic or non-metallic ore are reprocessed; or</td>
<td></td>
<td>NA</td>
</tr>
<tr>
<td></td>
<td>c. Tailings or residue from metallic or non-metallic ore are discharged into a containment cell or dam</td>
<td></td>
<td>600,000 tpa</td>
</tr>
</tbody>
</table>
1.4 **Scope and Limitations**

This report has been prepared by GHD for Cleanaway Solid Waste Pty Ltd and may only be used and relied on by Cleanaway Solid Waste Pty Ltd for the purpose agreed between GHD and Talison as set out in section 1.1 of this report. GHD otherwise disclaims responsibility to any person other than Cleanaway arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report. GHD disclaims liability arising from any of the assumptions being incorrect.

GHD has prepared this report on the basis of information provided by Cleanaway and others who provided information to GHD, which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.
2. **Applicant Information**

2.1 **Applicant details**

The Banksia Road WMF is an existing prescribed premises owned and operated by Cleanaway. Cleanaway is seeking a works approval to undertake development of a new cell for storage of lithium tailings within the existing premises boundary.

Applicant details and contact information for Cleanaway are summarised in Table 2-1.

**Table 2-1 Applicant Details**

<table>
<thead>
<tr>
<th>Applicant Details</th>
<th>Cleanaway Solid Waste Pty Ltd</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Applicant Name</strong></td>
<td>Cleanaway Solid Waste Pty Ltd</td>
</tr>
<tr>
<td>ACN</td>
<td>120 175 635</td>
</tr>
<tr>
<td>ABN</td>
<td>55 120 175 635</td>
</tr>
<tr>
<td><strong>Registered Address</strong></td>
<td>Level 4, 441 St Kilda Road</td>
</tr>
<tr>
<td></td>
<td>MELBOURNE VIC 3004</td>
</tr>
<tr>
<td><strong>Postal Address</strong></td>
<td>Cleanaway Solid Waste Pty Ltd</td>
</tr>
<tr>
<td></td>
<td>PO Box 214</td>
</tr>
<tr>
<td></td>
<td>DARDANUP WA 6236</td>
</tr>
<tr>
<td><strong>Authorised Representative / Contact Person for Enquiries</strong></td>
<td>Name</td>
</tr>
<tr>
<td></td>
<td>Position</td>
</tr>
<tr>
<td></td>
<td>Phone number</td>
</tr>
<tr>
<td></td>
<td>Email</td>
</tr>
</tbody>
</table>
3. **Premises Details**

3.1 **Location and legal land description**

The Banksia Road WMF is located in the Shire of Dardanup approximately 10 km south east of the City of Bunbury and 3.8 km south east of the town of Dardanup (Figure 1-1). The licensed Premises boundary (L8904) for the existing landfill aligns with the cadastral boundary for Lot 2 on Plan 65861, Banksia Road, Crooked Brook, WA 6236. The new tailings storage cell (Cell 12A), access ramps and leachate collection pond will be located wholly within the existing Premises boundary (Figure 3-1).

3.2 **Transport/Access**

The Banksia Road WMF is accessed via Banksia Road. The primary transport route to the Premises is shown in Figure 3-2.
LEGEND
- Works approval development footprint
- Premises boundary

Point | Easting | Northing |
--- | --- | --- |
1 | 386372.75 | 6300802.64 |
2 | 387499.07 | 6300802.92 |
3 | 388340.1 | 6300876.34 |
4 | 388347.13 | 6300210.5 |
5 | 386378.59 | 6300190.1 |

Cleanaway Solid Waste Pty Ltd
Bankoua Road Tailings Cell Works Approval
Prescribed Premises Boundary and Works

GHD: Site premises boundary, Footprints (2018); Landgate: Roads (2018), Imagery (2018). Created by: afeeneyG:\61\37572\GIS\Maps\Working\6137572_002_PrescribedPremisesBoundaryAndWorks_Rev0.mxd
Print date: 05 Dec 2018 - 14:01
Sensitive Land Uses

Major Road
Minor Road
Transport Route
RAV 7 and above
Site Area
3.3 Environmental setting

3.3.1 Climate

The Southwest of WA enjoys a Mediterranean type climate with cool wet winters and hot dry summers, with the majority of the rain falling in the winter. The nearest Bureau of Meteorology (BoM) climate station, which records wind speeds and directions, is Bunbury (Site number: 9965). It is located approximately 14 km to the north-west of the Premises. A summary of the rainfall and temperature data collected since 1995 is shown in Figure 3-3. The average maximum temperatures (1995-2018) for Bunbury range from 17.3°C in July to 30.0°C in February. The average minimum temperatures range from 7.1°C in July to 15.9°C in February (BoM 2018). The majority of rainfall is received between April and October. Rainfall averages 726.1 mm/year and mean monthly rainfall varies from 7.2 mm in February to 142.5 mm in July.

![Figure 3-3 BoM Climate Statistics for Bunbury (BoM 009965)](image)

The average morning (9 am) wind speed reported during summer for Bunbury BoM station is 15.5 km/h, prevailing predominately from the east and south east. The wind speed typically increases in the afternoon (3 pm) with an average wind speed 20.2 km/h reported which prevails from a westerly direction. During winter months winds abate to an average of 12.5 km/h during the morning prevailing from the east and north east. Afternoon winds increase to an average of 18.2 km/hr during winter months and range in direction from the west, north west and north (BoM 2018).

3.3.2 Topography

The Banksia Road WMF is situated along the boundary between the Swan Coastal Plain and the western facing slope of the Whicher Scarp. Due to its location on the scarp, the ground surface falls from approximately 125 m AHD in the south-east of the Premises to 45 m AHD at the western boundary although, due to landfilling activities, the natural ground surface has been modified.

3.3.3 Existing landuse

The Banksia Road WMF is a Class III Putrescible landfill site. It is currently licenced (L8904) to accept both liquid and solid wastes under Categories 61 and 64 respectively of Schedule 1 of the Environmental Protection Regulations 1987. The Premises currently accepts tailings from
titanium dioxide processing for storage in dedicated cells at the landfill in addition to municipal, commercial and industrial waste.

Landuses surrounding the Premises include rural properties, other waste management facilities and conservation areas (see section 3.3.6 for further detail relating to conservation areas). Other waste management facilities are located approximately 400 m north of the Premises and Cell 12A and include the Bunbury Harvey Regional Council Banksia Road Organics Processing Facility, the Shire of Dardanup Waste Transfer Station and a Water Corporation wastewater treatment plant.

### 3.3.4 Cultural heritage

A search of the Aboriginal Heritage Inquiry System identified the closest Registered Aboriginal sites as the Preston River (Site ID 19795) (part of Crooked Brook, a tributary of the Preston River) approximately 1.5 km south-west of the Premises and the Ferguson River (Site ID 19796) approximately 1.8 km east and 3.3 km north of the Premises (DPLH 2018).

A search on the inHerit Western Australia database did not identify any registered heritage sites within the Premises or immediate surrounding area (Heritage Council 2018). The closest registered sites are within the town of Dardanup approximately 3.8 km north-west of the Premises.

### 3.3.5 Geology and Soils

#### Geology

A desktop evaluation of the geology of the Premises was undertaken by Golder (2015) (Appendix B) based on the results of a number of drill programs undertaken within the Premises and immediate surrounds. The Premises straddles the boundary between the outcropping Leederville Formation in the east and the Yoganup Formation in the west. The regional geological formations present are described in Table 3-1 along with site specific descriptions of the subsurface conditions at the landfill presented in Golder 2015. The new tailings storage cell, Cell 12A will be established within the Yoganup formation which overlies the Leederville formation.

#### Table 3-1 Geological Formations in the Dardanup Landfill region (Golder 2015)

<table>
<thead>
<tr>
<th>Formation</th>
<th>Maximum Thickness (m)</th>
<th>Lithology</th>
<th>Subsurface Conditions based on Site Investigation at the Landfill</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yoganup Formation (superficial formation)</td>
<td>20</td>
<td>Shoreline deposit along the base of the Whicher Scarp comprising leached and ferruginised beach sand and conglomerate containing mineral sands.</td>
<td>Present in the western portion of the Premises below sandy surficial soils. Comprised dense to very dense sand with hard, red, brown and pink laterised zones below sandy surficial soils. Lenses or coarse sands and thin interbeds of orange, brown and light grey silt and clay are common throughout the formation.</td>
</tr>
<tr>
<td>Formation</td>
<td>Maximum Thickness (m)</td>
<td>Lithology</td>
<td>Subsurface Conditions based on Site Investigation at the Landfill</td>
</tr>
<tr>
<td>-------------------</td>
<td>-----------------------</td>
<td>---------------------------------------------------------------------------</td>
<td>------------------------------------------------------------------</td>
</tr>
<tr>
<td>Leederville</td>
<td>380</td>
<td>Interbedded sand, siltstone and shale with rare conglomerate and coal seams.</td>
<td>Present in the eastern portion of the Premises typically above 80 m AHD. Surface and shallow subsurface materials comprise variably laterised sandy clay or clayey sand, over highly plastic sandy or silty clay which are either colluvium or residual soils derived from weathering of the outcropping formation. The top of the Leederville formation has been encountered between 19 to 31 m AHD.</td>
</tr>
<tr>
<td>Bunbury Basalt</td>
<td>85</td>
<td>Porphyritic tholeiitic basalt. Top and bottom are commonly weathered in place to clay.</td>
<td>NA</td>
</tr>
<tr>
<td>Yarragadee</td>
<td>1,300</td>
<td>Sand and minor shale.</td>
<td>NA</td>
</tr>
</tbody>
</table>

**Subsurface conditions**

A recent geotechnical investigation undertaken for the new Cristal tailings storage cell located west of Cell 12A identified the below subsurface profile. This profile is expected to broadly apply to Cell 12A as a site specific geotechnical investigation not been undertaken. The Golder investigation summarised the subsurface profile as follows (Golder 2017):

- Topsoil (sand) to depths of up to 0.3 m;
- Sand extending to depths of 1.3-2.1 m;
- Clayey gravel/sandy gravel/gravelly sand extending to depths of 3.0-4.5 m; and
- Clayey sand/gravelly clay, sandy clay/clay extending to the maximum depth investigated of 20 m.

**3.3.6 Reserves, conservation areas and environmentally sensitive areas**

The closest Environmentally Sensitive Areas (ESA) are two locations associated with threatened flora approximately 2.2 km west and 2.4 km north of the Premises boundary. An area associated with the Crooked Brook approximately 4.4 km south-west of the Premises boundary is also classified as an ESA.

The Premises is bounded to the south and east by the Dardanup Conservation Park (Class A Crown Reserve). The Boyanup State Forest (managed by the DBCA) is approximately 500 m north of the Dardanup Conservation State Park and east of the Premises. Rural zoned properties are located along the western boundary of the premises.

**3.3.7 Contaminated sites**

The Premises has been classified under the *Contaminated Sites Act 2003* as ‘possibly contaminated – investigation required’.
A search of the Contaminated Sites Register identified the closest registered site to be approximately 5 km to the south-west of the Premises. The site is registered as Parcel ID 16309 and is listed as being remediated for restricted use.

3.3.8 Hydrology

The Premises is located within the proclaimed Preston River Catchment. The nearest surface water feature is the Crooked Brook approximately 1 km south of the Premises. The Ferguson River is also located approximately 2 km north. The Premises is not within a proclaimed groundwater protection area nor public drinking water supply area.

The closest area mapped as wetland within the Geomorphic wetlands of the Swan Coastal Plain dataset is a large Multiple Use Palusplain area within the rural farming area to the west if the Premises. The Palusplain area extends to approximately 1 km west of the Premises at its closest location.

Hydrogeological conditions of the Premises were originally assessed and summarised by Golder (2015). Based on the recommendations of the Golder report in accordance with licence conditions, additional groundwater monitoring wells were installed in 2018 which has increased the knowledge of the hydrogeological conditions for the Premises (GHD 2018a).

Regionally there are two aquifers present, the Superficial Aquifer comprising Bassendean Sand, Guildford and Yoganup formation and the underlying Leederville Aquifer. At the Premises the Superficial Aquifer is present within the Yoganup formation between 30-40m below the ground surface. The Yoganup formation comprises a relatively thick sequence of undifferentiated silty to sandy clays (with some minor sand dominant horizons) to depth of up to around 30 to 40 m (GHD 2018a). Towards the base of this sequence there is an increase in the sand component with this more sand dominant unit found to be moist to wet and is interpreted to be the Superficial Aquifer. Groundwater flow in this upper aquifer is west to north-westerly. Clay rich lenses have been found within the unsaturated zone of the Yoganup formation which have the potential to cause local seasonal groundwater perching.

A firm clay unit approximately 4 m thick underlies the undifferentiated silty to sandy clays of the Yoganup formation. The unit is underlain by a more sand dominant unit at a depth of 40 to 50m below ground level which is interpreted to be the lower aquifer of the Leederville formation (GHD 2018a). The firm clay unit is expected to have an extremely low permeability and would act as a confining layer separating the unconfined (Superficial) and confined (Leederville) aquifers. It is anticipated that this clay will also prevent infiltration of potential contaminants from migrating to the lower aquifer. Groundwater flow in the lower aquifer is north-westerly. Groundwater also flows downward between the Superficial and Leederville Aquifers (GHD 2018a).

The interpreted hydrogeological setting of the Premises based on the results of recent monitoring well installation by GHD (201a8) is presented within Figure 3-4.

Groundwater quality is typically fresh with less than 500 mg/L salinity however observations of up to 5,000 mg/L have been recorded from the groundwater monitoring wells. Groundwater discharges to the Preston River and abstraction for farming and livestock occurs in the surrounding area (Golder 2015).

An assessment of groundwater users within proximity to the Premises was undertaken by Golder (2015). Based on this assessment the closest groundwater abstraction bore for domestic or household use is approximately 900 m west of the premises boundary (2 km from Cell 12A) and the nearest bore designated for livestock use is approximately 600 m south west of the premises boundary (1.75 km from Cell 12A). Refer to Figure 5 in Appendix B for the location of all surrounding groundwater abstraction points.
3.3.9 Vegetation, Flora and Fauna

A Level 2 flora, vegetation survey and a Level 1 fauna habitat assessment of the Premises was carried out in 2014 (Astron 2014). The surveyed area was approximately 118 ha of which 7.4 ha is mapped as native vegetation. The western section of the Premises is a plantation of *Eucalyptus globulus* while the eastern end is native vegetation. The remainder of the site is disturbed by landfill development and was not included in the survey.

One-hundred and twenty-two vascular plant taxa, representing 80 genera from 35 families, were recorded within the native vegetation areas, with 10 taxa being non-native (weeds). A number of conservation significant flora taxa were listed from the database search results for the survey area vicinity; however suitable habitat for the majority of these taxa was not found (Astron 2014).

No conservation significant flora, threatened or priority flora or vegetation communities were recorded during the survey. In the adjacent Dardanup Conservation Reserve a priority ecological community is recorded. The native vegetation within the Premises is mapped within the buffer of this priority ecological community however is not recorded in Premises. Two jarrah-marri vegetation units were described for the survey area (Figure 3-5). Vegetation condition in the survey area ranged from ‘degraded’ to ‘very good to excellent’ and ‘very good’ for the majority of the vegetated area (Figure 3-6). In general though, the remnant vegetation is a mosaic of varying condition with timber harvesting, clearing tracks and previous clearing impacting on the vegetation quality and integrity (Astron 2014).

One broad fauna habitat type was recorded during the fauna assessment; a jarrah-marri woodland of mid to upper slopes. Twenty-five fauna species comprising 22 birds, two mammals and one reptile species were recorded during the 2014 survey. Three of the recorded species are listed as Matters of National Environmental Significance (MNES) under the Environment Protection and Biodiversity Conservation Act 1999 (Commonwealth) and listed as Threatened under the Wildlife Conservation Act 1950 (WA). These include:

- Forest red-tailed black cockatoo (*Calyptrorhynchus banksii naso*, Vulnerable),
- Carnaby’s cockatoo (*Calyptrorhynchus latirostris*, Endangered),
- Baudin’s cockatoo (*Calyptrorhynchus baudini*, Endangered), and

The fauna habitat present is suitable foraging and breeding habitat for the three species of black cockatoo with foraging evidence present within the survey area. Eighty potential black cockatoo breeding trees (diameter breast height greater than 50 cm) were recorded within the Premises including 17 trees containing hollows which are potentially suitable for Black Cockatoo breeding. Two of these hollows had evidence of scratches indicating they may have been used for breeding (Astron 2014).

Vegetation clearing is not required to establish infrastructure for this WAA therefore the identified native vegetation and fauna habitat will not be directly impacted by the proposed works. The tailings storage cell is approximately 400 m north of the nearest vegetation within the Dardanup Conservation Reserve and 500 m from the nearest native vegetation within the Premises boundary.
Transpacific Industries Group Ltd
Banksia Road Dardanup – Level 2 Flora and Vegetation Survey and Level 1 Fauna Assessment, November 2014

Figure 3-5: Vegetation Association Mapping

Legend

- Quadrat/Relevé
- Road
- Banksia Rd Landfill Site

Vegetation Mapping

Low Woodland of Eucalyptus marginata subsp. marginata, Corymbia calophylla over a Tetraria capillaris sward. Tall Open Shrubland over a Hakea lissocarpha, Hypocalymma angustifolia. Low Open Shrubland over a Xanthorrhoea preissii, Patersonia umbrosa var. xanthina and *Achaia maxima. Very Open Sedge/grassland on dark brown loam.

Low Open Woodland of Eucalyptus marginata subsp. marginata and Corymbia calophylla over a Tetraria capillaris sward. Tall Open Shrubland over a Hakea lissocarpha, Hypocalymma angustifolia and *Achaia maxima. Very Open Shrubland over a Xanthorrhoea preissii, Patersonia umbrosa var. xanthina and Open Sedge/grassland on dark brown loam.

Low Open Woodland of Eucalyptus marginata subsp. marginata, Corymbia calophylla over a Tetraria capillaris sward. Tall Open Shrubland over a Hakea lissocarpha, Hypocalymma angustifolia. Low Open Shrubland over a Xanthorrhoea preissii, Patersonia umbrosa var. xanthina and Open Sedge/grassland on dark brown loam.

Plantation - Eucalyptus globulus

Author: V. Clarke
Drawn: C. Dyde
Date: 19-10-2015

Figure Ref: 21135-15-IBDR-1Rev1_151019_Fig03_VegMap
Figure 3-6: Vegetation Condition Mapping

Legend

- Road
- Banksia Rd Landfill Site

Vegetation Condition

- Very Good to Excellent
- Very Good
- Good
- Good to Degraded
- Degraded

TransPacific Industries Group Ltd

Banksia Road Dardanup – Level 2 Flora and Vegetation Survey and Level 1 Fauna Assessment, November 2014

Author: V. Clarke
Drawn: C. Dyde
Date: 19-10-2015

Figure Ref: 21135-15-BIDR-1Rev1_151019_Fig04_VegCond
4. **Project Description**

4.1 **Scope of works and layout**

Cleanaway proposes to construct and operate a new tailings storage cell at the Banksia Road WMF for storage of lithium tailings which will be received from a Lithium hydroxide monohydrate production plant. The new tailings storage cell, Cell 12A, and associated leachate pond, will be dedicated for the storage of only lithium tailings or leachate to prevent mixing with other waste types which could restrict the ability to recover the material in future if another use is found. The tailings material will be transported via road to the Banksia Road WMF in side tipper trucks.

Cell 12A will be established on natural ground between the existing Cell 12, Cell 4B, Cells 1 and 2 and the Cristal Tailings Cell. A new leachate collection pond for Cell 12A will be located between the Cristal Tailings Cell and the existing leachate pond on natural ground (Figure 4-1). Some existing infrastructure is located within the proposed footprint of Cell 12A including sheds, wash-down bays and gas flares. The infrastructure will be decommissioned and removed by Cleanaway prior to commencing construction works.

![Figure 4-1 Location of Cell 12A and new leachate pond relative to surrounding landfill cells](image)

Cell 12A will be constructed in two stages with the first stage comprising construction of a lined embankment with leachate collection to contain the tailings and collect any leachate generated. The embankment will be constructed through excavation of the cell footprint and use of the excavated material to construct the embankments. The leachate pond will be constructed in the same manner. When embankment construction is complete the cell will be filled with tailings material. Once the embankment has been filled to capacity Stage 2 will commence in which tailings will be stacked in layers against the embankments of the surrounding landfill cells. Further details relating to the two stages are included in this Chapter and the attached design report for Cell 12A (Appendix C).

Based on the two stage design of the facility it is expected that, if Cell 12A is constructed to the maximum proposed height, based on a compacted tailings density of 1.35 t/m³, it will contain approximately 522,000 tonnes of tailings. Tailings delivery to the Premises will increase over time and is expected to reach approximately 600,000 tpa. Cleanaway intend to make application to construct additional storage areas in the future to accommodate the further volume of tailings which is anticipated to require storage.

4.2 **Project timing and phases**

Subject to the receipt of required approvals, Cleanaway is planning to commence construction of the Project in February 2019. Construction will be undertaken during the drier period of the year. The cell will be required for storage of lithium tailings in 2020 therefore Cleanaway intends to seek a licence amendment to authorise use of the cell and acceptance of tailings at the Premises once construction is complete.

4.3 **Engineering properties**

The tailings properties used in the design of Cell 12A are listed in Table 4-1. The full set of test results are provided in Appendix C. The properties are based on laboratory testing undertaken on three representative samples of tailings produced by a Lithium hydroxide monohydrate process plant in China which is similar to the plant which Cleanaway proposes to accept tailings
from. The Chinese plant processes the same spodumene ore concentrate from the Talison Greenbushes Lithium Mine as will be processed by the source plant.

Additional representative tailings samples will be tested when the source plant is operational to confirm the assumptions in particular for the stacking concept for Stage 2 of Cell 12A.

**Table 4-1 Key tailings properties**

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solids specific gravity</td>
<td>2.53 – 2.56 t/m³</td>
</tr>
<tr>
<td>Atterberg limits</td>
<td></td>
</tr>
<tr>
<td>LL 35-36%</td>
<td></td>
</tr>
<tr>
<td>PL 29-30%</td>
<td></td>
</tr>
<tr>
<td>PI 5-7%</td>
<td></td>
</tr>
<tr>
<td>LS 1-2%</td>
<td></td>
</tr>
<tr>
<td>Maximum dry density</td>
<td>1.50 – 1.51 t/m³</td>
</tr>
<tr>
<td>Moisture content of tailings after filtering</td>
<td>23.0-26.2% range</td>
</tr>
<tr>
<td></td>
<td>25.1% average</td>
</tr>
<tr>
<td>Optimum Moisture Content</td>
<td>23.2-24.1% range</td>
</tr>
<tr>
<td></td>
<td>23.6% average</td>
</tr>
<tr>
<td>Particle size distribution</td>
<td>76-92% passing 75 microns</td>
</tr>
<tr>
<td></td>
<td>33-40% passing 13 microns</td>
</tr>
<tr>
<td>Hydraulic conductivity</td>
<td>3.6 x 10⁻⁶ m/s</td>
</tr>
<tr>
<td></td>
<td>1.4 x 10⁻⁷ m/s</td>
</tr>
<tr>
<td></td>
<td>1.0 x 10⁻⁷ m/s</td>
</tr>
</tbody>
</table>

### 4.4 Material Characterisation of Lithium Tailings

The tailings are an inert, non-toxic material comprised of alumina-silicates, gypsum, residual salts, trace elements and oxides from spodumene ore. Characterisation of the tailings material proposed to be accepted by Cleanaway was undertaken by Ramboll (2018), and compared to the Department of Environment and Conservation (DEC) Landfill Waste Classification and Waste Definitions 2009 (DEC Waste Classification Guideline), in order to demonstrate suitability for storage within a designated cell at a Class III landfill. As per the testwork undertaken for the tailings engineering properties, the Plant which Cleanaway proposes to accept tailings from will not be operational until 2020, therefore material characterisation was undertaken on tailings samples sourced from a lithium hydroxide monohydrate process plant in China which is similar to the plant Cleanaway will receive tailings from and it receives and processes spodumene concentrate from the Talison Greenbushes Lithium mine. The tailings material used for the assessment, and the associated test results, are therefore considered representative for the purposes of this assessment.

The elemental composition of the tailings was assessed using Inductively Coupled Plasma Mass Spectrometry (ICP-MS) and X-ray Diffraction / X-ray Fluorescence (XRD/XRF). All elements assessed met the contaminant threshold criteria for Class I landfill, specified in Table 3 of the DEC Waste Classification Guideline, with the exception of Beryllium, Cadmium, Lead, Mercury and Nickel which were within or exceeded the Class III contaminant threshold (Ramboll 2018).

Leachable concentrations were determined in accordance with US EPA (2012) Leaching Environmental Assessment Framework (LEAF) (Method 1313) for those elements exceeding Class I contaminant threshold criteria, and lithium for which there is no Australian criteria. The
results of the assessment found that under relatively neutral and acidic (pH 4.93) conditions the leachable concentrations remain within the leachable concentration limits for a Class I landfill specified in Table 4 of the DEC Waste Classification Guideline (Ramboll 2018).

The DWER Landfill Waste Classification and Waste Definitions do not specify thresholds for material containing lithium, therefore lithium tailings cannot currently be classified according to this document. In the absence of any WA or Australian waste classification criteria relating to lithium, guidelines from other jurisdictions have been considered, namely the New Zealand Ministry for Environment Module 2: Hazardous Waste Guidelines, Landfill Waste Acceptance Criteria and Landfill Classification (NZ MfE Landfill Guidelines). This Guideline specifies screening criteria and concentration in leachate limits for lithium for Class A and Class B landfills. The Class A landfill requirements are generally consistent with the requirements for a Class III landfill in WA (i.e. well sited, lined, leachate collection system, daily cover, licenced) and are therefore considered as appropriate comparison for regulatory purposes.

The NZ MfE Landfill Guidelines specify a screening value of 400 mg/kg, and a concentration in leachate value of 20 mg/L. The NZ MfE Landfill Guideline screening value is considered to be an equivalent classification as the contaminant thresholds in Table 3 of the DWER Landfill Waste Classification and Waste Definitions, and the concentration in leachate value is considered to be an equivalent classification as the leachable concentration in Table 4. Leachable concentrations of lithium from the tailings were found to be within this interim concentration limit under neutral and acidic (pH 4.93) conditions.

Based on the outcomes of this testwork the tailings storage cell will be designed with appropriate lining for a Class III landfill to minimise the likelihood of contaminants leaching from the tailings.

4.5 Cell Design

The design concept for Cell 12A is divided into two stages with different design considerations:

- Stage 1 – Storage provided by excavating into natural ground and constructing HDPE lined embankments on the northern and western sides that tie into the existing waste cells (Cell 12 and Cell 1&2).

- Stage 2 – Tailings “dry stacked” against existing waste cells once Stage 1 reaches capacity, without an impounding embankment. A HDPE liner will be installed between existing waste and tailings.

Cell 12A has been designed generally in accordance with the requirements of the Department of Mines, Industry Regulations and Safety (DMIRS) Code of Practice – Tailings storage facilities in Western Australia (DMP, 2013) and the Australian National Committee on Large Dams (ANCOLD) Guidelines on Tailings Dams (2012). In addition it has been designed to meet Class III landfill standards where possible and practical. A Class III landfill is a lined landfill which may include leachate collection and is designed to accept putrescible and inert waste for burial. The tailings are classified as an inert waste.

An assessment of the Consequence Category in accordance with ANCOLD Guidelines on Tailings Dams (2012) and TSF Hazard Category as per the DMIRS Code of Practice was undertaken to inform key design parameters for Cell 12A. The Consequence Category determined through the assessment was Significant and the Hazard category determine was Category 1.

Geotechnical investigation of the Cell 12A footprint was not undertaken as the site conditions are expected to be similar to those encountered within the new Cristall tailings cell (this cell was recently been established to the west of the existing Cristall tailings cell). A geotechnical investigation was undertaken by Golder (2017) within the new Cristall tailings cell footprint.
Information from the Golder (2017) investigation was used to inform the design of Cell 12A. Site conditions will be inspected by a suitably experienced geotechnical engineer prior to embankment construction to identify if any foundation improvement works are required to address locally varied conditions.

The sections below describe the design, construction and operational elements of the new tailings storage. Detailed plans illustrating the cell and leachate pond design are included in Appendix C.

### 4.6 Cell 12A Stage 1

#### 4.6.1 Stage 1 Construction

Existing infrastructure within the cell footprint will be removed prior to cell construction. A layer of glass fines which has been identified within the cell footprint will also be removed prior to construction.

To construct the embankments the floor/footprint of the cell will be excavated to a depth of approximately 2 m with the excavated material (along with additional stockpiled material from the site if required) being used to build the embankments to a maximum embankment height above natural ground level of 7 m. The embankment crest has nominally been set at RL 88 m and is based upon the expected level of anchor trenches on the surrounding cells which the Cell 12A liner needs to be tied in to. The floor level will be a nominal RL 81 m at the north east corner with a minimum 1% slope toward a leachate sump which will be located in the south west corner of the cell.

The inside and outside batters of the embankments will have a 1V:3H slope for stability. The eastern and southern embankments are adjacent to existing landfill cells which will be filled to allow for the embankment construction on these sides.

Only the northern embankment needs to be constructed for vehicle access therefore the northern embankment crest will be constructed with a width of 15 m. The wider embankment will allow for tailings delivery trucks to drive onto the northern embankment and deposit tailings via side tipper onto the downstream side of the embankment. The embankment will have access ramps with a maximum slope of 1V:10H for the western entry ramp (heavier full tracks so less steep) and 1V:8H for the eastern exit ramp (empty trucks and downhill so will be steeper).

Embarkment crests will have a 1% cross fall toward the cell to capture all runoff within the cell. The downstream face of the embankments and access ramps will include a 200 mm thick topsoil layer with vegetation to protect against erosion.

The internal slopes and floor of the cell will be lined with an Elcoseal X2000 GCL and 2 mm thick smooth HDPE liner system similar to the existing lining arrangements at the Premises. The liner has been designed to meet Class III design requirements and will have a permeability of no greater than $10^{-9} \text{ m/s}$. A gravel layer (approximately 300 mm thick) will be placed on top of the liner to protect it and provide a drainage layer. Geotextile fabric (bidim A24 or similar) will then be placed on the gravel and secured by sand bags at approximately 5 m intervals.

The liner will be secured to the crests of the northern and western embankments by excavated anchor trenches. The liner will also be secured by tying into the existing anchor trenches of the adjacent landfill cells to the south and east.

#### 4.6.2 Leachate Management

Due to the properties of the tailings and the method of filling the cell, very little leachate is expected to flow to the leachate collection sump. However, a leachate collection system has
been designed at the base of the storage to collect and allow removal of any leachate that may be produced.

The floor of Cell 12A has been designed to have a minimum 1% grade toward the southwest corner into a leachate sump. The sump has a 5 m x 5 m floor and is 1.5 m deep. The sump will be filled with gravel and covered with geotextile (bidim A24 or similar), in a similar manner to the floor protection layer. The leachate collection system includes a riser pipe to allow a pump to be lowered to the sump and the leachate to be pumped to the leachate pond. The pipe will have a mesh screen on the end to separate tailings from entering the pipe. The pump will be a small submersible pneumatic pump with sufficient capacity to pump to the new leachate pond.

A new HDPE lined leachate pond will be constructed to receive leachate from Cell 12A. All runoff and drainage that comes into contact with the tailings will be classified as leachate and will be directed to the leachate pond. A HDPE pipeline will be established to convey leachate from Cell 12A to the leachate pond. The pond will share the east embankment wall with the existing primary leachate pond.

The new leachate pond has been designed to accommodate runoff pumped from Cell 12A for a 1 in 20 year AEP, 72 hour storm event (approximately 4,400 m³). The pond will be approximately 2 m deep and include allowance for 300 mm freeboard. The downstream and upstream embankment slopes will be 1V:3H and the embankment crests will be 5 m, with a 1% crossfall towards the downstream slope.

As the natural ground slopes toward the west, a stormwater drain has been designed along the eastern embankment crest to capture stormwater runoff from the primary leachate pond embankment. This stormwater will be directed to the existing stormwater drain south of the new leachate pond.

The leachate pond will be lined with an Elcoseal X2000 GCL and a 2 mm thick smooth HDPE liner system, similar to Cell 12A and the existing landfills cells. The liner will be connected to anchor trenches.

### 4.6.3 Surface Water Management

Surface water runoff from neighbouring cells, will be captured and directed into the leachate sump during the filling of Cell 12A (Stage 1) as this will be assumed contaminated. Embankment crests will have a 1% slope into the cell to allow crest runoff to be captured in the leachate sump. The runoff from the downstream face of the northern and western embankments and the access ramps will not be in contact with the tailings and will therefore be directed into the Premises stormwater drains nearby.

A spillway has been included in the cell design to ensure stability of Cell 12A in extreme rainfall events. The design of the spillway is based on a 1 in 100 Annual Exceedance Probability (AEP), 72 hour rainfall event. The spillway will be located on the southern end of the western embankment to allow discharge into the existing stormwater drain which then drains to the Stormwater Holding Pond located to the south west of the Premises. The spillway is designed to be 0.2 m deep and 4 m wide. It includes a concrete slab over the embankment crest and a rock lined chute down the embankment face, to the existing stormwater stacking drain.

### 4.6.4 Stage One Operations

Tailings will be deposited in to the embankment by side tipping trucks from the northern embankment. Dozers will then push the tailings into the cell areas and compact the tailings. The expected density which will be achieved through this process is 1.35 t/m³.
As the properties of the tailings out of the process plant will not be known until it is operational Cleanaway proposes the following tailings property limits would be implemented for material received at the Premises to ensure the integrity of the tailings stacking operation is maintained.

**Table 4-2 Suggested tailings property limits**

<table>
<thead>
<tr>
<th>Property</th>
<th>Limits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moisture content limit</td>
<td>-4% OMC to OMC</td>
</tr>
<tr>
<td>Particle size distribution (% passing by weight)</td>
<td>Passing 1.18 mm – 100%</td>
</tr>
<tr>
<td>Plasticity Index (%)</td>
<td>Less than 8</td>
</tr>
</tbody>
</table>

The Guidelines on Tailings Dams (ANCOLD, 2012) recommends “Significant consequence category” dams have adequate freeboard to contain the 1 in 100 year AEP, 72 hour rainfall event with an additional contingency freeboard of 300 mm. The spillway referred to in the previous section will allow for stormwater from the tailings surface to be conveyed into the Premises stormwater system during storm events larger than this. Stage 1 will have sufficient freeboard during the majority of the operation while the cell is being filled. When Stage 1 is nearing capacity however the freeboard may not be able to be achieved as the tailings will need to fill the embankment prior to commencing the Stage 2 stacked profile. A perimeter drain will be established adjacent to the crest at this point to collect runoff from the tailings surface which will be pumped to the new leachate pond via a HDPE pipe.

### 4.7 Stage Two

Once the Stage 1 of Cell 12A is complete (filled to capacity), it will continue to be developed through tailings stacking above the embankment. This is considered to form part of the ongoing operation of the tailings storage cell rather than construction. Tailings will be placed against the existing landfill cells. The tailings material will be pushed by dozers and stacked in layers to allow for compaction and drainage. The stacking design assumes that the adjacent landfill cells have been constructed to the final outer profile to allow the tailings to be stacked against them.

The tailings stacking concept has been developed to provide a stable tailings body that considers leachate management, surface water management and provides a separation between the tailings and existing general waste cells.

The tailings will be stacked with an outer slope of 1V:3H and placed in 500 mm layers to allow for compaction. The layers will have a 1% slope towards the outer edge of the stack. A perimeter drain will be constructed for every two 500 mm layers of tailings (one metre in elevation) to collect leachate runoff from the stack. The leachate collected in the drain will be pumped to the leachate collection pond. The stacking height and interval in which the perimeter drains are constructed is to be confirmed during the stacking operation.

The stacks will be progressively covered to allow for a separation between contaminated and non-contaminated stormwater. A surface water drain, separate from the leachate collection drain will be constructed further downstream of the stack to collect non-contaminated stormwater runoff from the covered sections of the stacks. The non-contaminated stormwater will be directed to the existing stormwater drains on the Premises.

The stack can either be progressively covered with the final cap design, or intermediate cap depending on the availability of material and Cleanaway’s construction programme. The final closure cap will be up to 1.5 m. Based on this final closure cap the final outer slopes of the stack will be 1V:4H and the final height is estimated to be RL 113 m is based on the final height of the nearby landfill cells.
A tailings management plan detailing the stacking operation concept will be developed prior to implementing Stage 2. The tailings management plan will be a live document and will be updated based on actual observations during the stacking operation and actual development of the adjacent landfill cells.

### 4.8 Stability Assessments

Stability analysis has been undertaken for both Stage 1 and Stage 2 design. The slope stability analyses were conducted using Geostudio Slope/W software and results were compared to the minimum factors of safety described in the ANCOLD Guidelines on Tailings Dams (2012). For all scenarios analysed both Stage 1 and 2 significantly exceeded the minimum factor of safety requirements. Full results of the analysis are included in the design report in Appendix C.