

Decision Report

Review of Existing Licence

Division 3, Part V Environmental Protection Act 1986

Licence number	L8904/2015/1
Licence holder	Cleanaway Solid Waste Pty Ltd
ACN	120 175 63
DWER file number	DER2015/001648-1
Premises	Banksia Road Putrescible Landfill Banksia Road CROOKED BROOK WA 6236
	Lot 2 on Deposited Plan 65861 Certificate of Title Volume 1670 Folio 568 As depicted in Schedule 1 of L8904/2015/1
Date of report	28/10/2021

Table of Contents

1.	Defi	efinitions of terms and acronyms1		
2.	Purpose and scope of assessment			3
	2.2 Cell 8 An		8 Amendment	3
	2.3	Exc	lusions from the scope	3
	2.4	Sub	mitted documents	4
3.	Ove	rvie	w of Premises	6
	3.1	Bac	kground	6
	3.2	Wo	rks approval and licence history	9
4.	Leg	islat	ive context and other approvals	11
	4.1	Occ	cupancy	.11
	4.2	Par	t IV of the EP Act	11
	4.3	Par	t V of the EP Act	12
	4.3	6.1	Applicable regulations, standards and guidelines	12
	4.3	3.2	Key and recent works approvals and amendments	13
	4.3	3.3	Compliance inspections	13
	4.3	8.4	Clearing	14
	4.3	5.5	Surrounding prescribed premises	14
	4.3	8.6	Other relevant matters	14
	4.4	Cor	ntaminated sites	15
	4.5	Oth	er relevant approvals	16
	4.5	5.1	Planning approvals	16
	4.5	5.2	Radiation management	16
5.	Loc	atio	n and siting	17
	5.1	Sitir	ng context	17
	5.1	.1	Climate	17
	5.1	.2	Wind direction and strength	17
	5.1	.3	Temperature	17
	5.1	.4	Rainfall	18
	5.2	Geo	blogy	19
	5.2	2.1	Regional geology	19
	5.2		Local geology	19
	5.2	2.1	Seismic activity	20
	5.3	Hyd	Irogeology	22
	5.3	8.1	Superficial aquifer	22
5.3.2 Leederville		3.2	Leederville aquifer	22
	5.4	Res	sidential and sensitive receptors	25

	5.5	Spec	ified ecosystems	.26
6.	6. Industrial tailings operations and management		.28	
	6.1 Prescribed premises category		cribed premises category	.28
	6.2	Oper	ations	.28
	6.3	Desię	gn and capacity	.29
	6.4	Liner	system and performance	.29
	6.4	1.1	ndustrial tailings liner design	.29
	6.5	Leac	hate extraction, collection, and storage	.30
	6.5	5.1 -	TDS Cell 1 Leachate Pond	.30
	6.	5. 2 l	Leachate extraction and storage	.31
	6.6	Sepa	ration distance to groundwater	.31
	6.7	Storn	nwater management	.31
7.	Lan	dfill c	peration and management	.32
	7.1	Prese	cribed premises category	.32
	7.2	Desig	gn and lifespan	.32
	7.3	Liner	system and performance	.32
	7.3	3.1 l	Landfill liner design	.32
	7.4	Leac	hate extraction, collection and storage	.33
	7.4	1.1 I	Leachate ponds	.34
	7.5	Wast	e acceptance	.35
	7.6	Land	fill Cover	.37
	7.7	Final	cover and capping	.38
	7.9	Sepa	ration distance to groundwater	.41
8.	Env	rironn	nental monitoring and sampling	.44
	8.1	Grou	ndwater monitoring	.44
	8.1	1.1	Hydrogeological context and understanding	.44
	8.1	1.2 (Groundwater quality	.46
	8.2	Dust	monitoring	.50
	8.3	Noise	e monitoring	.53
9.	Cor	sulta	tion	.55
10.	Ris	k asse	essment	.55
	10.1	As	sessment of operator	.55
	10.2	De	termination of emission, pathway and receptor	.55
11.	Det	ailed	risk assessment	.61
	11.1	Ris	sk Assessment – Stormwater	.61
	11	.1.1	Hazard characterisation and impact	.61
	11	.1.2	Criteria for assessment	.61

11.1	.3 Applicant/Licence Holder controls	61
11.1	.4 Consequence	62
11.1	.1 Likelihood of Risk Event	62
11.1	.2 Overall rating	62
11.1	.1 Acceptability of Risk Event	62
11.1	.2 Regulatory controls	62
11.2	Risk Assessment – Leachate	64
11.2	.1 Hazard characterisation and impact	64
11.2	.2 Criteria for assessment	64
11.2	.3 Applicant/Licence Holder controls	65
11.2	.4 Consequence	65
11.2	.5 Likelihood of Risk Event	65
11.2	.6 Overall rating	65
11.2	.7 Acceptability of Risk Event	65
11.2	.8 Regulatory controls	66
11.3	Risk Assessment – Fugitive Dust	67
11.3	.1 Hazard characterisation and impact	67
11.3	.2 Criteria for assessment	67
11.3	.3 Applicant/Licence Holder controls	67
11.3	.4 Consequence	68
11.3	.5 Likelihood of Risk Event	68
11.3	.6 Overall rating	68
11.3	.7 Acceptability of Risk Event	68
11.3	.8 Regulatory controls	68
11.4	Risk Assessment – Fugitive Dust (asbestos)	69
11.4	.1 Hazard characterisation and impact	69
11.4	.2 Criteria for assessment	69
11.4	.3 Applicant/Licence Holder controls	69
11.4	.4 Consequence	70
11.4	.5 Likelihood of Risk Event	70
11.4	.6 Overall rating	70
11.4	.7 Acceptability of Risk Event	70
11.4	.8 Regulatory controls	70
11.5	Risk Assessment – Noise	71
11.5	.1 Hazard characterisation and impact	71
11.5	.2 Criteria for assessment	71
11.5	.3 Applicant/Licence Holder controls	71

11.5.	4 Consequence	71
11.5.	5 Likelihood of Risk Event	71
11.5.	6 Overall rating	72
11.5.	7 Acceptability of Risk Event	72
11.5.	8 Regulatory controls	72
11.6	Risk Assessment – Odour	73
11.6.	1 Hazard characterisation and impact	73
11.6.	2 Criteria for assessment	74
11.6.	3 Applicant/Licence Holder controls	74
11.6.	4 Consequence	74
11.6.	5 Likelihood of Risk Event	74
11.6.	6 Overall rating	74
11.6.	7 Acceptability of Risk Event	74
11.6.	8 Regulatory controls	75
11.7	Risk Assessment – Landfill Gas	76
11.7.	1 Hazard characterisation and impact	76
11.7.	2 Criteria for assessment	76
11.7.	3 Applicant/Licence Holder controls	76
11.7.	4 Consequence	76
11.7.	5 Likelihood of Risk Event	76
11.7.	6 Overall rating	76
11.7.	7 Acceptability of Risk Event	77
11.7.	8 Regulatory controls	77
11.8	Risk Assessment – Windblown waste	78
11.8.	1 Hazard characterisation and impact	78
11.8.	2 Criteria for assessment	78
11.8.	3 Applicant/Licence Holder controls	78
11.8.	4 Consequence	79
11.8.	5 Likelihood of Risk Event	79
11.8.	6 Overall rating	79
11.8.	7 Acceptability of Risk Event	79
11.8.	8 Regulatory controls	79
11.9	Risk Assessment – Vermin/Pests	80
11.9.	1 Hazard characterisation and impact	80
11.9.	2 Criteria for assessment	80
11.9.	3 Applicant/Licence Holder controls	80
11.9.	4 Consequence	80

	11.9.5	Likelihood of Risk Event80	
	11.9.6	Overall rating	
	11.9.7	Acceptability of Risk Event81	
	11.9.8	Regulatory controls	
	11.10 R	isk Assessment – Smoke/Fire82	
	11.10.1	Hazard characterisation and impact82	
	11.10.2	Criteria for assessment	
	11.10.3	Applicant/Licence Holder controls	
	11.10.4	Consequence	
	11.10.5	Likelihood of Risk Event	
	11.10.6	Overall rating of smoke/fire event	
	11.10.7	Acceptability of risk event	
	11.10.8	Regulatory controls for smoke/fire event emissions	
12.	Determina	ation of Revised Licence conditions85	
13. Applicant's comments			
14.	14. Conclusion		
Appendix 1: Summary of direct interest stakeholders comments – Licence Review			
Appendix 2: Summary of direct interest stakeholders comments – Cell 898			
Appendix 3: Summary of applicant's comments on risk assessment and draft conditions			
Арре	Appendix 4: Reviewed Licence L8904/2015/1110		

1. Definitions of terms and acronyms

In this Decision Report, the terms in Table 1 have the meanings defined.

Table 1: Definitions

Term	Definition	
AACR	Annual Audit Compliance Report	
ACN	Australian Company Number	
AER	Annual Environment Report	
Category/ Categories/ Cat.	Categories of Prescribed Premises as set out in Schedule 1 of the EP Regulations	
CS Act	Contaminated Sites Act 2003 (WA)	
Decision Report	refers to this document.	
Delegated Officer	an officer under section 20 of the EP Act.	
Department	means the department established under section 35 of the <i>Public Sector Management Act 1994</i> and designated as responsible for the administration of Part V, Division 3 of the EP Act.	
DOH	Department of Health	
DWER	WER Department of Water and Environmental Regulation	
	As of 1 July 2017, the Department of Environment Regulation (DER), the Office of the Environmental Protection Authority (OEPA) and the Department of Water (DoW) amalgamated to form the Department of Water and Environmental Regulation (DWER). DWER was established under section 35 of the <i>Public Sector Management Act 1994</i> and is responsible for the administration of the <i>Environmental Protection Act 1986</i> along with other legislation.	
EPA	Environmental Protection Authority	
EP Act	Environmental Protection Act 1986 (WA)	
EP Regulations	Environmental Protection Regulations 1987 (WA)	
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999	
Existing Licence	The Licence issued under Part V, Division 3 of the EP Act and in force prior to the commencement of, and during this Review	
Licence Holder	Cleanaway Solid Waste Pty Ltd	
m ³	cubic metres	

Minister	the Minister responsible for the EP Act and associated regulations	
NEPM	National Environmental Protection Measure	
Noise Regulations	Environmental Protection (Noise) Regulations 1997 (WA)	
Occupier	has the same meaning given to that term under the EP Act.	
РМ	Particulate Matter	
PM ₁₀	used to describe particulate matter that is smaller than 10 microns (μm) in diameter	
Prescribed Premises	has the same meaning given to that term under the EP Act.	
Premises	refers to the premises to which this Decision Report applies, as specified at the front of this Decision Report	
Review	this Licence review	
Revised Licence	the amended Licence issued under Part V, Division 3 of the EP Act following the finalisation of this Review.	
Risk Event	As described in Guidance Statement: Risk Assessment	
UDR	Environmental Protection (Unauthorised Discharges) Regulations 2004 (WA)	
µg/m³	micrograms per cubic metre	
µg/L	micrograms per litre	

2. Purpose and scope of assessment

On 3 December 2020, Cleanaway Solid Waste Pty Ltd (Cleanaway) were notified of the Department of Water and Environmental Regulation's (DWERs) intention to undertake a risk-based Review of Licence L8904/2015/1 for the Banksia Road Putrescible Landfill under the *Environmental Protection Act 1986* (EP Act). The premises is located at 2 Banksia Rd, Crooked Brook WA (Lot 2 on Deposited Plan 65861).

In completing the Licence Review documented in this Decision Report, the department has considered and given due regard to its Regulatory Framework and relevant policy documents which are available at https://dwer.wa.gov.au/regulatory-documents.

2.1 Scope of the Review

Through the licence review, DWER completed a comprehensive review of all activities on the premises to assess their on-going acceptability. Updated regulatory controls have been imposed on the licence where necessary. The scope of the licence review primarily considered:

- leachate generation, migration and management;
- the understanding of local and site-specific hydrogeological conditions and the risks to inland waters such as surface water and groundwater;
- monitoring of emissions and the ambient environment;
- waste acceptance processes;
- premises operational management;
- other identified risks related to operations at the Premises including landfill gas generation, management of special waste types and stormwater management.

2.2 Cell 8 Amendment

On 26 August 2021 the Licence Holder submitted compliance documentation for the completion of construction of Landfill Cell 8. The construction of Cell 8 was assessed and approved under a licence amendment granted on 16 April 2017. The compliance documentation included certification by a suitably qualified independent third-party professional engineer, to certify that the works had conformed to the required specifications set via the licence amendment. DWER has reviewed the compliance documentation and is satisfied that Cell 8 was constructed in accordance with the requirements of the licence.

On 26 August 2021, the Licence Holder also submitted a licence amendment application to allow the operation of the newly constructed Cell 8.

In addition, to the scope set out in Section 2.1 above, DWER has also assessed the risks relevant to the operation of Cell 8 and consolidated the findings of this assessment and the assessment of all other activities as part of the licence review into this report.

2.3 Exclusions from the scope

Part V of the EP Act is related to the regulation of emissions and discharges from prescribed premises to ensure the protection of the environment and public health. Consistent with the Department's remit under Part V of the EP Act, a number of matters were excluded from the scope of the licence review:

 Aesthetics and visual impact of the premises – not within the remit of Part V of the EP Act;

- Impacts on tourism and land values not within the remit of Part V of the EP Act;
- Off-site traffic impacts not within the remit of Part V of the EP Act;
- Extractive Industries operations undertaken by J&P Metals on part of Lot 2 on Plan 65861 – activities not regulated under Licence L8904/2015/1;
- Future works approval or licence amendments including the works approval application for Cells 9, 10 and 12A submitted to DWER on 7 April 2021 these will be subject to a separate assessment process by DWER.
- Site staff, visitors and contractors Occupational Health and Safety legislation protects these from exposure risk and mandates prevention strategies; and
- Radiation risks regulated by the Radiological Council under the *Radiation Safety Act* 1975.

2.4 Submitted documents

The Licence Holder submitted the documents set out in Table 2 to DWER during the licence review assessment process. DWER has considered the content of these documents in completing the licence review and assessment of Cell 8.

Table 2: Documents and information submitted during the assessment process

Document/information description	Date received
Windblown Waste Management Plan – Banksia Road Landfill, Crooked Brook, WA 6236 as prepared by Cleanaway Solid Waste Pty Ltd (Cleanaway).	5 September 2019
Asbestos Management Plan – Cleanaway Banksia Road Landfill Dardanup, WA 6236 as prepared by Transpacific Cleanaway.	21 January 2021
Cleanaway Site Inspection Checklists – Inspection checklists used by Cleanaway for the inspection of: • Leachate systems • Active landfill operations • Cristal Pigment operations • Windblown waste • Fugitive dust emissions • Fire control • Stormwater systems • Pest, vermin and weeds • Litter	24 March 2021
Compliance Calendar Spreadsheets - Internal compliance spreadsheets used to track compliance tasks.	24 March 2021
Compliance Tracker – Internal compliance tracker as taken from Cleanaway's HSE Management System	24 March 2021
Landfill Gas Management Plan, Dardanup Landfill, Crooked Brook, WA 6236 as prepared by Cleanaway Solid Waste Pty Ltd (Cleanaway).	4 May 2021
Landfill Gas Collection System Expansion Proposal – Outlines the proposed expansion to the existing landfill gas management system including design, scope of works and proposed schedule	23 December 2021

Banksia Road Landfill Dust Management Plan (Revision 4) as prepared by JBS&G Australia Pty Ltd T/A Strategen-JBS&G - The objective of the Dust Management Plan is to provide a framework for the management and mitigation of dust from the activities and operations conducted at the site to minimise the risk of dust emissions crossing the site boundary.	24 March 2021
Banksia Road Dust Monitoring Program Monthly Report – February 2021 as prepared by JBS&G Australia Pty Ltd T/A Strategen-JBS&G	24 March 2021
Banksia Road Dust Monitoring Program Monthly Report – January 2021 as prepared by JBS&G Australia Pty Ltd T/A Strategen-JBS&G	24 March 2021
Environmental Management Plan (Version 3) - The Environmental Management Plan (EMP) as prepared by Tonkin provides relevant background information regarding the site, the design of the facility and the strategy and actions that are being taken to operate and manage the site. The objective of the EMP is to document management and mitigation measures to prevent or minimise adverse impact on human health and the environment.	24 March 2021
Banksia Road Waste Disposal Facility, Crooked Brook WA. 2020 Annual Groundwater Compliance Report – Licence L8904/2015/1, March 2021 as prepared by 360 Environmental Pty Ltd.	24 March 2021
Banksia Road Waste Disposal Facility, Crooked Brook WA. Hydrogeologic Risk Assessment and Groundwater Monitoring Program Review, March 2021 as prepared by 360 Environmental Pty Ltd.	24 March 2021
Banksia Road Putrescible Landfill Licence Condition Noise Monitoring Acoustic Assessment, March 2020 as prepared by Herring Storer Acoustics.	24 March 2021
Licence L8904/2015/1 Banksia Road Putrescible Landfill, Crooked Brook Email Transmittal, 17 February 2021, Herring Storer Acoustic.	24 March 2021
Dardanup Waste Facility Cell 12a, 9 & 10 Works Approval Application Environmental Acoustic Assessment, December 2020 as prepared by Herring Storer Acoustics	19 April 2021
Cleanaway Banksia Road Landfill 2020 Groundwater and Surface Water Radionuclide Monitoring Report, March 2021. Commercial in Confidence report prepared by 360 Environmental Pty Ltd	24 March 2021
Annual Radiation Monitoring Report 2019 to 2020 Banksia Road, Dardanup, 28 August 2020. Commercial in Confidence report prepared by Radiation Professionals Australia.	24 March 2021
Banksia Road Landfill Waste Disposal Application – Application form used by external parties declaring the waste type, description, volumes, any laboratory analytical results, and an applicant declaration.	24 March 2021
Waste Acceptance Process Flow Diagram – Internal Cleanaway document used to show the waste acceptance process.	24 March 2021
Banksia Road Landfill Rehabilitation and Closure Plan, Cleanaway, March 2021	24 March 2021
Dust Management Plan Dust Monitoring Program (12 July 2021) as prepared by JBS&G Australia Pty Ltd T/A Strategen-JBS&G	14 July 2021
Banksia Road Landfill Development Cell 8 Construction Compliance Document Supporting Letter – iwProjects dated 24 May 2021	26 August 2021
Cleanaway Banksia Road Landfill Cell 8 CQA Validation Report. 25 May 2021 as prepared by WML Consultants Pty Ltd.	26 August 2021

ARPANZA, 2015 Ionising Radiation and Health Fact Sheet (September 2015) as published by Australian Radiation Protection and Nuclear Safety Agency.	N/A
--	-----

3. Overview of Premises

3.1 Background

The Banksia Road Putrescible Landfill (the Premises) is located at Lot 2 on Deposited Plan 65861, Crooked Brook within the Shire of Dardanup, approximately 3.8 kilometres south-east of the town of Dardanup as depicted in Figure 1 below:



le Name: W/Projects/1/Open/Cleanaway/58071 Bankala Road DMP/GIS/Maps/ ages Reference: SLIP Public Services Longte 2020

Figure 1 - Site Location

Landfilling operations were established at the Premises in June 2000. Prescribed activities at the Premises have evolved as follows:

- The first two landfill cells were lined using the in-situ clays, incorporating a leachate collection system, and accepted waste until reaching capacity in 2006.
- The third cell was the first Class III cell to be constructed with a composite geosynthetic/ HDPE liner and included an independent leachate collection system. The design was revised following damage to the liner during construction and the cell was divided using an intermediate wall and formed cells 3 and 4.
- The fifth cell, a Class III composite geosynthetic/ HDPE lined with an independent leachate collection system, was constructed in May 2011 under Works Approval W4760/2010/1.
- An independent liquid waste 'MIC cell' (now referred to as TDS Cell 1) was constructed under Works Approval: W5096/2011/1 in 2012 for the discrete disposal of Titanium Dioxide Slurry.
- Leachate ponds 1 & 2 were constructed in 2012 under Works Approval W5124/2012/1.
- A landfill gas extraction system was installed in 2013 under Works Approval W5301/2012/1.
- Landfill Cell 4B was constructed in 2014 under Works Approval W5546/2013/1. The cell tied into the liners of Cells 3 and 4 with leachate being managed through landfill cell 4.
- Leachate evaporation pond 3 was constructed in 2015 under works approval W5748/2014/1.
- Cell 12, a Class III composite geosynthetic/ HDPE lined with an independent leachate collection system, was constructed and commissioned in 2016 under Works Approval W5748/2014/1 and subsequently authorised for operation through an amendment to the Licence in 2016.
- The Licence was amended in 2017 to allow the construction of three composite HDPE liner Class III Landfill cells (cells 6, 7 and 8).
- A new Cristal pigment waste cell and pond was constructed and authorised for operation through licence amendments in 2019.
- The licence was amended in 2021 to allow for upgrades/improvements to the stormwater infrastructure along the southern boundary of the premises.
- Licence Review initiated by DWER on 3 December 2020 to allow for a comprehensive review of all activities on the premises to assess their on-going acceptability (this report).
- Licence amendment application received by DWER on 26 August to give effect to the construction of Cell 8 which was completed in April 2021 and for the acceptance of waste into Cell 8 (this report).

Figure 2 below depicts the current premises layout and relevant infrastructure.



Figure 2: Site layout

Table 3 lists the prescribed premises categories in the existing licence and the approved design capacity or throughput.

Classification of Premises	Description	Approved Premises production or design capacity or throughput
Category 61 - Liquid waste facility	Premises on which liquid waste produced on other premises (other than sewerage waste) is stored, reprocessed, treated or irrigated.	353,000 tonnes per annual period
Category 64: Class II or III putrescible landfill site	Premises on which waste (as determined by reference to the waste type set out in the document entitled "Landfill Waste Classification and Waste Definitions 1996" published by the Chief Executive Officer and as amended from time to time) is accepted for burial.	350,000 tonnes per annual period

Table 3: Prescribed Premises Categories in the Existing Licence

3.2 Works approval and licence history

Table 4 summarises the works approval and licence history for the premises.

Table 4: Works approva	al and licence history
------------------------	------------------------

Instrument	Issued	Nature and extent of works approval, licence or amendment
W2548/1998/1	13/11/1998	First works approval issued for site construction. Issued to Kingscape Holdings Pty Ltd (J&P Metals). Approval was appealed and subsequently dismissed by the Minister for Environment.
W2895/1999/1	29/11/1999	Second works approval issued as the first approval expired prior to issue of development approval.
L7439/1998/1	14/06/2000	First licence issued to authorise landfilling operations as a Class II landfill.
L7439/1998/2	6/06/2001	Licence reissued.
L7439/1998/3	1/07/2002	Licence reissued.
L7439/1998/4	23/06/2003	Licence reissued.
L7439/1998/4	8/06/2004	Licence reissued.
L7439/1998/5	23/05/2005	Licence reissued, including upgrade of landfill classification to Class III. Decision was appealed and subsequently dismissed by the then Minister for Environment. First non-annual licence (3 years).
L7439/1998/5	19/10/2006	Licence transferred to Transpacific Waste Management.
L7439/1998/6	5/06/2008	Licence reissued for 3 years duration.
L7439/1998/7	23/03/2009	Licence amendment regarding construction of cell 4. Licence version updated to reflect ILS.
L7439/1998/7	8/10/2010	Licence amendment regarding the disposal of processed septage sludge from the Transpacific Waste Management Welshpool premises following appeal determination (Appeal 337 of 2009).

W4760/2010/1	9/12/2010	Works approval for construction of cell 5.
L7439/1998/8	3/06/2011	Licence reissued 3 years duration.
W5096/2012/1	9/02/2012	Works approval for construction of TDS Cell 1 (formerly MIC cell).
W5124/2012/1	1/03/2012	Works approval for construction of new leachate ponds 1 & 2.
L7439/1998/8	15/11/2012	Licence amendment regarding perimeter fencing requirements.
W5096/2012/1	15/11/2012	Works approval amendment to allow staged completion of TDS Cell 1 (formerly MIC cell).
W5301/2012/1	1/02/2013	Installation of landfill gas collection and flare.
L7439/1998/8	22/02/2013	Licence amendment to authorise use of TDS Cell 1 (formerly MIC cell).
W5546/2013/1	23/01/2014	Works approval for construction of cell #4B.
L7439/1998/9	29/05/2014	Licence reissued for 5 years and converted to REFIRE format.
W5748/2014/1	29/01/2015	Works approval for construction of cell 12 and leachate evaporation pond 3
L8904/2015/1	3/08/2015	Licence issued due to L7439/1998/9 ceasing to have effect.
L8904/2015/1	22/10/2015	Licence amendment to authorise operation of leachate evaporation pond 3, constructed under W5748
L8904/2015/1	5/05/2016	Licence amendment to: • change company name; • authorise operation of cell 12 constructed under W5748; and • address stormwater upgrades
L8904/2015/1	21/07/2016	 Licence amendment to: Accept approximately 3,000 tonnes per annual period of drill muds for blending and disposal to landfill; and increase allowable volumes of Processed Septage to 3,000 tonnes per annual period.
L8904/2015/1	13/04/2017	 Licence amendment for: construction and operation of three composite HDPE liner Class III landfill cells (cells 6, 7 and 8); construction and operation of a phytocapping trial on Class III landfill cell 5; and review of Premises operations and regulatory controls.
L8904/2015/1	2/02/2018	Amendment Notice 1 to reflect the completion of cell 6 construction and authorise its use.
L8904/2015/1	18/02/2019	Amendment Notice 2 for a new Cristal pigment waste cell and Cristal Pond under Category 61
L8904/2015/1	25/06/2019	Amendment Notice 3 to authorise the use of CC2 and Cristal pond constructed under Amendment Notice 2.
L8904/2015/1	17/12/2019	 Licence amendment to: Increase in quantity limit for Category 64 waste acceptance to 350,000 tonnes per annual period; Review of regulatory controls relating to dust and windblown

		Consolidate Amendment Notices 1, 2 and 3 into the licence document.
L8904/2015/1	12/05/2020	Licence amendment to reflect the completion of cell 7 construction and authorise its use.
L8904/2015/1	28/05/2021	Licence amendment to reflect proposed changes to the emissions and discharges during construction and operation of the proposed southern boundary stormwater drain.
L8904/2015/1	5/10/2021	DWER initiated licence amendment to give effect to the Minister's decision for the Cell 7 appeal. to allow the appeal to the extent that additional conditions are imposed on the licence relating to odour. The Minister otherwise dismissed all other grounds of appeal (Appeal 30 of 2020).
L8904/2015/1	28/10/2021	DWER initiated licence review including the assessment and authorisation to use Cell 8 (this report).

4. Legislative context and other approvals

4.1 Occupancy

Lot 2 on Deposited Plan 65861, Certificate of Title Volume 1670 Folio 568 is currently owned by J & P Corporation Pty Ltd. Cleanaway hold the lease for the premises until 1 September 2026 with four extension options remaining (each of a ten year period). DWER considers Cleanaway to be the occupier of the premises for the purposes of Part V of the EP Act.

4.2 Part IV of the EP Act

On 30 June 2011, Transpacific Waste Management Pty Ltd referred a proposal to EPA. The Proposal was for the development of a residue disposal cell. On 1 August 2011, the EPA made a determination to not assess the proposal, stating that the overall environmental impact of the proposal was not so significant as to require assessment by the EPA, and the subsequent setting of formal conditions by the Minister for Environment under Part IV of the EP Act.

On 16 March 2015, Cristal Pigment Australia referred a proposal to EPA. The Proposal was for the development of a residue disposal facility and an upgrade of part of Panizza Road. One submission was received during the public consultation period and on 13 May 2015, the EPA made a determination to not assess the proposal, stating that the overall environmental impact of the proposal was not so significant as to require assessment by the EPA, and the subsequent setting of formal conditions by the Minister for Environment under Part IV of the EP Act. EPA noted that the potential environmental impacts on Flora and Vegetation and Terrestrial Fauna can be adequately dealt with under Part V Division 2 (Clearing) of the EP Act and Inland Waters Environment Quality, Terrestrial Environmental Quality and Rehabilitation and Decommissioning can be adequately dealt with under Part V of the EP Act.

On 17 December 2018, DWER received a works approval application (W6212/2019/1) from Cleanaway for the construction of a Class III waste cell for the storage of tailings generated from the Albemarle lithium hydroxide refinery in Kemerton. On 1 May 2019, the Shire of Dardanup provided a third party referral of the proposed lithium tailings storage cell to the EPA. The referral was released for public comment between 15 May 2019 to 21 May 2019 with public submissions received relating to potential health effects associated with dust emissions and groundwater contamination. In reviewing the application, DWER determined that the application met the description of a Category 5 Tailings Storage Facility under Schedule 1 of the *Environmental Protection Regulations 1987* (EP Regs).

On 3 July 2019 the EPA made a determination to not assess the proposal, stating that the overall environmental impact of the proposal was not so significant as to require assessment by the EPA, and the subsequent setting of formal conditions due to the relatively small scale of the impacts, the small geographic footprint and relatively short duration of planned activities. The EPA considered the mitigation strategies proposed by the proponent to avoid and minimise impacts, noting that no native vegetation and fauna habitat was to be cleared, and the presence of other statutory processes to regulate emissions and discharges, such as Part V of the EP Act and the Noise Regulations. 19 appeals were received against this decision.

On 7 November 2019, Cleanaway advised DWER that it wished to withdraw its works approval application for the lithium tailings storage cell. As a result, the application has been marked as withdrawn in DWER's records and no further assessment has taken place. Appellants were advised by the Office of Appeals Convenor that the appeal investigation had been placed on hold noting the withdrawal. Should a new application for the storage of lithium tailings at the premise be received, this may trigger a reactivation of the appeals.

On 1 April 2021, Cleanaway referred a proposal to the EPA under Part IV of the EP Act for consideration. The proposal was for the continuation of existing landfill activities and the establishment of additional landfill cells within the existing premises boundary. The Proposal was limited in extent to the existing Premises boundary with no proposed increase to the existing approved throughput or removal of any remnant native vegetation. A public consultation period was undertaken between 12 and 18 July 2021 with 17 submission received. On 5 August 2021, EPA made a determination to assess the proposal stating that the proposal has the potential to impact on:

- Inland Waters from stormwater runoff and leachate seepage into groundwater;
- Social Surroundings from interference with amenity values;
- Generation of Greenhouse Gas emissions from flaring; and
- Air Quality from dust and odour.

DWER understand that the EPA is awaiting additional information from Cleanaway required to undertake their assessment.

4.3 Part V of the EP Act

4.3.1 Applicable regulations, standards and guidelines

The overarching legislative framework of this assessment is the EP Act and EP Regulations.

The guidance statements which inform this assessment are:

- Guidance Statement: Setting conditions (October 2015)
- Guidance Statement: Licence duration (August 2016)
- Guidance Statement: Publication of Annual Audit Compliance Reports (May 2016)
- Guideline: Decision making (December 2020)
- Guideline: Environmental siting (December 2020)
- Guideline: Regulatory principles (December 2020)
- Guideline: Risk assessments (December 2020)

4.3.2 Key and recent works approvals and amendments

Approval for waste disposal to commence in Cell 7 was granted by DWER through a licence amendment on 12 May 2020. One appeal was lodged with the Minister for Environment against the amendment. On 31 August 2021 the Minister for the Environment determined the appeal.

The Minister's decision was to allow the appeal to the extent that additional conditions are imposed on the licence relating to odour. The Minister otherwise dismissed all other grounds of appeal. On 5 October 2021, the department published a DWER initiated licence amendment to give effect to the Minister's decision.

On 4 August 2020, Cleanaway submitted an application for a licence amendment, requesting to increase the volume of solid waste accepted for landfilling from 350,000 tonnes to 390,000 tonnes per year. The application was advertised on the department's website on 9 September 2020 with 22 submissions opposing the application received. On 6 November 2020, DWER met Cleanaway to advise of the department's intent to refuse the licence amendment based upon Cleanaway's operating history, non-compliances with licence conditions and enforcement action taken by DWER in relation to activities at the Premises. Cleanaway subsequently withdrew the application on 11 November 2020.

A works approval application was received by the department on 7 April 2021 for the construction of additional landfill cells (Cells 12A, 9 and 10) at the premises. As detailed in Section 4.2, the EPA is assessing the additional cells under Part IV of the EP Act. Pursuant to Section 59B(7) of the EP Act, if the proposed application is related to a proposal which has been referred to the Authority under Section 38, the CEO is not to amend a Part V licence while any decision making authority is precluded by Section 41 from making any decision which could have the effect of causing or allowing that proposal to be implemented or contrary to, or otherwise than in accordance with, an implementation agreement or decision. DWER will assess this works approval application in parallel with the EPA.

4.3.3 Compliance inspections

Key matters that the department has identified through compliance inspections and a review of compliance history are summarised below:

- A compliance inspection conducted on 16 January 2018 identified that the Licence Holder failed to temporarily store drill muds in sealed vessels on a 200mm sacrificial sand layer within an active Class III landfill cell for the Active Landfill Area at the Premises, contrary to licence conditions. On 28 August 2020 Licence Holder was issued with a Prosecution Notice for the contravention of licence condition 1.4.3.
- Compliance inspections undertaken on 10 December 2019 and 11 June 2020 identified that waste was not being accepted in accordance with condition 1.4.1 of the existing licence. This non-compliance is the subject of a current investigation;
- Compliance inspections conducted on 11 February 2020 and 19 February 2020 identified that landfill cover was not applied appropriately, and that shredder floc was being used as a landfill cover material contrary to licence conditions. Shedder floc is waste residue remaining after the shredding of vehicles, whitegoods or other appliances. Shredder floc generally comprises of a high proportion of plastics and rubber which pose a high fire risk. On 28 August 2020 the Licence Holder was issued with a Prosecution Notice for the contravention of licence condition 1.4.7 (daily cover).
- On 15 October 2020, the Licence Holder was issued with a Prevention Notice, under Section 73A of the EP Act, relating to the acceptance, storage and processing of power poles. The Notice was issued as DWER considered that pollution was likely to arise from the power pole waste which had been accepted, stored and processed on

the premises in an uncontained location. Sampling of the power poles confirmed the leachable concentrations were above the class III waste acceptance criteria and are categorised as class IV waste in accordance with the *Landfill Waste Classification and Waste Definitions 1996* (LWCWD), which the licensee is not authorised to accept. The Prevention Notice required the Licence Holder to cease acceptance of power poles, remove the power poles offsite and undertake surface water and soil analysis to determine whether the acceptance and storage of the power poles caused any contamination. On 30 May 2021, DWER wrote to Cleanaway advising them of compliance with the Prevention Notice conditions and confirming that the Prevention Notice had ceased to have effect.

- Cleanaway Solid Waste Pty Ltd was convicted in Bunbury Magistrates Court on 2 November 2020 for 2 counts of breaching its licence under Section 58(1) of the *Environmental Protection Act 1986* relating to the incorrect storage of drill muds and the incorrect use of shredder floc as cover material as outlined above. The Court fined Cleanaway \$11,000 and \$14,000 respectively.
- The Department has seen an improvement in compliance, management and operations at the premises during inspections undertaken in November 2020 and August 2021. The most recent compliance inspection noted one non-compliance relating to maintenance of freeboard levels in the leachate evaporation ponds. This non-compliance and the actions taken to address freeboard levels are discussed further in Section 7.4.

4.3.4 Clearing

The premises has been subject to four native vegetation clearing applications, all relating to remaining vegetation to the east of Lot 2. Three applications were withdrawn by Cleanaway prior to being assessed by DWER. The fourth application was received by the department in January 2019. This application remains under assessment and covers the areas previously applied for, and a portion of the adjacent property to the north being Lot 81 on Plan 403943. The current assessment is awaiting further information from the applicant and no determination has been made on this matter.

4.3.5 Surrounding prescribed premises

Immediately north and adjacent to the Premises are the following premises which are, or have been prescribed under Part V of the EP Act:

- The former Shire of Dardanup Class II putrescible landfill (Lot 81 on Plan 403943) (no licence);
- The Shire of Dardanup Transfer Station (Licence L8888/2015/1);
- The Wellington Group of Councils Compost Facility (Licence L8746/2013/1);
- The Dardanup Wastewater Treatment Plant (Licence L9272/2020/1); and
- The TJ Depiazzi & Sons Composting Facility (Licence L7089/1997/11).

4.3.6 Other relevant matters

• In February 2020 the Licence Holder self-reported liner damage to leachate evaporation pond 3. In late winter 2019 a large bubble emerged in the liner of the leachate evaporation pond. The Licence Holder did not investigate the issue until mid-February 2020, stating that at the time the bubble appeared, Cleanaway was not in a position to empty the pond as it was mid-winter where leachate capacity was paramount. The damaged liner (large tear) has now been fixed and a third-party consultant is undertaking monthly groundwater bore sampling at several bores in

proximity to leachate evaporation pond 3. To date, no impacts have been observed and ongoing monitoring will confirm whether the liner breach has impacted groundwater;

- Stormwater generated on the Premises has been observed to be running off the site. The Department of Biodiversity Conservation and Attractions (DBCA) advised DWER that stormwater hits the large bund on the southern boundary of the Premises and runs down the firebreak on the adjacent Conservation Reserve causing erosion. A licence amendment for the upgrade and improvement of stormwater infrastructure along the southern boundary was issued to Cleanaway on 31 May 2021. Stormwater infrastructure and management is discussed further in Sections 6.7 and 7.10;
- Landfill fires at the Premises occurred on 12 January 2020, 27-28 January 2020 and 5 March 2020. DWER's Pollution Response Branch investigated the January fires and determined that the first fire was a surface fire caused by a battery and lasted about one hour. The second January fire was also a surface fire which originated from an unknown source. The fire ignited late on 27 January 2020 and reignited in the early hours of 28 January 2020. DWER officers attending the fire noted that the fire was spreading across the surface of the landfill in the shredder floc being used as cover. The March fire was approximately 1m³ with no visible flames and the cause was unknown. Investigations undertaken following the landfill fires identified that the fires did not impact the integrity of the liner system.
- Over the last 12 months there have been 75 reports to DWER pollution watch relating to the premises. Two thirds of these reports are attributable to Odour, Dust and Windblown waste. DWER investigated the source of the odour complaints and determined the source was likely to be primarily related to emissions originating from another prescribed premises within the precinct rather than the Banksia Road Waste Management Facility.

4.4 Contaminated sites

The Premises was reported to the department under Section 11 of the *Contaminated Sites Act* 2003 (CS Act), which commenced on 1 December 2006. The Premises was reported under the CS Act due to landfilling activities undertaken at the premises since 1999. This activity has the potential to cause contamination as specified in the guideline '*Potentially Contaminating Activities, Industries and Landuses (Department of Environment, 2004 & DER 2014).* The site is located in area of moderate to low risk of acid sulfate soils which may have been disturbed by construction of the landfill and previous extractive industry activity prior to 1999.

Land at Lot 2 on Diagram 65861, as shown on certificate of title 1670/568, was classified under Section 13 of the CS Act as *possibly contaminated - investigation required* on 28 May 2014 and a memorial (M675551) was placed on the certificate of title.

The classification was based on groundwater monitoring results submitted to the former Department of Environment and Conservation (DEC) by May 2014. The investigations found at that time that the pH of groundwater and copper concentrations were outside the accepted range or exceeding assessment levels for fresh waters, drinking water and long-term irrigation as published in the guideline 'Assessment Levels for Soil, Sediment and Water' (DEC, 2010 & Department of Environment Regulation [DER], 2014). Hydrocarbons were also found to be present in groundwater at concentrations below the relevant screening criteria.

As a requirement of the Licence, groundwater monitoring is conducted at the premises. The groundwater results are being monitored by the department against the current, relevant environmental and health guidelines.

A summary of the contaminated sites within 2 km of the premises is shown in Table 5 below.

Table 5:	Surrounding	contaminated	sites
----------	-------------	--------------	-------

Lot No.	Classification	Summary
Lot 2 Banksia Road	Possibly contaminated - investigation required – Classified 28 May 2014	Current Cleanaway Banksia Road premises
Lots 81 & 800 (Formerly Lot 1 Banksia Road)	Possibly contaminated - investigation required – Classified 28 May 2014	Former Shire of Dardanup Class II putrescible landfill site
Lots 82 & 20	Possibly contaminated - investigation required – Classified 28 May 2014	Dardanup Wastewater Treatment Plant

4.5 Other relevant approvals

4.5.1 Planning approvals

Planning/development approval has previously been granted for activities at the Premises. The following approvals have been identified:

- 1999: Minister for Planning's response to an appeal for the planning approval to establish a private, Solid Waste Disposal Facility subject to conditions.
- 2006: State Administrative Tribunal to extend the 1999 planning approval indefinitely and to allow for the upgrade of the existing landfill facility from Class II to Class III landfill, subject to conditions.
- 2007: P04/07; A8241; 13/03/2007 approval for temporary storage facilities.
- 2010: P76/10; A8241; 15/12/2010 approval for Landfill cell 5.
- 2011: P74/11; A8241; 14/12/2011 approval for leachate ponds.
- 2014: P92/14; A8241; 02/12/2014 approval for leachate dam and associated works.
- 2016: P10/26; A8241; 18/04/2016 approval for stormwater infrastructure.
- 2016: P112/16; A8241; 14/12/2016 approval for landfill cells 6, 7 and 8.
- 2018: P146/7; A8421; 30/05/2018 approval construction and use of a waste cell and waste pond and associated works.

4.5.2 Radiation management

The *Radiation Safety Act 1975* is administered by the Radiological Council, an independent statutory authority advising and responsible to the Minister for Health. Daily administration of the *Radiation Safety Act 1975* is delivered by personnel of the Radiation Health Branch, part of the Environmental Health Directorate of the Department of Health. The Radiation Management Plan for the Cleanaway Banksia Road Waste Disposal Facility was approved for registration in November 2018 under permit number RS77/2018 29488.

While DWER regulates the activities on the premises, its regulatory remit does not include the regulation of radiation risks at the premises.

5. Location and siting

5.1 Siting context

The landfill is located at Lot 2 on Deposited Plan 65861, Crooked Brook within the Shire of Dardanup, approximately 3.8 kilometres south-east of the town of Dardanup.

5.1.1 Climate

The region is described as having a Mediterranean climate with warm to hot, dry summers and cool wet winters.

5.1.2 Wind direction and strength

The closest available wind data for the Premises can be sourced from the Bunbury Meteorology Site (Number 009965). The Bureau of Meteorology (BoM) provides the 9 am and 3 pm wind speed and direction for the Bunbury Meteorology Site, shown in Figure 3. Several residential receptors are in line with the pathway of prevailing morning easterly winds. It is important to note that these wind roses show historical wind speed and wind direction data for the Bunbury weather station and should not be used to predict future data.



Figure 3. Bunbury 9am and 3 pm wind roses (1995 – 2021)

5.1.3 Temperature

The mean maximum temperature during summer is 29.1 degrees Celsius with a mean maximum winter temperature of 17.8 degrees Celsius.



Figure 4. Bunbury mean maximum temperature

5.1.4 Rainfall

Mean annual rainfall is 718.4 mm and has varied from 484.4 mm in 2010 to 995.6 mm in 1999. On a monthly basis, mean rainfall is < 20 mm per month from December to March, increasing to over 115 mm/month in winter. Pan evaporation is 1825 mm year and is also markedly seasonal. Evaporation exceeds rainfall from October to April, is approximately equivalent in May and September and less than rainfall from June to August. The average rainfall for Bunbury is shown in Figure 5.



Figure 5. Bunbury mean rainfall

5.2 Geology

5.2.1 Regional geology

The western portion of the premises is characterised by the clayey sands of the Yoganup Formation which has been deposited against the Whicher Scarp during a period of higher sea level (shoreline marine deposit) (Golder 2015). The site straddles the boundary between the outcropping Leederville Formation (east) and the Yoganup Formation (west) which abuts the Whicher Scarp. The Leederville Formation outcrops along the Whicher Scarp and on the Blackwood Plateau and the shallow weathered profile has been laterised into a massive laterite and pisolitic gravel that is observable at surface in the eastern portion of the site (Baddock 2005).

Published geological maps and surveys of the general site area indicate that both the Quaternary age superficial deposits and the Cretaceous Leederville Formation are present in the upper 100 m beneath the Site (Geological Survey of Western Australia, 1981). The surface of the Leederville Formation slopes downward towards the western site boundary from both the east and the west, due to the Dardanup Syncline which passes within or near the western boundary of the site (Baddock 2005).

5.2.2 Local geology

The superficial formations, in the vicinity of the premises comprise:

• Bassendean Sand – consisting of white quartz, with mineral sand deposits at its base. Depths vary from 1.9 metres below ground level (mbgl) to 4 mbgl: and

• Yoganup Formation – a sequence of shore-line deposits consisting of leached and ferruginised beach sand.

Environmental investigations undertaken at the premise have confirmed the shallow geology as sandy clays and clayey sands overlain by a sandy topsoil and laterite. Golder (2015) reported that the variably iron cemented sands of the Yoganup Formation comprise predominantly dense to very dense sand with hard, red-brown and pink laterised zones. Iron cementing/staining of the Yoganup sands tends to decrease with depth where it is characterised as dense, pale grey to cream, clayey to silty, fine to medium grained sand. Lenses of coarse sands and thin interbeds of orange, brown and light grey silt and clay are common throughout the Yoganup Formation.

In the eastern portion of the site (above 80 m AHD), investigations identified that surface and shallow subsurface materials comprise variably lateritised sandy clay or clayey sand over highly plastic sandy or silty clay which are either colluvium or residual soils derived from the weathering of the outcropping Leederville Formation.

The Leederville Formation is described as bands of charcoal grey clay with some fine, medium, and coarse, white and beige sand lenses. These materials are consistent with the description of the Quindalup Member of the Leederville Formation (Baddock 2005) which suggests these materials are proximal to shallow marine origin, dominated by clay in the upper horizons, however they also contain thin beds of coal (lignite) (Golder 2015).

Stass (2016) details that the clay content within the soil profile increases with depth to approximately 9 mbgl when the geology becomes generally sandier, however it is noted that clay and sandier layers interfinger at this depth providing complex geology and flow patterns. Permeability tests undertaken at approximately 9 mbgl depth reported permeabilities of 2.1x10⁻¹⁰ m/s and 5.9x10⁻¹⁰ m/s within the standard range of clays which suggests low permeability clays are present between 9 mbgl depth and approximately 19 mbgl to 29 mbgl. Additionally, drilling and installation of groundwater monitoring wells has confirmed the presence of the Leederville Formation at levels, which vary between 35 mbgl and 40 mbgl (19 mAHD to 31 mAHD) at the site.

5.2.1 Seismic activity

The Darling Scarp Fault runs in a north/south direction along the Darling Scarp. This fault line passes approximately 1,680 m to the east of the Premises. The Darling Scarp Fault was formed over 540 million to 1.6 billion years ago and is a major geological boundary separating the Archaean Yilgarn Craton in the east from the younger Pinjarra Orogen to the west.

As part of the licence review, the department sought input and advice from Geoscience Australia, the national public sector geoscience specialists. The advice received from Geoscience Australian in regards to seismic activity and history is outlined below:

- The site straddles the northern Whicher Scarp and is proximal to the Darling Fault Scarp;
- The Whicher scarp is thought to have formed as the result of marine abrasion (Cope 1975, Playford et al. 1976), and is not considered to be underlain by an active fault. However, Cope (1975) note a 10 m vertical warping of Yoganup Formation strandlines between Yoganup and Dardanup. While Cope (1975) ascribed the deformation to regional, aseismic warping associated with the Jarrahwood axis, warping at this scale is more readily associated with active faulting and folding. A potential source has not been identified;
- No definitive evidence has been discovered to suggest that the Darling fault (or related structures) is currently seismically active;
- As illustrated in Figure 6 below, few earthquake epicentres, and no active faults are

known from the immediate area. The Boyanup scarp section of the Whicher scarp, which transects the site, is thought to be related to marine abrasion;

- The earthquakes observed in proximity to the premise as depicted in Figure 6 have all occurred within the Yilgarn Craton, with some spatially associated with the Collie coal mine;
- The pattern of epicentres is generally expanding outwards from the centres of Meckering, Calingiri and Cadoux; and
- The biggest risk to lined containment cells is through permanent ground deformation relating to a surface-rupturing earthquake. This would be a very rare occurrence in the Perth Basin.



Figure 6. Seismic activity since 1960

Key findings:

The Delegated Officer considers that:

- the closest fault line is 1,680 m east of the premises with no definitive evidence to suggest that the Darling fault (or related structures) are currently seismically active;
- the risk of permanent ground deformation relating to a surface-rupturing earthquake is considered to be very rare; and
- Infrastructure at the premise is unlikely to be impacted by seismic activity.

5.3 Hydrogeology

5.3.1 Superficial aquifer

Groundwater beneath the site within the superficial formation has been observed as flowing in a northwesterly direction. The superficial formation at the site is reported to have no significant shallow groundwater due to the site having a small catchment and steep slope sloping to the west which reduces the time and volume of infiltration of stormwater into the shallow soils of the site (Stass, 2016). This is confirmed by previous investigations at the site that have reported minimal groundwater within the shallow groundwater wells installed at the premises. The upper 10 m of the site soil profile has been tested to determine infiltration permeabilities for landfill operations and has been reported $<1x10^{-9}$ m/s confirming very low infiltration rates.

Given the clay-dominated geology and low permeabilities, there is the potential for perched groundwater to be seasonally present beneath the premises. These perched layers may be inconsistent and discontinuous across the site. 360 Environmental reported that evidence of this was observed during the construction of Cell 8, where a perched water table was discovered in the south-east corner of the cell excavation, just above the cut line. Investigation of this identified area determined that it is a naturally occurring perched water table.

The shallow groundwater that has been encountered at the site has predominantly been located in the low-lying western portion of the site and has been reported to have retreated further westward in recent years with declining water levels (Stass 2016). This is consistent with groundwater levels in the region which have been reported to have fallen by up to 5 m due to groundwater abstraction and climate change. GHD (2018) reports that the water table of the shallow aquifer (superficial aquifer) was generally found at depths of around 20 mbgl in the low elevation areas (west of site) and up to 50 mbgl in the higher elevation areas (east of site), indicating a significant unsaturated zone beneath the premises.

5.3.2 Leederville aquifer

The permanent, confined Leederville Formation, which consists of interbedded sandstones, siltstones and coal units in the region has been encountered at the site between 35 mbgl and 40 mbgl (Stass 2016, Golder 2015, GHD 2018). Stass (2016) and GHD (2018) reported the presence of a clay unit, comprising dense grey to brown clay, found at all drilling locations at depths of 20 mbgl to 45 mbgl. The clay unit is expected to represent a confining or semi-confining unit separating the superficial aquifer from the underlying Leederville aquifer. The hydrogeological cross section in Figure 7 depicts the relationships between major aquifers in the region between the coast and the Darling Fault (adapted from Commander, 1984, and from Golder Associates, 2015). Aquifers in the Leederville Formation are unconfined near the eastern boundary of the landfill site, and to the east of the site, with the aquifer receiving direct recharge from infiltrating rainfall immediately to the east of the landfill site.



Figure 7. Hydrogeological cross section

The downward hydraulic head gradient detected by drilling indicates that it is likely that some recharge to the Leederville Formation aquifers takes place by leakage through the superficial formations beneath the Banksia Road landfill site. However, the rate of seepage into the Leederville Formation is likely to be low in this area, due to the generally clayey nature of the sediments at depth in the superficial formations.

Regionally, and in the western portion of the premises the Leederville aquifer has been observed to exhibit sub-artesian hydrogeological characteristics, meaning that the aquifer is under pressure and pushes upwards against the confining clay layer. This upwards flow/pressure reduces the likelihood of infiltrating surface water or landfill leachate from migrating into the Leederville aquifer. It is likely that there would be some upward leakage of water from the Leederville Formation into superficial sediments in this area, but the rate of seepage would be greatly inhibited by the generally clayey nature of sediments near the unconformity surface.

The flow direction of the Leederville Aquifer expected to follow the regional flow direction, which has been generally observed in a west to northwest direction. Local geology and confining clay layers may influence the observed depth to the Leederville aquifer during drilling activities. A review of groundwater monitoring and hydrogeological context is undertaken in Section 8.1.

The Leederville Aquifer serves as a domestic water supply for the Dardanup area and the Priority 1 Public Drinking Water Source Area (Dardanup Water Reserve) is located approximately 2.5 km downgradient of the premises.

Up to 44 abstraction bores were identified within 3 km of the site abstracting for domestic and stock consumption. The closest down-gradient groundwater abstraction bore is located 1,100 m from the premises boundary which is approximately 1,500 m from onsite containment infrastructure. Based on the reported total well depths for the wells, 31 of the abstraction bores are assumed to be installed in the Leederville aquifer with only 13 assumed to be in the superficial aquifer. No total drill depths were reported for the remaining 13 abstraction bores and the aquifer into which they are installed in cannot be confiremed. The location of the identified bores is depicted in Figure 8.

A Senior DWER hydrogeologist has calculated the potential travel time for groundwater in the superficial aquifer (and potential contaminants) from the landfill to reach the closest abstraction bore. Using the hydraulic conductivity of silty sand (1.3 m/day), which is considered to be the worst-case scenario, groundwater from beneath the premises was calculated to take approximately 250 years to reach the closest abstraction bore. As the observed lithology beneath the premises comprises a predominant silt-clay mix which is considered less permeable to the silty sand, a further calculation was undertaken using the hydraulic conductivity for silt (0.12 m/year). Using the hydraulic conductivity for silt, groundwater from beneath the premises is calculated to take approximately 12,500 years to reach the closest abstraction bore.



Figure 8. Nearby registered bores

The Dardanup Water Reserve drinking water source protection plan (2018) existing land uses are based on the areas of the wellhead protection zone. The risk assessment process used to determine likelihood and hazards associated with land use activities that results in levels of risks in response within the boundary is based on the *Australian Drinking Water Guidelines 2011* management framework. This approach is consistent with Water Corporation's risk assessment processes and is also referenced in the Departments Strategic policy, *Protecting public drinking water source areas within Western Australia.*

The boundary itself was assessed by the Water Resource Assessment Branch to determine the hydrogeology of the source used to supply drinking water. The advice received stated that bores are screened within the semi-confined Leederville aquifer with the reserve boundary based on the hydrogeological assessment. The plan states the risk of contamination based on the existing land surrounding land use activities had a lower potential from contamination, *'This is because the source is protected from surface contamination by the considerable depth to the groundwater and the presence of a semi-confining layer that sits above the groundwater, acting as a partial barrier to contamination*'.

Key findings:

The Delegated Officer considers that:

- The near surface geology has very low infiltration rates with confining clay layers present throughout the soil profile.
- There is the potential for perched groundwater lenses to be seasonally present beneath the premises. These perched layers may be inconsistent and discontinuous across the site.
- The presence of a dense clay unit at all drilling locations represents a confining or semi-confining unit separating the superficial aquifer from the underlying Leederville aquifer.
- The Leederville aquifer is considered to be recharged east of the premises and has been observed to exhibit sub-artesian hydrogeological characteristics in the western portion of the premises.
- The flow direction of the superficial aquifer has been observed flowing to the west and northwest with the Leederville Aquifer expected to follow the regional flow direction.
- The liner tear identified in February 2020 in leachate evaporation pond 3 has been repaired and monthly groundwater monitoring is being undertaken to confirm that the liner tear has not resulted in any contamination. To date, no impacts have been observed and ongoing monitoring will confirm whether the liner breach has impacted groundwater.
- There are a large number of groundwater abstraction boreholes in the vicinity of the site. These bores are abstracting primarily from the Leederville aquifer with some bores assumed to be in the superficial aquifer.
- Using conservative assumptions, it has been calculated that groundwater from the premises would take approximately 250 years to reach the closest groundwater abstraction bore. By using a Silt geological unit, groundwater from the premises would take approximately 12,500 years to reach the closest groundwater abstraction bore.

5.4 Residential and sensitive receptors

The distances to residential and sensitive receptors are detailed in the Table 6 and depicted in Figure 9.

Sensitive Land Uses	Distance from Prescribed Activity		
Residential Premises	• 0.54 km south of the southwest corner of the Premises, separated by the Dardanup Conservation Park.		
	• 0.92 km due west of the Premises.		
	1 km west southwest of the southwest corner of the Premises		
	1.2 km southwest of the southwest corner of the Premises		
	• 1.5 km due south of the Premises, separated by the Dardanup Conservation Park and Boyanup State Forest.		

Table 6: Receptors and distance from activity boundary

•	1.5 km northwest of the northwest corner of the Premises.
•	1.5 km northeast of the northeast corner of the Premises separated by the Dardanup Conservation Park and Boyanup State Forest.
•	1.75 km east northeast from the eastern boundary of the Premises separated by the Dardanup Conservation Park and Boyanup State Forest.



Figure 9: Distance to closest residential receptors

5.5 Specified ecosystems

Specified ecosystems are areas of high conservation value and special significance that may be impacted as a result of activities at, or emissions and discharges from the Premises. The distances to specified ecosystems are shown in Table 7. Table 7 also identifies the distances to other relevant ecosystem values.

Table 7	7:	Environ	mental	values
---------	----	---------	--------	--------

Specified ecosystems	Distance from the Premises
Dardanup Conservation Park	Adjacent to southern and eastern boundaries of the Premises

Boyanup State Forest	Approximately 0.7km south of the Premises and 1km east	
Priority Ecological Community (PEC) – Dardanup Jarrah and Mountain Marri woodland on laterite (P1)	Three occurrences of this PEC occur within the Dardanup Conservation Park. The closest occurrence is mapped within 15 metres of the Premises eastern boundary.	
Priority Ecological Community/Threatened Ecological Community (TEC) – Banksia Dominated Woodlands of the Swan Coastal Plain	An occurrence of this PEC/TEC is mapped adjacent to the southern boundary of the Premises and also to the west of the Premises on the opposite site of Banksia Road.	
Geomorphic wetland: Multiple use Palusplain and Dampland (flat, seasonally waterlogged)	Approximately 400 metres southwest through to the northwest of the Premises boundary.	
Crooked Brook (significant stream)	Located approximately 1100m south/ southwest of the Premises boundary flowing in a generally east/west direction. Flows into Preston River which is located approximately 5km downstream.	
Preston River	Approx. 5km west of the Premises. Groundwater from the superficial aquifer discharges into the Preston River.	
Groundwater	It is understood that the superficial aquifer is present within the Yoganup geological formation between 20m to 30m below ground level. It is also possible that further isolated perched aquifers occur under the Premises 15 – 20m below ground level. The permanent, confined Leederville aquifer has been encountered at the site between 35 mbgl and 40 mbgl Groundwater flows in a northwest direction.	
Beneficial users of groundwater	Approximately 41 bores are located within 3km of the Premises. Water abstracted from these bores are used for such purposes as:	
	 Stock watering Dairy purposes Irrigation of pasture Domestic use 	
Dardanup Water Reserve	The Priority 1 groundwater protection zone for Dardanup Water Reserve is located approximately 2.5 km northwest of the premises.	
Priority Flora	 Priority 3 flora species – adjacent to the south east corner of the Premises and approximately 180m south of the Premises Priority 4 flora species - approximately 160m east of the Premises 	
Fauna - Baudin's black cockatoo (<i>Calyptorhynchus baudinii</i>), Carnaby's black-cockatoo (<i>Calyptorhynchus latirostris</i>) and the forest red-tailed black-cockatoo (<i>Calyptorhynchus banksii naso</i>)	The remaining vegetation on the eastern side of the Premises contains areas of potential black cockatoo breeding habitat as well as foraging and roosting habitat.	

6. Industrial tailings operations and management

The industrial tailings storage facility (TSF) contains storage cells, leachate collection cells and leachate collection ponds. The Site is configured to allow acceptance of Titanium Dioxide waste from nearby titanium dioxide processing operations. The tailings waste is disposed of into two HDPE lined, purpose-built cells known as TDS Cell 1, TDS Cell 2 and TDS Cell 2A. Cell 1 was formally referred to as the MIC (Millennium Inorganic Chemicals) Cell, with Cell 2 formerly known as Tronox Cell 2. The risk assessment of emissions and discharges associated with Industrial Tailings activities is included in Sections 10 and 11.

6.1 Prescribed premises category

To date, the TSF has been classified and licensed as a Category 61 Liquid Waste Facility. DWER has reviewed the operations at the premises and the category assigned to similar activities including the 2019 Lithium Tailings application (now withdrawn). The delegated officer considers the acceptance and storage of titanium dioxide tailings at the Banksia Road facility aligns with the description of a Category 5:premises on which ...(c) tailings or residue from metallic or non-metallic ore are discharged into a containment cell or dam under Schedule 1 of the EP Regs.

The delegated officer notes that regulation under Part V of the EP Act does not exempt an occupier from the need to obtain relevant approvals and meet the requirements of other legislation and regulatory functions. DWER has communicated with DMIRS who have confirmed that they are aware of the acceptance and disposal or titanium dioxide tailings at the premise. DWER has committed to forwarding the findings of the licence review and reviewed licence to DMIRS.

Key findings:

The Delegated Officer considers:

- The ongoing acceptance of titanium dioxide tailings at the Banksia Road will be regulated as a Category 5: premises on which ...(c) tailings or residue from metallic or non-metallic ore are discharged into a containment cell or dam.
- The facility may be subject to regulatory requirements in addition to those required under Part V of the EP Act.
- DWER understand that DMIRS are aware of the operations at the premises and the outcome of the licence review will be provided to DMIRS.

6.2 **Operations**

The premises accepts slurried tailings from titanium dioxide processing plants for containment in dedicated cells onsite, with leachate is collected and returned to the processing plants. Tailings are received from two plants - the Kemerton processing plant and the Australind finishing plant.

Physical and chemical properties of the waste were investigated by WML Consultants in 2011 as part of the works approval application to construct the MIC Cell, with updated analysis undertaken by Golder & Associates (Golder) in 2017 to support the Cell 2 Application.

The waste has a chemical composition predominantly made of iron (II) and iron (III) hydroxides, aluminium hydroxide, manganese hydroxide, magnesium hydroxide, calcium chloride, carbon, and titanium oxide. The waste also contains additional metals including aluminium, arsenic, cadmium, cobalt, copper, lead, manganese, magnesium, mercury, molybdenum, nickel, silver and zinc. The most common elements within leachate from the

waste are calcium, sodium and chloride, but potassium is also present. The waste is known to contain low levels of naturally occurring radioactive materials (NORM) including uranium and thorium.

Golder compared the 2017 characterisation sampling results to both the previous waste characterisation completed in 2011 by WML Consultants and the LWCWD. Golder determined the waste can be classified as a Class I waste. DWER has reviewed the characterisation data and found that all sampling results meet the waste classification for a Class I waste with the exception of Molybdenum that meets the classification of a Class III waste. DWER notes however, that the Australian Standard Leaching Procedures (ASLP), the procedures specified in AS 4439.3-1997 for assessing the leachability of wastes, sediments and contaminated soils was not followed for the sampling undertaken by Golder. The samples used for comparison with the LWCWD were collected from the leachate within from the titanium dioxide cells. Golder determined this to be representative of leachates that could be generated from contact with the solids, however, without following the ALSP, DWER identify there is potential for under or over reporting of concentrations.

The existing Licence does not require regular sampling or characterisation of the tailings and tailings leachate and additional regulatory controls will be considered for inclusion in the reviewed licence.

As part of the licence review, DWER sought advice from the Radiological Council. The Radiological Council confirmed that the site is regulated under the *Radiation Safety Act* for radiation, however as the content of the natural radionuclides in the waste is low, it presents a low radiological risk. The Radiological Council stated that under the *Radiation Safety Act*, Cleanaway is required to ensure that the dose to members of the public, including for locations offsite, does not exceed the public dose limit. From the Monitoring requirements imposed on the premises under the *Radiation Safety Act*, the Radiological Council have confirmed that there have been no issues of non-compliances to date.

6.3 Design and capacity

The titanium dioxide slurry cells were designed by the Applicant with consideration given to the Environmental Protection Authority Victoria's (EPA Vic) *Best Practice Environmental Management Guidelines for the Siting, Design, Operation and Rehabilitation of Landfills* (VIC BPEM) and the *Australian National Committee on Large Dams (ANCOLD) Guidelines for Tailings Dams; Planning Design, Construction, Operation and Closure, 2012.*

TDS Cell 1 was designed to accommodate 350,000 m³ of titanium dioxide tailings over a five-year period. Deposition commenced in mid-2013 and completed mid-2019. Based on current receival rates, TDS Cell 2 is estimated to have a 5-year design life before reaching capacity of an additional 350,000 m³.

All TDS Cells and associated leachate ponds and pipework were subject to Construction Quality Assurance (CQA) reporting requirements which were reviewed and approved by DWER.

6.4 Liner system and performance

6.4.1 Industrial tailings liner design

The liner details for the current and existing cells relating to TDS Cells are described in Table 8 below (from the base of the liner to the top):

Table 8:	Industrial	tailings	liner	construction

Cell	Liner construction
TDS Cell 1	 Layer 1: Subsoil beneath the cells consists a minimum of 15 meters of clayey silt and sand that has an in-situ permeability of between 10⁻⁷ and 1 × 10⁻¹⁰ m/s. The subsoil was reworked and compacted in layers not exceeding 150mm in thickness to a minimum 95% of maximum dry density and -2% to + 2% of optimum moisture content as per AS1289. Layer 2: Lower Geosynthetic Clay Liner (GCL) – GCL consisting of a layer of bentonite needle punched between two layers of geotextile and installed in direct contact with the engineered subsoil. Layer 3: 1.5 mm High Density Polyethylene (HDPE) overlying the lower GCL. Layer 4: Cushion/Protection geotextile - the composite lining system will be protected from the leachate collection system and overlying materials with a non-woven cushion/protection geotextile. Layer 5: Leachate Collection System - a 300-400mm mm thick layer of permeable gravel with an associated network of perforated collection pipes. The collection pipes direct leachate to the leachate collection sump. The leachate drainage gravel layer is covered with a separation geotextile.
TDS Cell 2 TDS Cell 2A	 Layer 1: Subsoil beneath the cells consists a minimum of 15 meters of clayey silt and sand that has an in-situ permeability of between 10⁻⁷ and 1 × 10⁻¹⁰ m/s. The subsoil was reworked and compacted in layers not exceeding 150mm in thickness to a minimum 95% of maximum dry density and -2% to + 2% of optimum moisture content as per AS1289. Layer 2: Lower Geosynthetic Clay Liner – GCL consisting of a layer of bentonite needle punched between two layers of geotextile and installed in direct contact with the engineered subsoil. Layer 3: 2.0 mm High Density Polyethylene (HDPE) overlying the lower GCL. Layer 4: Over-liner drainage collection system - comprising a network of geotextile wrapped perforated plastic pipes, embedded in a 400 mm thick sand filter layer will be provided. Layer 5: The drainage sand is protected from erosion by a 100 mm thick drainage aggregate. In addition to the liner design, TDS Cell 2 has been constructed with an underliner pressure relief system. The system provides a means of relieving under liner pressure that may arise from near-surface ground flow, should any occur.

6.5 Leachate extraction, collection, and storage

6.5.1 TDS Cell 1 Leachate Pond

The liner design of TDS Cell leachate ponds are described below in Table 9 (from the base of the liner to the top):

Leachate Pond	Liner construction
TDS Cell 1 Leachate Pond	 Layer 1: Subsoil beneath the cells consists a minimum of 15 meters of clayey silt and sand that has an in-situ permeability of between 10⁻⁷ and 1 x 10⁻¹⁰ m/s. The subsoil was reworked and compacted in layers not exceeding 150mm in thickness to a minimum 95% of maximum dry density and -2% to + 2% of optimum moisture content as per AS1289. Layer 2: Lower Geosynthetic Clay Liner (GCL) – GCL consisting of a layer of bentonite needle punched between two layers of geotextile and installed in direct contact with the engineered subsoil. Layer 3: 1.5 mm High Density Polyethylene (HDPE) overlying the lower GCL.
TDS Leachate Pond	 Layer 1: Subsoil beneath the cells consists a minimum of 15 metres of clayey silt and sand that has an in-situ permeability of between 10⁻⁷ and 1 × 10⁻¹⁰ m/s. The

Table 9: Industrial tailings leachate pond liner construction
• Layer 5. 2.0 min high Density r oryentylene (hDr L) overlying the lower GCL

6.5.2 Leachate extraction and storage

Following extraction from both the TDS Cell 1, TDS Cell 2 and TDS Cell 2A leachate is extracted to the TDS Cell 1 leachate pond prior to gravity flowing to the TDS leachate pond. Leachate stored in the pond will either evaporate or be collected to be returned for re-use as process water at the Titanium Dioxide processing plant.

The titanium dioxide tailings and the extracted leachate are considered a Controlled Waste as listed in Schedule 1 of the *Environmental Protection (Controlled Waste) Regulations 2004* (Controlled Waste regulations) – *Waste from the production, formulation, or use of inks, dyes, pigments, paints, lacquers or varnish.*

6.6 Separation distance to groundwater

The titanium dioxide cells and leachate containment infrastructure have been designed with a separation distance to groundwater of approximately 20 m. The Licence Holder's groundwater monitoring regime continues to monitor depth to groundwater and potential impacts to groundwater during operations.

6.7 Stormwater management

The stormwater management system has been designed to direct rainfall runoff to the existing stormwater pond, located to the southwest of TDS Cell 2, and immediately to the south of the TDS Leachate Pond. Surface water management structures have been designed to accommodate 1 in 100 year ARI rainfall event. Incidental rainfall in the basins of TDS Cells and the TDS Leachate ponds is contained and managed within the facilities in a similar manner to supernatant water and leachate.

Key findings:

The Delegated Officer considers that:

- The construction of the TDS Cell 1 and TDS Cell 2 meet the design requirements typical of Class III landfill cells.
- DWER has reviewed the characterisation data and found that all sampling results meet the waste classification for a Class I waste with the exception of Molybdenum that meets the classification of a Class III waste.
- There are minor variances in the liner construction of TDS Cells and leachate ponds. This is due to the liner systems being designed to meet a minimum hydraulic conductivity specification and not a minimum thickness. The HDPE liners installed in all TDS cells and ponds meet the required specifications.
- The Radiological Council confirmed that the site is regulated under the *Radiation Safety Act 1975* for radiation and presents a low radiological risk. The Radiological Council confirmed that there have been no issues of non-compliances to date.
- The existing Licence does not require regular sampling or characterisation of the tailings and tailings leachate. Additional regulatory controls will be considered for inclusion in the reviewed licence.

7. Landfill operation and management

The landfill operations encompass the closed and active solid waste cells, drainage infrastructure, stormwater collection dams and leachate collection ponds. The active putrescible landfill cells are not accessible to the general public, with waste accepted from contracted clients only.

7.1 Prescribed premises category

The landfill operations are regulated as a Category 64: Class II or III putrescible landfill site. This is still considered to be the appropriate category for these operations. The ongoing acceptance and processing of drilling muds are regulated as a Category 61: Liquid waste facility

7.2 Design and lifespan

Cleanaway has developed a whole of life model to understand future landfill cell construction and landfill cap staging plan based on the below assumptions:

- Receive up to 350,000 tonnes of landfill waste per annum;
- Achieve a landfill density of 0.94 tonne per m3, and
- Progressive rehabilitation of landfill cells in part or in full after reaching final waste contour.

The Delegated Officer notes that only Cell 7 and 8 are approved for landfilling and that any proposed future cells will be subject to all relevant approvals.

7.3 Liner system and performance

7.3.1 Landfill liner design

The liner details for the current and existing cells are described in Table 10 below (from the base of the liner to the top):

Cell	Liner construction
Cell 1 Cell 2	 Layer 1: Subsoil beneath the cells consists a minimum of 15 metres of clayey silt and sand that has an in-situ permeability of between 10⁻⁷ and 1 × 10⁻¹⁰ m/s. Layer 2: 300mm clay liner meeting hydraulic conductivity of less than 1 × 10⁻⁵ m/s. The clay liner was compacted in layers not exceeding 150mm in thickness to a minimum 95% of maximum dry density and -2% to + 2% of optimum moisture content as per AS1289. The liner drained to a central drainage sump from which leachate was extracted from the cell to the primary leachate pond. Layer 3: Cushion/Protection layer – consists of a 300 mm layer of sand for the protection of the clay liner.
Cell 3 Cell 4 Cell 5 Cell 12	 Layer 1: Subsoil beneath the cells consists a minimum of 15 metres of clayey silt and sand that has an in-situ permeability of between 10⁻⁷ and 1 × 10⁻¹⁰ m/s. The subsoil was reworked and compacted in layers not exceeding 150mm in thickness to a minimum 95% of maximum dry density and -2% to + 2% of optimum moisture content as per AS1289. Layer 2: Lower Geosynthetic Clay Liner (GCL) – GCL consisting of a layer of bentonite needle punched between two layers of geotextile and installed in direct contact with the engineered subsoil.

Table 10: Landfill liner construction

	 Layer 4: Cushion/Protection geotextile - the composite lining system is protected from the leachate collection system and overlying materials with a non-woven cushion/protection geotextile. Layer 5: Leachate Collection System - a 300 mm thick layer of permeable gravel with an associated network of perforated collection pipes. The collection pipes direct leachate to the leachate collection sump. The leachate drainage gravel layer is covered with a separation geotextile. Layer 6: Separation geotextile Layer 7: 350 mm sand drainage layer
Cell 6 Cell 7 Cell 8	 Layer 1: Subsoil beneath the cells consists a minimum of 15 metres of clayey silt and sand that has an in-situ permeability of between 10⁻⁷ and 1 × 10⁻¹⁰ m/s. The subsoil was reworked and compacted in layers not exceeding 150mm in thickness to a minimum 95% of maximum dry density and -2% to + 2% of optimum moisture content as per AS1289. Layer 2: Lower Geosynthetic Clay Liner (GCL) – 300 mm GCL consisting of a layer of bentonite needle punched between two layers of geotextile and installed in direct contact with the engineered subsoil. Layer 3: 2.0 mm High Density Polyethylene (HDPE) overlying the lower GCL. Layer 4: Cushion/Protection geotextile - the composite lining system is protected from the leachate collection system and overlying materials with a non-woven cushion/protection geotextile. Layer 5: Leachate Collection System - a 300- mm thick layer of permeable gravel with an associated network of perforated collection pipes. The collection pipes direct leachate to the leachate collection sump. The leachate drainage gravel layer is covered with a separation geotextile. Layer 6: Separation geotextile Layer 7: 350mm sand drainage layer

7.4 Leachate extraction, collection and storage

Leachate management revolves primarily around minimising the amount of leachate being generated to mitigate the risk of leachate migration and impacts to the surrounding environment. This is achieved by ensuring that there is adequate uncontaminated surface/storm water diversion away from the waste mass and that the appropriate final waste profile is attained, and subsequently that the waste is suitably capped as soon as is reasonably possible in order to shed surface water flow away from the waste mass.

Leachate is managed via a range of treatment options to reduce the volume within the landfill and prevent the annual accumulation of leachate on the site. The quantity of leachate generated during the operating life of the landfill is dependent on a range of site-specific factors including:

- Timing of when new landfill cells will be commissioned (summer or winter);
- Size of the landfill and area of exposed landfill liner;
- Quantity of waste within the landfill cells;
- Shape of the waste mass (slope angle);
- Operation of the landfill;
- Type of waste; and,
- Type and depth of cover material.

Leachate is extracted (either pumped or via gravity) from the existing landfill cells into the primary leachate pond.

A leachate balance assessment was prepared for the site in 2015 by Golder Associates, to estimate the leachate generation across the lifetime of the site. An updated leachate balance assessment was undertaken by Tonkin Consulting Pty Ltd (Tonkin) in 2021 to account for

changes at the premises, including the construction of additional landfill cells, additional leachate ponds and the installation of sprinklers in the leachate ponds. The 2021 balance model found that leachate generation exceeded the disposal capacity of the existing infrastructure in all stages of the site's operation and closure. A compliance inspection undertaken in August 2021 identified some material issues relating to not maintaining the required freeboard in the leachate evaporation ponds. Cleanaway is proactively addressing the issues identified, including installing additional sprinklers to all leachate ponds to increase evaporation. Additionally, Cleanaway has begun carting leachate for use as dust suppression on the active tipping face as per the licence conditions to return freeboard to compliance.

The Delegated Officer notes that there are currently no assessment or reporting requirements for operational leachate head across the liner floor and there is not enough information to adequately demonstrate compliance with leachate management and disposal capacity.

The Delegated Officer has identified that the existing Licence does not require regular sampling or characterisation of leachate generated by the landfill. Without characterising the landfill leachate there is uncertainty over whether the groundwater monitoring suite is adequate.

7.4.1 Leachate ponds

Following extraction, leachate is directed (either pumped or via gravity) into the primary leachate pond where it is then pumped to one of three large leachate storage and evaporation ponds. The leachate pond liner specifications are described below in Table 11:

Leachate Pond	Liner construction
Primary Leachate Pond Leachate Evaporation Ponds	 Layer 1: Subsoil beneath the cells consists a minimum of 15 metres of clayey silt and sand that was reworked and compacted to achieve a minimum in-situ permeability of 1 x 10⁻⁸; Layer 2: Geosynthetic Clay Liner (GCL) – GCL consisting of a layer of bentonite needle punched between two layers of geotextile and installed in direct contact with the engineered subsoil; and Layer 3: 1.5 mm High Density Polyethylene (HDPE) overlying the GCL.

Table 11: Landfill leachate pond liner construction

A summary of the Leachate collection and recirculation system is outlined below:

- All landfill leachate ponds are HDPE lined to achieve a permeability of at least <1x10⁻⁹ m/s or equivalent.
- All leachate from the existing landfill cells, including Cell 8 once operational, is directed into a dedicated, cell specific, leachate collection sump, from where the leachate is extracted, either pumped or via gravity, into the primary leachate pond;
- The primary leachate pond has a capacity of 7000 kL;
- The primary leachate pond transfers leachate via pump into leachate evaporation ponds 1, 2 and 3 with capacities of 7848 kL, 8033 kL and 7000 kL respectively;
- The collective capacity of the leachate ponds is 29,881 kL;
- Leachate evaporation ponds 1, 2 and 3 have an operating depth of 2.0 meters allowing for 0.5 m freeboard; and
- Leachate freeboard is maintained via evaporation, and if required, recirculation onto the active tipping area.

The proposed ponds have been designed to sufficiently contain all leachate and stormwater produced as a result of a 1% AEP rainfall event.

Key findings:

The Delegated Officer considers that:

- The category determination of Category 64: Class II or III putrescible landfill site remains the relevant category for the waste disposal activities at the premises.
- The category determination of Category 61: Liquid waste facility remains the relevant category for the acceptance, processing and disposal of drilling muds at the premises.
- The design and construction of the landfill cells (excluding Cells 1 and 2 which were designed to Class II standard), the primary leachate pond and the leachate evaporation ponds are consistent with the specification expected for Class III landfills. The suitability of the construction in the context of the site's location will be considered in the risk assessment.
- The Licence Holder does not routinely monitor leachate levels within the active or closed landfill cells. The volume of leachate held within the landfill cells and how the leachate head may be influencing the rate of leachate seepage through the liner is therefore uncertain.
- The most recent compliance inspection of the premises identified that the freeboard required by the existing licence was not being maintained on the leachate evaporation ponds.
- A leachate balance assessment completed in 2021 balance found that leachate generation exceeds the disposal capacity of the existing leachate infrastructure in all stages of the site's operation and closure.
- The data gap identified for leachate levels within the landfill cells does not allow the leachate balance assessment model to be validated or may infer that the assessment may be too conservative.
- Additional regulatory controls will be considered for inclusion in the reviewed licence to ensure that data gaps are addressed.

7.5 Waste acceptance

The existing licence allows for the disposal of 350,000 tonnes per year of Class II and III waste and 353,000 cubic metres of Category 61 liquid waste. Table 12 below describes a summary of the waste received at the premises for the most recent reporting periods.

 Table 12: Waste receival summary

Wasto type	Tonnes Per Annual Period				
waste type	2019	2020			
All Waste Types	344227.35	335511.55			
Contaminated Solid Waste	319370.20	318673.74			
Inert Waste Type 1	16620.71	14594.99			
Inert Waste Type 2	-	-			
Putrescible Waste	1118.83	763.58			

Wasto turo	Tonnes Per Annual Period			
waste type	2019	2020		
Special Waste Type 1	374.06	324.54		
Special Waste Type 2	0.78	-		
Processed Septage	1776.56	1154.70		
Cristal Pigment Slurry	153558.13	155132.58		
Drill Muds	796.25	505.90		

Following compliance inspections, the two recent prosecutions and the giving of an EPN, Cleanaway have acknowledged deficiencies in the waste acceptance procedures at the premises. Cleanaway subsequently developed and implemented a new Waste Acceptance Program that seeks to ensure that only wastes authorised by the licence are accepted for waste disposal. The implemented Waste Acceptance Program includes the following control measures:

- A controlled site entrance that includes a weighbridge that is staffed by trained and experienced personnel;
- A data management system that includes recording of all incoming waste loads;
- An area dedicated to undertaking load inspections, including random inspections, and sampling of incoming loads;
- A communication system linking the weighbridge staff and the site operating personnel; and
- Visual inspection of waste during unloading and deposition by operating personnel at the tipping face.

During compliance inspections to the premises conducted on 11 November 2020 and 25 August 2021, DWER confirmed that Cleanaway have implemented the new waste acceptance procedure. DWER noted that Cleanaway were requiring customers to submit National Association of Testing Authorities Australia accredited laboratory results with the Cleanaway waste disposal application form, prior to sending any contaminated waste to the premises. DWER officers verified that Cleanaway is receiving supporting documentation to demonstrate class III acceptance criteria before accepting the waste to the premises.

In the event that prohibited waste is identified in an incoming vehicle, Cleanaway's procedures require the vehicle to be refused entry and to be redirected to a facility that can receive such wastes. In the event that prohibited waste is found during a load inspection or during waste deposition, their procedures require the load to be rejected and removed from the site by the transporter. The transporter, waste generator and authorities will be notified of rejected waste loads. Records of loads that are rejected will be documented.

Key findings:

The Delegated Officer notes that:

- Cleanaway has acknowledged the deficiencies in their previous waste acceptance procedures and have developed and implemented a new Waste Acceptance Program at the premises.
- DWER compliance inspections since November 2020 have confirmed the on-going

implementation of the new Waste Acceptance Program and inspections have not identified non-conforming waste at the premises since the new Waste Acceptance Program has been implemented.

7.6 Landfill Cover

Daily landfill cover, among other things, is applied as a means of reducing odour, dust, windblown waste and the attraction of birds and vermin. Cover is also important to prevent the spread of fire, should one occur, across the surface of the waste mass.

The existing licence outlines daily cover requirements and the approved cover materials, including; clean fill, inert waste and solid waste as detailed in Table 13. The existing licence also requires that sufficient stockpiles of cover are maintained on the premises at all times to fulfil the cover requirements.

Waste type	Material	Depth	Timescales
Clean Fill	No cover requirement		
Special Waste Type 1 Special Waste Type 2	Either: (a) 300 mm of Type 1 Ir Clean fill; or (b) 1,000 mm of Solid w	nert waste or vaste	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.
Contaminated Solid Waste Drill muds Inert Waste Type 1 Inert Waste Type 2 Putrescible Waste	Type 1 Inert waste or Clean Fill	150 mm	As soon as practicable and not later than the end of the working day that the waste was deposited.
Processed Septage	Type 1 Inert waste or Clean Fill	300 mm	As soon as practicable and not later than the end of the working day that the waste was deposited.
All waste types (excludes		1,000 mm	Within 3 months of achieving an interim waste contour.
Cristal Pigment Slurry)		2,000 mm	Within 18 months of achieving final waste contours.

Table 13: Existing cover requirements

Landfill cover requirements for highlight odorous wastes were recently included in the existing licence following an appeal determination relating to a licence amendment allowing the operation of Cell 7.

As detailed in section 4.3.3, the Licence Holder was convicted for breaching its licence conditions relating to the application of landfill cover and the type of landfill cover being used. Subsequent inspections identified sufficient stockpiles of cover material available at the tipping face that is to be used for daily cover. The licence holder advised compliance inspection officers that landfill cover was applied appropriately as per the licence conditions at the end of each day. As the most recent compliance inspection was conducted during operational hours,

the compliance inspection officers could not verify compliance with the condition.

Key findings:

The Delegated Officer notes that:

- The additional cover requirements for highly odorous wastes imposed on the existing licence following the recent Minister's recent appeal determination on the licence amendment for Cell 7 will be carried forward and imposed on the reviewed licence.
- The risk assessment will consider the on-going extent and suitability of existing landfill cover requirements.

7.7 Final cover and capping

Final cover is the layer of material that is placed over the waste mass to control emissions and discharges during the period between the final waste levels being reached and capping being installed.

Final cover should be used to reduce rainwater infiltration into the waste mass and therefore minimise the generation of leachate in the landfill cell. Final cover is also used to minimise odour and dust emissions from the waste, windblown litter, the presence of scavengers and vermin and the risk of fire spreading across the site.

Capping has the same objective as final cover, however infiltration rates through final caps are expected to be much lower than that for final cover. Capping also prevents contaminated run-off from the landfill cells, minimizes the escape of landfill gas and prepares the site for its future intended use.

Ideally capping should be installed progressively throughout the life of the landfill as each cell is completed and normally within 12-18 months of reaching final waste levels.

The existing licence includes cover requirements of 2m of clean fill within 18 months of achieving final waste contours. Based on information provided by Cleanaway, the Delegated Officer understands that all landfill cells on the premises have achieved interim waste contours with limited sections of cells having achieved final waste contours. Cleanway proposed to move waste disposal operations back into previously landfilled cells to bring them up to final waste contours. This is intended to occur when sufficient cells have been filled to provide a large enough platform for operational vehicles to safely operate.

All landfill cells, whether at interim or final waste contours have been provided with 2m of cover consisting of low permeability soils but the progressive final capping of landfill cells has not occurred. Requirements for progressive final capping, capping design and timeframes are not included within the existing licence.

Cleanaway have advised DWER that final capping of the areas of cells that have reached final waste contours is pending the outcome of a phytocap trial. Cleanaway has completed an in-situ soil investigation to consider the potential to move from the proposed synthetic cap design to a phytocap at the premises. Synthetic caps provide a physical barrier to reduce the movement of moisture through the cap and into the waste. For a phytocap, the control of moisture movement into the completed cell is provided by the hydraulic properties of the soil and the water use requirements of the plants matching the net moisture input from climate. A 2 year phytocap trial commenced in 2019 on the southern portion of Cell 5. The performance monitoring report of the trial is due to be provided to DWER by December 2021, upon completion of the two-year monitoring period.

Information provided in Version 5 of Banksia Road Landfill Rehabilitation and Closure Plan (March 2021), states that final capping of the landfill is expected to be undertaken over 10

rehabilitation stages, with final capping commencing in February 2022 as shown in Table 14 below:

Rehabilitation Stage	Cells	Hectares	Capping Date
1	5	4.40	February 2023
2	1 2	2.60	December 2023– March 2024
3	12A	2.20	January 2025 – March 2025
4	Part 7, Part 3 & 4 Part 4B, Part 12, Part 15	3.13	December 2027 – March 2028
5	Part 3 & 4, Part 4B Part 12	4.50	December 2025 – March 2026
6	Part 3 & 4, 6, 7	3.90	December 2026 – March 2027
7	Part 7-10	6.93	December 2031– March 2032
8	Part 15-17	6.22	December 2039– March 2040
9	11-14	6.45	December 2044– March 2045
10	18-20	7.35	December 2050– March 2051

Table 14: Proposed landfill capping events

The capping campaigns are proposed to commence in summer to limit wet weather delays and allow for vegetation planting in autumn or winter.

The existing licence conditions do not impose a requirement to cap the titanium dioxide disposal cells.

Key findings:

The Delegated Officer notes that:

- All landfill cells that have achieved interim waste contours have been provided with 2m of final cover consisting of low permeability soils which will limit ingress of rainwater.
- Only limited sections of landfill Cells have achieved final waste contours and Cleanway intends to move back into previously landfilled cells to bring them up to final waste contours. This is intended to occur when sufficient cells have been filled to provide a large enough platform for operational vehicles to safely operate.
- Progressive capping of landfill cells has not occurred.
- The lack of capping across the site means that leachate generation is not being mitigated to the extent that would be achieved had completed cells been progressively capped.
- Cleanaway has been trialing a photocap trial to determine the capping design for the site. The results of this trial are due to be provided to DWER by December 2021, upon completion of the two-year monitoring period.
- The capping schedule put forward by Cleanaway covers an extended period and will allow some Cells to remain uncapped until 2028.
- Requirements for progressive capping, capping design and completion timeframes

are not included within the existing licence.

- There is no existing requirement for the titanium dioxide tailings to be capped. The risk assessment will consider whether additional controls are required in relation to the capping of this waste, noting that the tailings dry out once disposed of in the cell and could potentially be a source of dust
- Final capping of previously landfilled cells is of a high priority. Additional controls will be considered in the reviewed licence to ensure final waste contours and final capping is undertaken in a timely manner.

7.8 Landfill gas management

In 2013, a landfill gas extraction system was installed under Works Approval W5301/2012/1. The works approval assessed the specifications of the landfill gas infrastructure and determined that the 400 - 2,000 m³/hr enclosed biogas system will destroy any contaminants including dioxins and furans.

The initial works approval stated that additional vertical extraction wells would be installed at a later date to more efficiently transfer landfill gas to the flare. Cleanaway was required to notify DWER of the scope and timeframes of any proposed expansion of the landfill gas collection and management system at least 6 months prior to any expansion occurring. Cleanaway submitted a proposal to DWER on 21 December 2020 to meet the requirement of the licence and expand the landfill gas management infrastructure. The existing and proposed expansion of the landfill gas network will extend the landfill gas well extraction network through cells 3, 4, 4B, 12, through the eastern and southern section of cell 5 and provides for the installation of horizonal wells in Cells 6 and 7. The proposed expansion of the landfill gas network does not include vertical wells in Cell 6, 7 or 8.

The proposal was reviewed by DWER to determine that it meets the requirements of the licence and the original landfill gas infrastructure as initially assessed in the works approval. The Delegated Officer wrote to Cleanaway on 18 June 2021 confirming that the proposal meets the requirements of the condition and that the design and construction of the landfill gas, condensation and utilisation (flaring and engine) infrastructure is consistent with the assessment undertaken under works approval W5301/2012/1.

The on-going suitability of the flare to deal with the landfill gas quantities and flow rates being generated by the closed cells is not addressed in the existing licence. Should the flare be undersized, there could be increased risks of odour and lateral landfill gas migration.

The current licence requires Cleanaway to undertaken monitoring and reporting of landfill gas parameters on a monthly basis for the parameters specified within the licence. This monitoring is undertaken on extracted landfill gas from within the completed landfill cells with no landfill gas monitoring wells installed outside of the landfill cells. Should a parameter fall outside of the corresponding trigger level the licence holder is required to undertake further sampling and assess the potential for a landfill fire to be occurring within the landfill. Through a review of literature and the reporting submitted to date, the parameters within the current licence have been found to be unreliable and not a true indicator of a landfill fire occurring at the premises. A more accurate indicator of a landfill fire within a landfill is the measurement of Landfill gas temperature at the gas extraction well. According to the *British Columbia Ministry of Environment Landfill Gas Management Facilities Design Guidelines*, (2010) it is expected that landfill temperatures are in the order of 30 to 40 degrees Celsius during the stable final phase of methanogenesis.

Fires may occur entirely under the cover of the landfill and may not be visually present to site employees. A list of signs that landfill fire may be presently occurring or have occurred include:

- Monitoring data shows high O₂, high CO (> 1,000 ppm), and high LFG temperature (> 60 degrees Celsius);
- Accelerated landfill settlement in localized areas;
- Impacted infrastructure such as melted wellheads or piping;
- Smoke, odour, or residue; and
- Vacuum conditions present within the well field.

Regular monitoring of the gas collection system will also facilitate the prevention and early detection of fires, enable balancing of the gas field and ensure that landfill gas is being extracted efficiently with due regard to migration. A landfill fire may be officially confirmed through the use of field equipment monitoring and laboratory testing for incomplete combustion compounds such as carbon monoxide. Generally, carbon monoxide monitors are not included as part of the standard monitoring package for a landfill gas management system, but samples can be sent to a laboratory for analysis should the initial field test be outside the adopted trigger level.

The need to extend the landfill gas network to all closed cells and for monitoring to be undertaken for lateral landfill gas migration will be considered in the risk assessment to determine whether additional controls are required.

Key findings:

The Delegated Officer considers that:

- Cells 1, 2 and the western portion of Cell 5 benefit from active landfill gas management;
- Active landfill gas management is approved for installation in Cells 3, 4, 4B, 12 and the eastern and southern sections of Cell 5 but has not yet been installed. The expansion of the landfill gas management infrastructure will provide a good coverage for those cells;
- Horizontal wells have been installed in landfill Cells 6 and 7. No vertical wells exist in these Cells.
- No LFG monitoring occurs outside of the landfill cells. The requirement for landfill gas monitoring wells to be installed to monitor for lateral migration will be considered in the risk assessment;
- Screening criteria and reporting to assess the potential for a landfill fire to be occurring within the landfill have been found to be unreliable and not a true indicator of a landfill fire occurring at the premises. The requirement for changes to and/or additional screening criteria and reporting will be considered in the reviewed licence.
- The existing licence does not require an assessment of the on-going suitability of the flare to deal with the landfill gas quantities and flow rates being generated by the closed cells to mitigate odour and potential landfill gas migration. The requirement for additional controls will be considered in the reviewed licence.

7.9 Separation distance to groundwater

The landfill cells and leachate containment infrastructure have been designed with a separation distance to groundwater of approximately 20 m. The Licence Holder's groundwater monitoring regime continues to monitor depth to groundwater and potential impacts to groundwater during operations.

7.10 Stormwater management

Stormwater management systems should be designed to ensure that stormwater that contacts the waste does not cause an adverse impact on surface water or groundwater and that all water that comes into contact with waste is directed to the leachate management system.

The surface water management system at the site includes:

- Run-on Control System to prevent surface water flow onto the active portion of the landfill; and
- Run-off Control System to collect and control the surface water run-off from the active area of the landfill.

Stormwater management is accomplished by a combination of methods including establishing and maintaining grades, constructing bunds and swales, and redirecting the water to the dedicated stormwater containment infrastructure. Sediment control features have been designed to allow settlement under gravity. The stormwater management system has been upgraded over the years through licence amendments to ensure stormwater is controlled effectively on site. Site stormwater infrastructure includes:

- Perimeter drains to intercept flows and prevent stormwater from leaving the premises;
- Internal drains to direct surface water run-off into the active landfill area;
- Stormwater ponds (Referred to as Stormwater Ponds 1 and 2) for retention of stormwater; and
- Sedimentation basins to promote settlement of suspended solids.

In mid-2019 the stormwater drain along the southern boundary of the premises was observed to be failing at a number of locations along its length. The failures were primarily due to erosion of the drain formation, resulting in surface water flowing into the adjacent conservation park. A review of the drain and the surrounding terrain identified that the drain failed in a number of locations where the original geotextile drain liner had either been damaged by movement in the drain formation or had degraded under UV exposure (IW Projects, 2021). This resulted in stormwater escaping through the drain liner and ultimately eroding the side wall and base of the drain such that stormwater flowed out of the drain and onto the adjacent conservation park fire break. In some locations the level of the adjacent fire break was lower than the level of the drain. This led to significant erosion and resulted in large portions of the drain being washed away (IW Projects, 2021).

Cleanaway submitted a licence amendment application on 18 March to address the erosion and stormwater upgrades. The southern stormwater drain was redesigned to incorporate a 'meandering' design to minimise the removal of native vegetation.

A DWER specialist confirmed that the drain was adequately designed with a focus on accommodating peak flows without overtopping or erosion for a 1 in 100 year ARI rainfall event. The construction and operation of the southern stormwater drain upgrade was approved under a licence amendment issued on 28 May 2021. The Delegated Officer notes that the environmental compliance report has not yet been received for the construction of the southern stormwater drain.

Based on information provided with the above licence amendment, the model outputs presented in Attachment 8b of Golder's Report, *Stormwater Management Plan* identify that the stormwater system's total design volume is 108,400 m³, with a required storage volume of 84,400 m³. The overall system therefore is suggested to have a total excess capacity of 24,000 m³.

During the licence review, Cleanaway submitted additional stormwater modeling undertaken by Golder to include storm durations of up to 7 days. Based on the modelling and information provided, storm durations of between 9-hours to 24-hours were determined to be critical for stormwater storage volumes at the premises. The modelling confirms that the inclusion of storm durations of up to 7 days does not increase the risks relating to volume, peak flow and velocity as previously modelled for storm event periods up to 3 days. Golder also confirmed that the stormwater design and volume calculations assume that no infiltration or seepage occur from any storage infrastructure (lined storage cells) and that stormwater pond 1 is at capacity (i.e. fully filled) with stormwater pond 2 and the western storage areas to be dry/empty.

Based upon a review of available aerial imagery and information gathered during licence inspections, there is evidence that both the Primary and Secondary stormwater ponds hold water year-round. It is currently unknown if these stormwater detention volumes present year-round impact the ability of the stormwater management system of containing a 1 in 100 year ARI rainfall event of a 7 day duration.

A part of the licence review, the department sought information from DBCA relating to vegetation health in the Dardanup Conservation Park. DBCA provided the following information to the department regarding vegetation health:

- The vegetation within the Conservation Park is of an 'Very Good to 'Excellent' condition as per the Keighery (1994) vegetation condition scale;
- There are some signs of dieback presence along the southern boundary however only the boundary has been mapped for *Phytophthora cinnamomi; and*
- Intensified concentration of water drainage can exacerbate the impacts of *Phytophthora cinnamomi*.

A DBCA dieback interpreter advised, following analysis for the presence of dieback along the southern boundary that "The increase in disease occurrence is directly associated with water runoff through infested soil, off the southern face of the bund wall, inadvertently allowing for rapid water movement (along with their ineffective drainage) which is acting as a vehicle for disease distribution along the northern boundary of the Conservation Park".

Key findings:

The Delegated Officer considers that:

- The stormwater management system has recently been upgraded to address erosion issue on the southern boundary. The Environmental Compliance Report for these works has not yet been submitted to the department;
- The current stormwater capture and drainage infrastructure is designed to manage a 1% AEP rainfall event whilst minimising erosion;
- Dieback observed in the Dardanup Conservation Park along the southern boundary has been associated with increased water run-off through infested soil. Additional requirements for stormwater control along the southern boundary will be considered in the risk assessment.
- The inclusion of modelling for storm durations of up to 7 days does not increase the risks relating to relation to volume, peak flow and velocity as previously modelled for storm event periods up to 3 days.
- There is uncertainty in relation to the potential for normal operating water levels in stormwater pond 1 and stormwater pond 2 to impact the ability of the stormwater management system to contain a 1% AEP rainfall event of a 7 day duration. This will be considered as part of the risk assessment for stormwater management to determine whether further licence controls are required.

8. Environmental monitoring and sampling

8.1 Groundwater monitoring

8.1.1 Hydrogeological context and understanding

The Existing Licence includes conditions requiring the monitoring of groundwater. Originally nine groundwater sampling locations were installed in 2005. A shallow and a deep nested pair of wells were installed at each of these locations. Several of these wells were subsequently interpreted to be screened across both the superficial and Leederville aquifers and as a result, original wells, SE1, SE5, SE7 and SE9 deep (D) and shallow (S), were replaced in May 2018. Monitoring wells screened across multiple aquifers may (under the correct hydrogeological conditions) provide a preferential pathway for contaminants of concern to migrate between the aquifers. The current groundwater monitoring network is presented below in Figure 10.



Figure 10: Groundwater monitoring bore network

The most recent groundwater levels provided to DWER were collected in the March and October 2020 monitoring events with groundwater levels summarised as follows:

- Depth to groundwater ranged from 24.95 mbgl (SE10S, October 2020) to 49.04 mbgl (GW5S, March 2020). The deepest groundwater is reported in the east of the site where topography rises.
- Groundwater elevations ranged from 33.42 mAHD (SE9D, March 2020) to 57.17 mAHD (GW5S, October 2020)

Groundwater contour map for the October 2020 monitoring event as prepared by 360 Environmental is presented in Figure 11 and Figure 12.



Figure 11: Superficial aquifer groundwater level contours (October, 2020)



Figure 12: Leederville aquifer groundwater level contours (October, 2020)

The 360 Environmental Hydrogeologic Risk Assessment and Groundwater Program Review report (March, 2021) recommended that additional monitoring wells are required to address data gaps in the spatial coverage of the monitoring network. The recommendations made by 360 Environmental include:

- Inspect the integrity of GW7D and, if necessary, redrill the well;
- Consideration should be made for the decommissioning and replacement of the deep monitoring wells screened over the superficial and Leederville aquifer (SE1D, SE3D, SE6D, SE7D, SE8D and SE10D) if impacts to their shallow well pairs arise;
- Replace well pairs if they are destroyed during operations; and
- Wells should be paired with the shallow well targeting the saturated zone within the superficial aquifer and the deep well screened and isolated in the upper portion of the Leederville Aquifer.

A DWER experienced hydrogeologist reviewed the distribution of monitoring bores at the Banksia Road site as outlined within the 360 Environmental report. Although the review identified that the currently installed monitoring well network is generally suitable for a landfill facility of this type and size, the review identified a data gap in the information that was provided, being the absence of a discussion on, and consideration of the potential significance of seasonally perched lenses within the superficial formation. This is important, as seasonally perched groundwater lenses could provide a pathway for the transport of contaminants from the landfill site to receptors, such as deep-rooted vegetation that accesses these perched lenses.

8.1.2 Groundwater quality

Based on the site history, DWER considers that the main sources of potential contamination and their associated chemicals of potential concern (COPCs) are summarized in Table 15. COPC's are used as indicator species to identify potential impacts from landfill cells and the titanium dioxide TSFs:

Source	Potential COPC's		
Leachate generated from current and future landfill material within the landfill cells	Physicochemical parameters (pH, EC, TDS, chloride, sulfate, and sodium), metals, cyanide, fluoride, non-chlorinated organics(hydrocarbons, cresols, benzene, toluene ethylbenzene, phenols, polycyclic aromatic hydrocarbons, volatile and semivolatile		
Landfill leachate contained in lined leachate ponds	organic compounds), chlorinated organics (pesticides, polychlorinated biphenyls, solvents), nutrients, phenols, pathogens, persistent organic pollutants, PFAS.		
Leachate from titanium dioxide tailings storage	Radionuclides, metals, sulfides		
Seepage from the stormwater dams	TDS, major cations and anions, metals, hydrocarbons		
Fire-fighting response	PFAS		

Table	15: Pc	otential	chemicals	of	potential	concern	COPC	5)
1 4010		///////	ononiouio	•••	potontiai	001100111		•

Note: Radionuclides are monitored and regulated under the Radiation Safety Act.

Sample collection, field quality assurance and quality control (QAQC) and handling is undertaken in general accordance with the National Environment Protection (Assessment of Site Contamination) Measure (as amended 2013) (NEPM). Samples are analysed by NATA accredited laboratories, with laboratory QAQC techniques provided in accordance with NEPM requirements.

Groundwater has been routinely analysed for heavy metals, major ions, nutrients,

hydrocarbons, PFAS/PFOA and pesticides, with results compared to assessment criteria, as listed below, based on the identified environmental value of the site and the identified sensitive receptors:

- Australian Drinking Water Guidelines (ADWG) NHMRC and NRMMC 2011 (v3.5 updated 2018) on the basis that the Leederville aquifer serves as the primary domestic water supply for the Dardanup area;
- Long-term Irrigation Water Guidelines (LTIG) and Stock Water Guidelines (SWG) -ANZECC and ARMCANZ 2000. The land use to the west of the site is predominantly agricultural, including crop and livestock farming. The presence of elevated water storage tanks and windmills indicate that groundwater is abstracted by landowners for livestock water and irrigation purposes;
- Non-potable Groundwater Use Guidelines (NPUG) DoH 2014. Abstracted groundwater from surrounding land users may also potentially be used for non-potable uses; and
- PFAS National Environmental Management Plan V 2.0 (January 2020). Applicable for the assessment of human health and ecological risks associated with PFAS compounds.

Comparison to freshwater guidelines is not considered relevant for the premises on the basis that superficial aquifer is greater than 20 mbgl and does not directly interact or discharge to any freshwater wetlands, rivers or groundwater dependent ecosystems. There is potential for seasonally perched groundwater lenses to support dependent vegetation. This data gap will be considered as part of the risk assessment.

pH values historically range between 3.9 and 6.8. This indicates acidic to slightly acidic conditions across the premises with no clear trends evident from the reviewed data;

The superficial aquifer is currently sampled from monitoring wells GW1S, GW5S, GW7S, GW9S and SE10S. Monitoring well GW5S is located approximately 500m upgradient from current and historical landfilling activities and is considered to be an accurate reflection of background levels. GW1S is located down/cross-gradient of the unlined landfill cells (Cells 1 and 2) and cross-gradient from the titanium dioxide tailings cells, and GW7S, GW9S and SE10S located downgradient from landfilling and leachate storage infrastructure. The analytical results for the superficial aquifer for the 2013 - 2021 monitoring period are summarised below:

- Dissolved metals have been reported historically in all shallow groundwater monitoring wells with the highest concentrations reported in the upgradient monitoring well GW5S and the cross/down-gradient GW1S:
 - Aluminium has been reported at concentrations exceeding the NPUG in groundwater monitoring well GW5S and GW7S.
 - Nickel was reported above the ADWG in monitoring well GW5S during the 2020 monitoring period.
 - Total iron has been reported in most shallow monitoring wells above the LOR with the highest concentrations reported in the upgradient monitoring well GW5S at concentrations exceeding the NPUG.
 - Manganese has been reported in most shallow monitoring wells above the LOR reported above the ADWG in GW1S, GW9S and GW5S.
- Chloride concentrations recorded in the monitoring wells GW1S and GW5S have historically been above NPUG and LTIG with the highest value 737 mg/L being recorded in GW5S in October 2020;

- Total nitrogen has been reported in all shallow groundwater wells at concentrations of <10 mg/L with concentrations above the LTIG reported at SE1S, GW7S and SE10S;
- Ammonia has been detected in concentrations above the LOR at all groundwater wells and has been detected at concentrations above NPUG in GW5S. All reported concentrations are similar across the site;
- Total phosphorus has been reported in concentrations sporadically above LOR and above LTIG in groundwater wells SES1, SE9S, SE10S, GW1S, GW5S and GW7S with the highest concentrations being detected in the upgradient well;
- Hydrocarbons have historically been reported in upgradient monitoring well GW5S and cross/down-gradient monitoring well GW1S only. Concentrations have been reported at and slightly above the ADWG at the upgradient monitoring well GW5S and above the ADWG and NPUG at monitoring well GW1S located down/cross-gradient of the unlined landfill cells (Cells 1 and 2) and cross-gradient from the titanium dioxide tailings cells;
- PFAS/PFOA have predominantly reported below LOR for all shallow groundwater monitoring wells. Historically there have been occasional, sporadic total PFAS/PFOA results above the laboratory limit of reporting in several shallow monitoring wells, including the upgradient shallow well GW5S, cross-gradient well GW1S and downgradient wells GW7S and SE10S. These reported concentrations have all been below the selected PFAS National Environmental Management Plan screening criteria except for SE10S which reported concentrations of the sum of PFHxS and PFOS above drinking water values;
- Polycyclic aromatic hydrocarbons (naphthalene and phenanthrene) have been sporadically reported in monitoring wells at low concentrations;
- No phenols have been reported;
- No pesticides have been reported; and
- No PCBs, TCE/PCE or triazines have been reported.

The analytical results for the superficial aquifer are consistent between monitoring events and the concentrations reported in the down/cross gradient wells are consistent with or less than the concentrations of the upgradient wells.

The Leederville aquifer is sampled from the following wells: GW1D, GW7D, GW9D, SE1D, SE3D, SE4D, SE7D, SE9D and SE10D. The upgradient deep monitoring well (SE5D) has been reported as typically dry or has insufficient water for sampling since 2018. This is in line with the regional observations of the Leederville aquifer being unconfined near the eastern boundary of the landfill site, with the aquifer receiving direct recharge from infiltrating rainfall immediately to the east of the landfill site. GW1D is located down/cross-gradient of the unlined landfill cells (cells 1 and 2) and cross-gradient from the titanium dioxide tailings cells. All other deep monitoring wells are located downgradient from landfilling and leachate storage infrastructure. The analytical results for the Leederville aquifer for the 2013 - 2021 monitoring period are summarised below:

- Dissolved metals have historically been reported below the LOR with the following exceptions:
 - Aluminium has been reported in all deep monitoring wells with concentrations observed above the NPUG in monitoring wells GW1D and GW7D;
 - Total iron has been reported in most deep monitoring wells above the LOR with the highest concentrations reported in monitoring well GW1D; and
 - Manganese has reported in most shallow monitoring wells and sporadically has

been reported above the ADWG in monitoring well GW9D and GW7D.

- Chloride concentrations in GW1D were reported above NPUG guidelines during the 2020 monitoring period. It is noted that the chloride concentrations recorded from GW5S (upgradient well) have historically been above NPUG with the highest value 357 mg/L being recorded in October 2016;
- Total nitrogen has predominantly been reported at concentrations of <10 mg/L with the highest concentrations often reported at SE6D located along the northern premises boundary at concentrations above the LTIG;
- Ammonia has been predominantly reported below or at the LOR. All reported concentrations are similar across the site and have not exceed adopted assessment criteria;
- Total phosphorus has been predominantly reported below the LOR with sporadic reported concentrations of up to 0.91 mg/L observed in monitoring wells GW1D, SE3D, SE6D and GW7D;
- Hydrocarbons have not been reported above the adopted assessment criteria in deep monitoring wells;
- PFAS/PFOA have been predominantly reported below LOR, however, historically there
 have been occasional, sporadic total PFAS/PFOA results above the laboratory limit of
 reporting in monitoring wells SE1D, SE3D, SE6D, SE7D, SE9D, SE10D, GW1D,
 GW7D and GW9D. These reported concentrations have all been below the selected
 PFAS National Environmental Management Plan screening criteria;
- Naphthalene has sporadically been reported at low concentrations with historical concentrations generally below <0.05 µg/L;
- No phenols have been reported in samples collected from the deep groundwater monitoring wells;
- No pesticides have been reported in samples collected from the deep groundwater monitoring wells; and
- No PCBs, TCE/PCE or triazines have been reported in samples collected from the deep groundwater monitoring wells.

The analytical results for the Leederville aquifer are consistent between monitoring events and the concentrations reported in the down/cross gradient wells are consistent with or less than the concentrations of the upgradient wells.

In order to further understand the groundwater and leachate chemistry at the premises, leachate ponds were analysed for heavy metals, major ions, nutrients, hydrocarbons, PFAS/PFOA and pesticides. The results indicate:

- The dissolved metal concentrations reported in the groundwater chemistry are not representative of the leachate pond concentrations;
- Ammonia, total nitrogen, and total phosphorus were reported in leachate ponds at concentrations greater than 40 times those reported in the groundwater monitoring wells. Significantly, the shallow and deep wells located in close proximity to the leachate ponds do not show elevated nutrients;
- Hydrocarbon concentrations in the leachate ponds were reported at concentrations greater than ten times those reported in the groundwater monitoring wells. Hydrocarbons have only been reported in 2 of the 17 monitoring wells sampled in the 2020 monitoring period with one of the detections reported in the upgradient monitoring well GW5S;

- Concentrations of major cations were reported in leachate at concentrations between 8 and 300 times those reported in the shallow and deep groundwater monitoring wells with the highest major ion concentrations in groundwater reported in the upgradient monitoring well GW5S;
- Concentrations of major anions were reported in leachate at concentrations of up to 30 times those reported in the shallow and deep groundwater monitoring wells with the highest chloride concentrations in groundwater reported in the upgradient monitoring well GW5S. Concentrations of bicarbonate and sulfate were reported in higher concentrations in groundwater than leachate, indicating natural background concentrations.

To support the Radiation Management Plan yearly reporting, groundwater monitoring is undertaken. Monitoring bores are sampled on a quarterly basis and analysed for radium 226 (Ra-226) and radium 228 (Ra-228) radionuclide analysis and uranium (U-238) and thorium (Th-232) elemental analysis. From the Monitoring requirements imposed on the premises under the *Radiation Safety Act*, the Radiological Council have confirmed that there have been no issues of non-compliances to date.

Key findings:

The Delegated Officer considers that:

- Groundwater monitoring has been undertaken at the premise since 2005.
- The superficial aquifer is currently sampled from monitoring wells GW1S, GW5S, GW7S, GW9S and SE10S. Monitoring well GW5S is located approximately 500m upgradient from current and historical landfilling activities and is considered to be an accurate reflection of background levels.
- The groundwater monitoring bore network is generally suitable but additional monitoring wells are required to ensure appropriate spatial coverage;
- The groundwater monitoring data from the premises indicates that activities on the premises are not impacting the environmental values of the superficial or Leederville aquifers.
- Uncertainty exists in relation to the site-specific hydrogeological interpretation of the superficial aquifer beneath the premises and the presence and significance of seasonal perched groundwater lenses. This uncertainty will be taken into consideration in the assessment of potential risk to off-site receptors and the need for additional regulatory controls; and
- Groundwater monitoring and previous qualitative groundwater assessments have been undertaken at the premises, however no quantitative assessment of the longterm impacts to groundwater has been undertaken. Such assessments are able to consider the progressive degradation of liner systems both during operation and post closure and the ability of the environment to attenuate potential contaminants of concern. The requirement to undertake this assessment will be considered in the risk assessment.

8.2 Dust monitoring

Dust monitoring conducted by DWER between 19 March 2020 and 20 April 2020 at a nearby residence showed that the average PM₁₀ concentrations recorded for the entire period was 18.5ug/m³. The National Environment Protection Measure for Ambient Air Quality (NEPM) for particles is 50ug/m³ over a 24 hour period. The NEPM sets national standards for the six key air pollutants to which most Australians are exposed: carbon monoxide, ozone, sulfur dioxide,

nitrogen dioxide, lead and particles with the desired outcome of ambient air quality that allows for the adequate protection of human health and well-being. The highest reported 24 hour PM_{10} average was 30.62ug/m³ recorded on 8 April 2020.

DWER concluded that the results were inconclusive in assessing dust emissions and the effectiveness of controls from the premises as the wind was generally from the wrong direction and other sources of dust (fire and ploughing) were implicated. They also noted that further investigations would be required when the wind direction is favorable to determine if receptors are being impacted by dust.

The Dust Management Plan (DMP) developed by Cleanaway included a requirement imposed by the Shire of Dardanup to undertake dust monitoring at three locations for a six-month period. The purpose of the dust monitoring program was to establish data regarding existing ambient air quality surrounding the site to allow an assessment of the effectiveness of the management of emissions during site operation activities.

The monitoring program was carried out by Strategen JBS&G over a six month period between 20 November 2020 and 18 May 2021 to encompass the dryer months of the year. Three DustTrak monitors were installed along the premises boundary to the northeast, northwest and south of the premises to assess the effectiveness of the management of dust emissions during site operation activities and confirm that off-site impacts were being minimized. The locations were informed by analysis of summer wind direction, and available information on visual observation of dust emissions. The DustTrak monitors were fitted with wind sensors for meteorological monitoring.

The recorded 24-hour average concentrations at the three locations were observed to be trending together throughout the monitoring period, indicating that the particulate concentrations recorded at each location were predominantly influenced by particulate levels in the airshed rather than a site source close to the monitor. The NE monitor typically recorded the lowest daily averages, with the highest typically reported at the S monitor.

The 24-hour average concentrations recorded during the monitoring period were below the PM_{10} NEPM criteria. The exceptions were on 20 December 2020 and on seven days during the second half of April 2021. On the 20 December 2020, the 24-hour average concentration at both the NW and S monitors exceeded the NEPM criteria. The NE monitor also recorded the highest 24-hour average concentration for the monitoring period on this date but did not exceed the NEPM criteria. The high 24-hour averages at all three locations at the same time are indicative of an off-site influence on the particulate levels on this date. It is possible that smoke from a large fire at Hesterbrook located approximately 60 km southeast of Dardanup was being detected.

During the last two weeks of April there were smoke alerts issued by the Department of Fire and Emergency Services (DFES) for the greater airshed, including the City of Bunbury and surrounds. The cause of the smoke was attributed to prescribed burns being conducted by DBCA. Smoke at the site was reported by site personnel as dense and persistent throughout this period. Exceedances of the 24-hour NEPM criteria during this time are, therefore, attributed to the smoke and were not investigated further by Strategen.

DWER Air Quality Branch (AQB) reviewed the results of the dust sampling investigations and advised:

- Notwithstanding that DustTraks are non-standard monitoring equipment, the monitoring program was generally fit for purpose given the objectives of the study;
- The monitoring data indicates that there were a number of exceedances of the PM₁₀ NEPM criterion of 50 μg/m³ (24-hour average);
- All exceedances appear to be primarily due to bushfires or prescribed burning. Average dust levels recorded over the monitoring period are comparable with those

recorded at the department's Bunbury air quality monitoring station; and

 Analysis of the dust concentrations indicates that apart from periods influenced by bushfires and prescribed burning, dust concentrations recorded below the 24-hour NEPM criteria are potentially due to activities at the premises during working hours, or due to exposed ground surfaces outside of working hours under high wind speeds. In this analysis undertaken, values less than 15 ug/m³ have been excluded to focus on concentrations above background levels. The dust concentration roses shown below in Figure 13 indicate that the most likely dust sources are within the premises, or along the boundaries, such as roads. The analysis is biased towards the wind directions that occurred during the monitoring period, with the majority of wind values in the southern sector of 90° through to 270°.













Figure 13: Dust concentrations above background levels

As part of the monitoring program carried out by Strategen JBS&G as part of the DMP, sampling was also undertaken with a 10-minute reporting period to identify dust spikes and to determine if corrective actions to mitigate dust emissions are required to be implemented. The 10-minute average results indicated that:

- Exceedances of the corrective action trigger level were largely due to off-site influences, evidenced by elevated concentration detected at all monitoring locations coinciding with known events (prescribed burns and bushfires as described above) contributing to elevated particulate levels in the regional airshed;
- Peak concentrations at the NE monitor attributed to on-site activities exceeded the corrective action trigger level on one occasion (10 February 2021). Implementation of controls to mitigate fugitive dust resulted in a rapid decay in measured dust concentrations to below the trigger level;

- Following a review of activities, it was concluded that the exceedance of this corrective action trigger level was due to non-routine operations (traffic diversion during road maintenance); and
- When compared to the other monitoring locations, the NE monitor recorded elevated concentrations during strong north-easterly winds that pass over the body of the site. It was identified that this was possibly due to wind erosion of unsealed surfaces within the site.

It should be noted that the elevated levels observed within the 10-minute dust spike monitoring did not result in an exceedances of the 24h-hour NEPM assessment criteria for the protection of human health and wellbeing.

AQB noted that factors that may influence particle size and composition of dust emissions from a landfill site are underlying soil type, type of waste disposed of at the site and site activities. DWER consulted the Department of Health as part of licence review who noted that the toxicity of the dust being emitted from the Premises could not be assessed due to the lack of information relating to the composition of the dust. Given this data gap the Delegated Officer considers there is currently insufficient data available to comprehensively characterise potential consequences associated with dust emissions from premises. In order to inform a dust emission risk assessments, the Delegated Officer considers that analysis of the dust composition is an important consideration in the assessment of potential impacts.

To support the Radiation Management Plan yearly reporting, dust monitoring, dust deposition monitoring and contamination wipe testing is undertaken. From the Monitoring requirements imposed on the premises under the *Radiation Safety Act*, the Radiological Council have confirmed that there have been no issues of non-compliances to date.

Key findings:

The Delegated Officer considers that:

- The results of the dust monitoring indicate that particulate concentrations typically remained below the 50 μg/m³ hour NEPM criteria.
- Excluding results influenced by bushfires and prescribed burning, dust concentrations recorded below the 24-hour NEPM criteria are potentially due to activities at the premises during working hours, or due to exposed ground surfaces outside of working hours under high wind speeds.
- The Delegated Officer considers that analysis of the dust composition is an important consideration in the assessment of potential impacts related to dust and particulate emissions and verification of dust control measures.
- The results of the dust monitoring will be considered in the risk assessment undertaken for dust emissions and that additional regulatory controls will be considered for inclusion in the reviewed licence.

8.3 Noise monitoring

A number of noise assessments have been undertaken at the premises. In 2020 Herring Storer Acoustics (HSA) was commissioned by Cleanaway to undertake a noise assessment relating to noise emissions from the Banksia Road landfill. The purpose of the assessment was to assess noise emissions for the current and proposed operations at the facility for compliance with the requirements of the *Environmental Protection (Noise) Regulations 1997*.

To enable the assessment of noise emissions from the current operations, noise level measurements were carried out by HSA continuously from 28 February to 10 March 2020. The monitoring data analysed by HSA showed that the measured L_{A10} (15min) levels were mostly

above 40dB(A) during operational hours of 0600 and 1800 daily, which was higher than the 30-33dB(A) levels which were modelled by HSA at the worst case receiver.

HSA chose the noise data measured on 3 March 2020 as representative of a period of ideal noise propagation for the analysis. According to HSA, the site was in full operation on 3 March 2020 due to the long weekend break, which may imply that noise emissions represent the worst-case scenario. However, it can be seen from the overall monitored noise levels that noise levels recorded during the long weekend on 1 and 2 March 2020 were significantly higher than 3 March 2020 (DWER, 2020).

The 3 March 2020 noise data also indicated that $L_{A10 (15min)}$ levels measured at the residence were mostly higher than 40 dB(A), with almost 50 per cent higher than 45dB(A) from the time period between 0600 and 1800 on 3 March 2020 (these levels are above the assigned levels in the *Environmental Protection (Noise) Regulations 1997*). HSA stated that, when compared with the data measured within the site, these high noise levels did not correlate with the landfill operation, and were influenced by noise sources other than the landfill site noise emissions, such as birds (particularly crows) (HSA, 2020).

HSA concluded that the results showed that compliance with the *Environmental Protection* (*Noise*) *Regulations 1997* was achieved at the residential location for all hours.

DWER's Environmental Noise Branch (ENB) was not able to confirm that the conclusions in the HSA report were reliable due to the following factors:

- noise monitoring was conducted over 10 days, however HSA only chose one day for analysis;
- the high noise levels were attributed to noise sources other than landfill operations. Audio recording were not provided to backup this claim; and
- the report did not provide details of what equipment was in operation, in which areas of the landfill.

DWER sought additional information from HSA and although HSA provided some clarifications or statements to ENB's comments, no additional data or evidence was presented to support each of the statements. Therefore, ENB could not advise whether the Licence Holder satisfactorily met Condition 2.5 of the existing licence (DWER, 2020).

DWER completed noise monitoring (between 15 October and 11 November 2020) in response to noise complaints raised by two neighbors located near to the premises. DWER's investigation confirmed that the residents in these two premises could, on occasion hear the noise associated with the operation of the landfill, which appeared to be most noticeable on calm days. The monitored noise results indicated that noise emissions from the landfill site complied with the Noise Regulations at both noise sensitive premises during the investigation period.

The investigation also concluded that although noise from the reversing alarms was below the relevant assigned noise level by including the adjustment for tonality, it may not comply with regulation 7(1)(b) of the *Environmental Protection (Noise) Regulations 1997* (Noise Regulations), which requires that noise must be free of tonality.

Key findings:

The Delegated Officer considers that:

- DWER noise monitoring has indicated that noise levels from the premises comply with the levels prescribed in the Noise Regulations;
- Noise from the premises may not comply with Regulation 7(1)(b) of the Noise Regulations which requires that noise must be free of tonality;
- Additional controls will be considered in the reviewed licence to address potential issues associated with tonality.

9. Consultation

Registered stakeholders and direct interest stakeholders were notified in writing on 3 December 2020 that the department had initiated a formal licence review of Cleanaway's Licence. The formal notification included the scope of the licence review and the avenues for stakeholders to submit a public submission.

During the review process, DWER sought comment and input from community, regulatory stakeholders and specialist advice. In addition, DWER undertook a Community Engagement Session on 27 January 2021 with all comments and subsequent submissions considered in the review.

All submissions received as part of the licence review and Cell 8 amendment are summarised, along with DWER's response, in Appendix 1 and 2.

10. Risk assessment

10.1 Assessment of operator

DWER's published *Guidance Statement: Risk Assessments* (February 2017) states that operator history is a relevant consideration in establishing risk context and in determining risk likelihood criteria.

Operator history has been considered in the assessment of this licence review. Complaints received in relation to the Premises have been considered, as well as information from compliance inspections and the content of Annual Audit Compliance Reports (AACR) and Annual Environmental Reports.

10.2 Determination of emission, pathway and receptor

In undertaking its risk assessment, DWER will identify all potential emissions pathways and potential receptors to establish whether there is a Risk Event which requires detailed risk assessment.

To establish a Risk Event there must be an emission, a receptor which may be exposed to that emission through an identified actual or likely pathway, and a potential adverse effect to the receptor from exposure to that emission. Where there is no actual or likely pathway and/or no receptor, the emission will be screened out and will not be considered as a Risk Event. In addition, where an emission has an actual or likely pathway and a receptor which may be adversely impacted, but that emission is regulated through other mechanisms such as Part IV of the EP Act, that emission will not be risk assessed further and will be screened out through Table 16.

The identification of the sources, pathways and receptors to determine Risk Events are set out in Tables 16 below

Table 16: Identification of emissions, pathway and receptors

Risk Events					Continue to detailed		
Sources/Activities	Potential emissions	Potential receptors	Potential pathway	Potential adverse impacts	risk assessment	Reasoning	
		Dardanup Conservation Park adjacent to southern and eastern boundary					
		Priority Ecological Community within 15m			Yes	Refer to section 11.1	
		Threatened Ecological Community adjacent to southern boundary					
		Geomorphic wetland approximately 400 metres south west through to the north west of the Premises boundary.	overtopping of stormwater storage dams or the failure of stormwater conveyance	Impacts to conservation			
Collection, storage and management of stormwater.	Stormwater Potentially contaminated stormwater Sediment laden stormwater	Crooked Brook (significant stream) located approximately 1100m south/ south west of the Premises boundary flowing in a generally east west direction. Flows into Preston River which is located approximately 5km downstream.	stormwater conveyance infrastructure Stormwater overflow causing erosion and deposition of sediment Infiltration through soil profile to groundwater Movement through groundwater	stormwater conveyance values of the Conservation infrastructure Park. Stormwater overflow causing erosion and deposition of sediment Contamination of waters or deterioration of	No	The Delegated Officer considers it unlikely that a Risk Event resulting in unacceptable stormwater emissions will occur. As such, the Delegated Officer does not consider the risk to be significant enough to warrant further assessment.	
		Preston River located approx. 5km west of the Premises. Groundwater from the superficial aquifer discharges into the Preston River.		through soil profile water Erosion t through ter			
		Beneficial users of groundwater (including future users)					
		The superficial aquifer present within the Yoganup geological formation					
		The confined Leederville Aquifer					
			Infiltration through soil profile to groundwater				
		Beneficial users of groundwater (including future users)	Movement through groundwater		Yes	Refer to Section 11.2	
Acceptance, buriel and decomposition			Abstraction of groundwater				
of 350,000 tonnes of waste per annum			Direct exposure via irrigation and/or spraying				
Acceptance and disposal of 353,000 tonnes of titanium dioxide tailings per annum		The superficial aquifer present within the Yoganup geological formation	Overland flow due to overtopping of leachate storage ponds or failure of	Degradation to the beneficial use of groundwater			
Collection, storage and management of leachate	Landfill leachates Titanium dioxide tailings	The confined Leederville Aquifer	leachate conveyance infrastructure	Health impacts to			
Leachate loss resulting from liner system failure Leachate loss resulting from overtopping of leachate storage	leachates	Dardanup Water Reserve located 2.5km northwest Dardanup Water Reserve located 2.5km northwest					
conveyance infrastructure			Infiltration through soil profile to groundwater				
		Movement ti groundwate					
		Geomorphic wetland approximately 400 metres south west through to the north west of the Premises boundary.	Overland flow due to overtopping of leachate	Contamination of waters or deterioration of	No	The Delegated Officer considers it unlikely that a Risk Event resulting in unacceptable leachate emissions from landfill or	

		Crooked Brook (significant stream) located approximately 1100m south/ south west of the Premises boundary flowing in a generally east west direction. Flows into Preston River which is located approximately 5km downstream.	storage ponds or failure of leachate conveyance infrastructure Overland flow due to	local/regional surface water ecosystems	
			dioxide tailings containment cells or failure of leachate conveyance infrastructure		
		Preston River located approx. 5km west of the Premises.	Infiltration through soil profile to groundwater		
		River.	Movement through groundwater		
			Overland runoff from contaminated stormwater migration		
Transport of waste loads within the		Closest residential receptors 500m south and 900m west.	_		
Unloading of waste at the landfill tipping area	Dust (excluding asbestos)	Dardanup Conservation Park adjacent to southern and eastern boundary	Air / wind dispersion	Impacts to health, wellbeing and amenity	Yes
Covering of waste Vehicle movements on unsealed		Priority Ecological Community within 15m	_	Impacts to health, wellbeing and amenity	
grouna/roads		Threatened Ecological Community adjacent to southern boundary			
Acceptance and burial of asbestos waste	Asbestos fibres	Closest residential receptors 500m south and 900m west.			
Transport of waste loads within the Premises prior to unloading		Township of Dardanup located 3.8 kilometres northwest		Adverse health impacts including asbestosis, mesothelioma and cancer	
Unloading of waste at the landfill tipping area		Users of the Dardanup Conservation Park adjacent to southern and eastern boundary	Air / wind dispersion		Yes
Vehicle movements on unsealed ground/roads		Workers onsite			
		Closest residential receptors 500m south and 900m west.			
Acceptance and burial of 350,000 tonnes of waste per annum	0,000 353,000 lings per nin the Noise ndfill	Users of the Dardanup Conservation Park adjacent to southern and eastern boundary		Impacts to health, wellbeing and amenity	
Transport of waste loads within the Premises prior to unloading Unloading of waste at the landfill		Dardanup Conservation Park adjacent to southern and eastern boundary			Yes
		Priority Ecological Community within 15m	Air / wind dispersion		
tipping area			-		
Vehicle movements including		Threatened Ecological Community adjacent to southern boundary			
		Township of Dardanup located 3.8 kilometres northwest			No
Acceptance and burial of 350,000 tonnes of waste per annum	Odour	Closest residential receptors 500m south and 900m west.	Air / wind dispersion	Impacts to health, wellbeing and amenity	Yes

tailings leachates will occur given the distance to the receptors. As such, the Delegated Officer does not consider the risk to be significant enough to warrant further assessment.
Refer to Section 11.3
Refer to Section 11.4
Refer to Section 11.5
The Delegated Officer considers it unlikely that a Risk Event for noise will occur given the minimum distance of 3.8 km between the Premises boundary and these receptors.
Refer to Section 11.6

Acceptance and disposal of 353,000 tonnes of titanium dioxide tailings per annum					
Decomposition of accepted and deposited waste					
Surface of leachate ponds					
Recirculation of leachate on landfill liner					
Irrigation of leachate to aid evaporation (leachate pond and tipping face)		Township of Dardanup located 3.8 kilometres northwest			No
Fugitive landfill gas emissions					
Landfill gas not being effectively controlled					
Landfill gas engines and flares not operating effectively					
	Light spill	Closest residential receptors 500m south and 900m west.	- Light spill	Impacts to health, wellbeing	
Acceptance and burial of waste outside of daytime hours		Township of Dardanup located 3.8 kilometres northwest		and amenity	- No
Acceptance and disposal of titanium dioxide tailings outside of daytime hours		Priority Ecological Community within 15m		Impacts to conservation	
		Threatened Ecological Community adjacent to southern boundary		Park.	
	Fugitive landfill gas (typically composed of methane, carbon dioxide, nitrogen, oxygen and hydrogen and many trace gases such as hydrogen sulphide, carbon monoxide, halogenated organics and aromatic hydrocarbons Emissions from the flaring of captured landfill gas	Priority Ecological Community within 15m	Air / wind dispersion Lateral migration of landfill gas through the soil profile	Adverse impacts to health including asphyxia. Amenity (from odour)	N
		Threatened Ecological Community adjacent to southern boundary			Tes
Landfill gas generated through the decomposition of waste within the landfill		Closest residential receptors 500m south and 900m west.			
Flaring of captured landfill gas			Passive venting to air	Explosion risk	
		Township of Dardanup located 3.8 kilometres northwest		N	No
	Emissions from the flaring of captured landfill gas	Closest residential receptors 500m south and 900m west.	Air / wind dispersion	Impacts to health and wellbeing	
Fiaring of captured landfill gas		Township of Dardanup located 3.8 kilometres northwest			INO
Acceptance and burial of 350,000 tonnes of waste per annum		Closest residential receptors 500m south and 900m west.	- Air / wind dispersion	Amenity and nuisance impacts	Yes
Transport of waste loads within the Premises prior to unloading Unloading of waste at the landfill	Windblown waste/litter	Township of Dardanup located 3.8 kilometres northwest		Attraction of pests and vermin	
					l

The Delegated Officer considers it unlikely for odour to travel this distance or cause any distinguishable impacts from background concentrations. This is based on the minimum distance of 3.2 km from the Premises boundary to these receptors.
The Delegated Officer considers it unlikely that a Risk Event for light will occur given the distance to receptors and the short periods that lighting is required at the premises during normal operations.
Refer to Section 11.7
The Delegated Officer considers that fugitive landfill gas is likely to disperse given the distance from the Premises to the nearest residential receptors.
The Delegated Officer considers that emissions from flaring of landfill gas is likely to disperse given the distance from the Premises. This is based on the minimum distance of 3.2 km from the Premises boundary to these receptors.
Refer to Section 11.8

tipping area Covering of waste		Dardanup Conservation Park adjacent to southern and eastern boundary		Amenity and nuisance impacts Impacts to conservation values of the Conservation Park.	
Waste providing a breeding habitat for rats, flies, cockroaches and	Vermin/pests and pathogens	Closest residential receptors 500m south and 900m west.	Air and land via insects, birds and rodents	Amenity impacts and pest associated diseases	Yes
mosquitoes as well as feral animals as disease vectors		Dardanup Conservation Park adjacent to southern and eastern boundary		Impacts to conservation values of the Conservation Park.	
	Smoke/fire	Closest residential receptors 500m south and 900m west.	Air / wind dispersion	Amenity and public health (adverse health) Yes	
		Township of Dardanup located 3.8 kilometres northwest			Yes
		Users of the Dardanup Conservation Park adjacent to southern and eastern boundary			
		Dardanup Conservation Park adjacent to southern and eastern boundary			
Fire/Smoke emissions arising from landfill fires. Mixing of incompatible waste types		Beneficial users of groundwater (including future users)	Infiltration through soil profile to groundwater Movement through groundwater Abstraction of groundwater Direct exposure via irrigation and/or spraying	Degradation to the beneficial use of groundwater Health impacts to groundwater users	
Fire causing damage to landfill liners which results in release of landfill		Geomorphic wetland approximately 400 metres south west through to the north west of the Premises boundary.	Overland flow due to overtopping of leachate storage ponds or failure of leachate conveyance infrastructureContamination of waters or deterioration of local/regional surface water ecosystemsMovement through groundwaterOverland runoff (from stormwater migration)Contamination of waters or deterioration of local/regional surface		
leachate	Landfill leachates emissions caused by fire Release of chemicals used to control fire Landfill leachates	Crooked Brook (significant stream) located approximately 1100m south/ south west of the Premises boundary flowing in a generally east west direction. Flows into Preston River which is located approximately 5km downstream.		Contamination of waters or deterioration of local/regional surface water ecosystems	or Yes
		Preston River located approx. 5km west of the Premises. Groundwater from the superficial aquifer discharges into the Preston River.			
		The superficial aquifer present within the Yoganup geological formation	Infiltration through soil profile to groundwater	Degradation to the	
		The confined Leederville Aquifer	Infiltration through soil profile to groundwater	beneficial use of groundwater Health impacts to	
		Dardanup Water Reserve located 2.5km northwest	Infiltration through soil profile to groundwater	groundwater users	

Note 1: Consequence ratings, likelihood ratings and risk descriptions are detailed in the Guideline: Risk Assessments (DWER 2020).

Refer to Section 11.9
Refer to Section 11.10
Refer to Section 11.10

11. Detailed risk assessment

11.1 Risk Assessment – Stormwater

11.1.1 Hazard characterisation and impact

As described in Sections 6.7 and 7.10 stormwater management systems should be designed to ensure that stormwater that contacts the waste does not cause an adverse impact on surface water or groundwater and that all water that comes into contact with waste is directed to the leachate management system.

The Delegated Officer considers impacts to the conservation value of the Dardanup Conservation Park to be the primary receptor most at risk in relation to stormwater runoff. In mid-2019 the stormwater drain along the southern boundary of the premises was observed to be failing at a number of locations along its length. The failures were primarily due to erosion of the drain formation, resulting in surface water flowing into the adjacent conservation park. This resulted in stormwater escaping through the drain liner and eroding the side wall and base of the drain such that stormwater flowed out of the drain and into the Dardanup Conservation Park.

A licence amendment was granted on 28 May 2021 to reflect upgrades to the southern boundary stormwater drain to address the identified erosion issues. The Delegated Officer notes that the environmental compliance report has not yet been received for the construction of the southern stormwater drain.

In development of the risk assessment, the Department has had regard to information received from DBCA relating to vegetation health in the Dardanup Conservation Park. DBCA provided the following information to the department regarding vegetation health:

- The vegetation within the Conservation Park is of an 'Very Good to 'Excellent' condition as per the Keighery (1994) vegetation condition scale;
- There are some signs of dieback presence along the southern boundary however only the boundary has been mapped for *Phytophthora cinnamomi; and*
- Intensified concentration of water drainage can exacerbate the impacts of *Phytophthora cinnamomi*.

A DBCA dieback interpreter advised, following analysis for the presence of dieback along the southern boundary that "The increase in disease occurrence is directly associated with water runoff through infested soil, off the southern face of the bund wall, inadvertently allowing for rapid water movement (along with their ineffective drainage) which is acting as a vehicle for disease distribution along the northern boundary of the Conservation Park".

11.1.2 Criteria for assessment

Impact to the Dardanup Conservation Parks can be assessed against the general provisions of the EP Act. Section 50A of the EP Act makes it an offence for a person who causes, or allows to be caused, material environmental harm.

11.1.3 Applicant/Licence Holder controls

This assessment has considered the Applicant's controls set out below:

- Engineered stormwater collection and management system as described in Sections 6 and 7;
- Run-on Control System to prevent surface water flow onto the active portion of the

landfill;

- Perimeter drains to intercept flows and prevent stormwater leaving the premises;
- Stormwater ponds (referred to as Stormwater Ponds 1 and 2) for the retention of stormwater generated at the premises;
- Sedimentation basins to promote settlement of suspended solids;
- Monitoring of groundwater to validate stormwater management infrastructure is working effectively; and
- Closure and rehabilitation of completed landfill cells in a timely manner.

11.1.4 Consequence

Taking into consideration the Licence Holder's controls the Delegated Officer has determined that stormwater emissions may cause mid level impact to the Dardanup Conservation Park by spreading dieback. Therefore, the Delegated Officer considers the consequence of leachate emission impacts to be **Major**.

11.1.1 Likelihood of Risk Event

The Delegated Officer has determined that a until the southern stormwater infrastructure has been completed and deemed to have been adequately constructed and the stormwater system has been demonstrated to be able to contain a 1 in 100 year ARI rainfall event, taking into account normal operating water levels in stormwater ponds 1 and 2, the likelihood of stormwater emissions casing major impact to the Dardanup Conservation is considered to be **Possible**.

11.1.2 Overall rating

The Delegated Officer has compared the consequence and likelihood rating described above for the Risk Criteria and determined that the overall rating for the risk of stormwater to impact the Dardanup Conservation Park is **High**.

11.1.1 Acceptability of Risk Event

As per DWER's acceptability and treatment of Risk Events the Delegated Officer has determined that the risk event is tolerable and will be subject to regulatory controls.

11.1.2 Regulatory controls

The Delegated Officer has determined that the controls stated by the Licence Holder are required to control the risk of stormwater impacts to the Dardanup Conservation Park and that the controls stated by the Licence Holder will be regulatory controls under the Licence.

In addition, the Delegated Officer considers that conditions need to be added to the reviewed licence to allow for:

- Submission of an Environmental Compliance Report for the upgrades to the southern stormwater drain;
- An assessment of the effectiveness of the upgrades to the southern stormwater drain to contain stormwater within the premises and prevent the spread of die back in the adjacent Dardanup Conservation Park;
- Inspections and maintenance to confirm the on-going effectiveness and integrity of the southern stormwater drain and the adjacent fire track and to require and report measures taken to rectify any damage and ensure against reoccurrence;

• Assessment of the ability of the stormwater system to manage a 1 in 100 year ARI rainfall event, taking into account the normal operating water levels in stormwater ponds 1 and 2 and identification of whether additional improvements are required to ensure stormwater is retained and managed on the premises.

11.2 Risk Assessment – Leachate

11.2.1 Hazard characterisation and impact

Landfill leachate is formed from the infiltration of water through the landfill cells, the moisture content of the buried waste and when decanted off the accepted titanium dioxide tailings. Leachate generated from a putrescible landfill may contain dissolved and decomposing organic matter, inorganic compounds (such as sulfates, chloride and ammonium salts), nutrients, hydrocarbons, metals and metalloids, pesticides, synthetic organic compounds and other miscellaneous contaminants including PFAS. Leachate generated from the titanium dioxide tailings may contain iron (II) and iron (III) hydroxides, aluminium hydroxide, manganese hydroxide, magnesium hydroxide, calcium chloride, carbon, titanium oxide and low levels of naturally occurring radioactive materials (NORM) including uranium (25 – 50ppm) and thorium (300 – 700ppm). Under the existing licence, landfill and tailings leachate composition is not currently monitored at the Premises.

The Delegated Officer considers the receptor most likely to be at risk from Leachates is groundwater. Leachate seepage to groundwater from the landfill cells (closed and active), the leachate ponds and/or the titanium dioxide tailing cells (excluding radioactive nucleotides) may arise if defects occur during placement and/or over time in the operation of the cell or leachate management system, including leachate storage ponds. Landfill liner systems cannot be made completely impermeable, and all liners will therefore experience a certain level of leachate seepage over the lifecycle of operation. The failure to manage leachate levels within the landfill cell can impact the rate of seepage through the lining system. Leachate emissions may also occur as a result of overtopping of leachate storage infrastructure, or failure of leachate conveyance infrastructure.

Leachate emissions may also result from fire suppressant runoff in the event of firefighting activities and fire damage to lining systems, liner system failure which typically occurs as a result of basal or side slope instability, seismic activity, poor installation and construction practices, poor waste placement practices, or other activities that compromise the structural integrity of the landfill subbase.

The quantity and quality of leachate will be influenced by the waste types, management of waste within the landfill cells, the integrity of landfill liners, the management of leachate head on the landfill liners, any recirculation and reinjection of leachate into the waste mass, the control of stormwater and ambient meteorological conditions.

11.2.2 Criteria for assessment

The guidelines which are considered appropriate for the known and potential beneficial uses of groundwater in the vicinity of the premises include:

- Australian Drinking Water Guidelines (ADWG) NHMRC and NRMMC 2011 on the basis that the Leederville aquifer serves as the primary domestic water supply for the Dardanup area;
- Long-term Irrigation Water Guidelines (LTIG) and Stock Water Guidelines (SWG) -ANZECC and ARMCANZ 2000. The land use to the west of the site is predominantly agricultural, including crop and livestock farming. The presence of elevated water storage tanks and windmills indicate that groundwater is abstracted by landowners for livestock water and irrigation purposes;
- Non-potable Groundwater Use Guidelines (NPUG) DoH 2014. Abstracted groundwater from surrounding land users may also potentially be used for non-potable uses; and
- PFAS National Environmental Management Plan V 2.0 (January 2020). Applicable for

the assessment of human health and ecological risks associated with PFAS compounds.

11.2.3 Applicant/Licence Holder controls

This assessment has considered the Applicant's proposed controls set out below:

- Engineered landfill cell, industrial tailings cells, leachate collection system and stormwater management systems as described in Sections 6 and 7 above;
- Operational management approaches;
- Minimising the amount of leachate being generated, including stormwater controls;
- Operation of the leachate collection system, including leachate extraction sumps, leachate storage and evaporation ponds;
- Enhanced leachate evaporation rates achieved by:
 - Recirculation of leachate over exposed black HDPE liner within the leachate ponds;
 - o Spray irrigation over the leachate pond surface; and
 - Recirculation onto the landfill active tipping face.
- Timely handling, compaction and covering of waste;
- Monitoring of groundwater detailed in Section 8.1 to validate containment and management infrastructure is working effectively; and
- Closure and rehabilitation of completed landfill cells to mitigate leachate generation and emissions.

11.2.4 Consequence

The Delegated Officer has taken into account the siting of the site and the results of groundwater monitoring to date and comparison to relevant assessment criteria and determined the impact of leachate emissions on groundwater to be low-level off-site impacts. Therefore, the Delegated Officer considers the consequence to be **Moderate**.

11.2.5 Likelihood of Risk Event

The Delegated Officer has identified data gaps in the site-specific hydrogeological interpretation for the Premises, specifically the potential significance of perched aquifers in the superficial formations. This is important, as perched groundwater could be a pathway for the transport of contaminants from the landfill site to receptors.

Based upon the applicant's controls and the data gas outlined above, the Delegated has determined that moderate impacts from the release of leachate emissions is **Possible** and could occur at some time.

11.2.6 Overall rating

The Delegated Officer has compared the consequence and likelihood rating described above for the Risk Criteria and determined that the overall rating for the risk of leachate impacts during operations is **Medium**.

11.2.7 Acceptability of Risk Event

As per DWER's acceptability and treatment of Risk Events the Delegated Officer has determined that the risk event is tolerable, and likely to be subject to regulatory controls.

11.2.8 Regulatory controls

The Delegated Officer has determined that the controls stated by the Licence Holder are required to control the risks of potential leachate emissions and that the controls stated by the Licence Holder will be regulatory controls under the Licence.

The Delegated Officer notes that additional conditions need to be added to the licence to allow for the assessment of data gaps identified through the licence review. These include:

- Characterisation of both landfill and tailings leachate to ensure the groundwater monitoring suite is appropriate to detect leachate emissions;
- Undertake investigations to address identified data gaps in the current local and sitespecific hydrogeological interpretation for the Premises, including the installation of additional groundwater monitoring wells if required;
- Undertake a detailed quantitative hydrogeological risk assessment to consider progressive degradation of liner systems during both operation and post closure and the ability of the environment to attenuate potential contaminants of concern;
- Undertake investigations to determine the current levels of leachate within the landfill cells and propose leachate head management levels for each active and closed landfill and TDS cell;
- Provide an action plan for achieving (if required) and maintaining leachate levels below leachate head management levels;
- The addition of waste acceptance reporting conditions;
- The addition of characterisation sampling of titanium dioxide tailings; and
- The addition of requirements relating to the provision of final capping plans for both the landfill and TDS cells to ensure final capping is undertaken as a priority.
11.3 Risk Assessment – Fugitive Dust

11.3.1 Hazard characterisation and impact

Dust may cause reduced local air quality and nuisance impacts and may also cause public health impacts if particulate matter is inhaled. There is potential for some of the dust generated to contain contaminants from waste accepted at the premises which may cause additional health impacts if inhaled. Wind direction and strength may impact the intensity and direction of dust impacts. The Delegated Officer considers the receptor most likely to be at risk from dust emissions to be offsite residential receptors. Residential properties are located between 500 m to >2 km from the Premises with some separated by native vegetation. Commercial receptors are located to the north of the Premises.

Elevated total suspended particulates can impact ambient environmental quality resulting in amenity impacts. Dust emissions can be harmful to human and fauna respiratory systems. Particulate matter that is less than 10 (PM₁₀) and 2.5 (PM_{2.5}) micrometres can be harmful to human and fauna respiratory systems. The chemical and physical properties of the dust particles (considering the waste types present at the Premises), the size of the particles and the duration of exposure are all factors that may affect the severity of impacts.

Potential sources of dust generation include:

- Vehicle movements throughout the landfill;
- Stockpiling and general handling of waste including waste loading/unloading;
- Filling/burial of waste;
- Placement of cover material; and
- Exposed areas of soil and clean fill during normal operations.

11.3.2 Criteria for assessment

The relevant criteria for assessment of dust emissions as PM_{10} is 50 µg/m³ over 24 hours, and $PM_{2.5}$ is 25 µg/m³ over 1 day as specified in the *National Environment Protection (Ambient Air Quality) Measure* (NEPM). The NEPM is the relevant criteria for assessment in relation to human health and wellbeing.

Amenity impacts can also be assessed against the general provisions of the EP Act, specifically whether fugitive dust unreasonable interferes with the health, welfare, convenience, or comfort of any person.

11.3.3 Applicant/Licence Holder controls

This assessment has considered the Applicant's proposed controls set out below:

- Vehicle speed restrictions to reduce dust lift off and the implementation of a reduced speed limit in unfavorable conditions;
- Timely handling, compaction and covering of waste;
- Progressive sealing of the main haul roads to reduce dust generation from unsealed roads;
- Use of dust suppression/water cart to reduce dust generation;
- Maintain sufficient water in stormwater dams for dust suppression;
- All waste loads are covered to avoid dust loss;
- Operation of a wheel wash at the premises to reduce the amount of sediment

transported onto paved roads by vehicles exiting the premises; and

• Undertake the wetting down of potential dust generating material prior to disposal at the tipping face.

11.3.4 Consequence

Given the data gap identified in the review of monitoring data, a lack of baseline dust composition data, impact to amenity, the number of reports to pollution watch, submissions received during the community consultation process, the sensitivity of the most affected receptor (residential premises), and the potential for dust to contain contaminants from waste accepted at the premises, the Delegated Officer considers there is currently insufficient data available to comprehensively characterise potential consequences associated with dust emissions from the activities on the premises. Therefore, until such time that further sampling and analysis is undertaken, the Delegated Officer has determined that the impact of dust emissions during operations to be **Major**.

11.3.5 Likelihood of Risk Event

The results of the dust monitoring indicate that particulate concentrations typically remained below the criteria of 50 μ g/m3 hour NEPM criteria. Based upon the low concentrations reported in the sampling undertaken, applicants controls and management measures the Delegated Officer has determined that the release of dust causing a major impact to residential receptors will probably not occur in most circumstances. Therefore, the Delegated Officer considers the likelihood to be **Unlikely**.

11.3.6 Overall rating

The Delegated Officer has compared the consequence and likelihood rating described above for the Risk Criteria and determined the overall rating for the risk of dust impacts is **Medium**.

11.3.7 Acceptability of Risk Event

As per DWER's acceptability and treatment of Risk Events the Delegated Officer has determined that the risk event may be acceptable and will be subject to multiple regulatory controls.

11.3.8 Regulatory controls

The Delegated Officer has determined that the controls stated by the Licence Holder are required to control the risk of potential dust emission impacts on sensitive receptors and that the controls stated by the Licence Holder will be regulatory controls under the Licence.

The Applicant will also be required to implement the following controls to manage the potential impacts from dust emissions:

- Extend the bitumised southern haul route;
- Development of a sampling analysis plan that specifically considers dust emissions and dust composition from the premises operations, relevant to the identified sensitive receptors;
- Infrastructure requirements including operation and maintenance of a water cart and wheel wash, dust suppression to non-vegetated areas and batter slopes and the laydown area; and
- Operational requirements including maximum site speed limit of 20 km per hour, use of water cart to maintain roads in a damp state and dust management practices at the tipping face.

11.4 Risk Assessment – Fugitive Dust (asbestos)

11.4.1 Hazard characterisation and impact

The spread of asbestos, particularly airborne fibres, poses a significant health risk to people exposed to the Premises air shed. Residences are located between 500 m to >2 km from the Premises with some separated by native vegetation and are considered to be the receptor most at risk from fugitive dust (asbestos). Commercial receptors are located to the north of the Premises.

Asbestos is accepted at the landfill in line with the premises Asbestos Management Plan (2016) which states that:

- All deliveries containing asbestos must be booked with 24 hours notice prior to delivery at the premises.
- Loads suspected of containing asbestos will be treated as being contaminated with asbestos;
- All asbestos accepted at the Premises must be double wrapped and contained in such that asbestos fibres do not entre the atmosphere. Minimum wrapping is heavy duty polythene plastic ≥0.2 mm thick and must be labelled "caution asbestos" in letters no less than 50mm high;
- Large loads including contaminated soil loads must ensure that asbestos fibres are controlled in accordance with he agreed mechanism for wetting down, covering, transporting and discharging of the waste;
- All ACM is to be unloaded in such a manner to avoid generation of dust and release of asbestos fibres;
- If asbestos is detected in an uncontained load it will be wet down with water cart and disposed of immediately;
- As a contingency measure visual inspection must be undertaken prior to pushing up any material;
- The disposal location of all asbestos and suspected contaminated loads will be the 'Dedicated Asbestos Burial Area';
- Bulk loads are wet down prior to and during levelling and immediate burial; and
- The location of all 'Dedicated Asbestos Burial Areas' will be recorded in a register should waste excavation is required;

Dust containing asbestos fibres may be generated during operational activities such as waste acceptance (including damage to asbestos waste wrapping), traffic movement and disposal. Asbestos fibres can cause adverse health impact to offsite identified sensitive receptors via an inhalation pathway.

11.4.2 Criteria for assessment

The Department of Health (DOH) recommends a 0.01 fibres per millilitre (f/ml) asbestos air quality limit to protect the public, which is the limit of detection using the membrane filter methodology.

11.4.3 Applicant/Licence Holder controls

This assessment has considered the Applicant's proposed controls set out below:

Implementation of the Asbestos Management Plan (2016);

- Vehicle speed restrictions to reduce dust lift off and the implementation of a reduced speed limit in unfavorable conditions;
- Timely handling, compaction and covering of waste;
- Progressive sealing of the main haul roads to reduce dust generation from unsealed roads;
- Use of dust suppression/water cart to reduce dust generation;
- Maintain sufficient water in stormwater dams for dust suppression;
- All waste loads are covered to avoid dust loss;
- Operation of a wheel wash at the premises to reduce the amount of sediment transported onto paved roads by vehicles exiting the premises; and
- Undertake the wetting down of potential dust generating material prior to disposal at the tipping face.

11.4.4 Consequence

Based upon the sensitivity of the most affected receptor (residential premises) the Delegated Officer has determined that the potential impact of the release of asbestos fibres during operations may result in adverse health effects. Therefore the Delegated Officer considers the consequence to be **Severe**.

11.4.5 Likelihood of Risk Event

Based upon the applicants controls during operational activity the Delegated Officer has determined that the release of asbestos fibres from landfill operations causing a Severe consequence would only occur in exceptional circumstances. Therefore, the Delegated Officer considers the likelihood to be **Rare**.

11.4.6 Overall rating

The Delegated Officer has compared the consequence and likelihood rating described above for the Risk Criteria and determined that the overall rating for the risk of dust impacts containing asbestos fibres during operations is **High**.

11.4.7 Acceptability of Risk Event

As per DWER's acceptability and treatment of Risk Events the Delegated Officer has determined that the risk event may be acceptable and will be subject to multiple regulatory controls.

11.4.8 Regulatory controls

The controls stated by the Licence Holder are required to mitigate risks associated with fugitive dust (asbestos) to sensitive receptors and will be applied, where appropriate, as regulatory controls under the Licence with consideration to the Asbestos Guidelines. In addition, a waste acceptance limit for asbestos waste (Special Waste Type 1) will also be included within the licence. To validate the controls relating to asbestos are effective in mitigating emissions of asbestos fibres, dust monitoring requirements will include an assessment of asbestos fibres in the dust.

11.5 Risk Assessment – Noise

11.5.1 Hazard characterisation and impact

Activities within the Premises may generate noise emissions which may result in health and amenity impacts for people near the Premises and users of the Dardanup Conservation Park. Noise may also impact native fauna of the Dardanup Conservation Park resulting in disruption to feeding and breeding habits. The Delegated Officer considers the receptor most likely to be at risk from noise emissions are residential receptors located 550 m to the south of the premises. The Delegated Officer notes that this sensitive receptor is located 1,500 m southwest from landfilling activities. Noise emissions may occur from vehicle movements and placement of waste.

Wind direction and strength may impact the intensity and direction of noise impacts. Residences are located between 550 m to >2 km from the Premises with some separated by native vegetation. Commercial receptors are located to the north of the Premises.

Investigations undertaken at the premise identified that noise generated from the reversing alarms on vehicles may be observed as tonal at the closest residences, particularly on calm days when the ambient noise level is low. In such a situation, noise received at neighboring premises must be free of tonality, as specified in Regulation 7(1)(b)(i) of the Noise Regulations.

11.5.2 Criteria for assessment

The criteria for assessment of noise emissions is the *Environmental Protection (Noise) Regulations 1997* (Noise Regulations) and the premises activities are subject to these regulations.

11.5.3 Applicant/Licence Holder controls

This assessment has considered the Applicant's proposed controls set out below:

- Regular maintenance of equipment and noise control equipment (mufflers, baffles etc) are in good working order;
- Installation of broadband reversing alarms on all vehicles used on site;
- Direction of heavy vehicles, where practicable, away from the southern portion of Banksia Road where residences are located;
- Creation and maintenance of buffer zones around the site boundary;
- Maintenance of a noise complaint register including investigating noise complaints when received and mitigate noise emissions where possible; and
- Restricting hours of operations to avoid noise generating activities.

11.5.4 Consequence

The Delegated Officer considers that noise levels from the landfill site comply with the Noise Regulations. The impact of noise emissions on native fauna will be minimal on a local scale. The potential tonality of the reversing alarms may result in mid level impact to amenity on a local scale. The Delegated Officer therefore considers the consequence of noise emissions from the premises to be **Moderate**.

11.5.5 Likelihood of Risk Event

The Delegated Officer has determined that the noise emissions causing a moderate consequence will probably not occur in most circumstances. Therefore, the Delegated Officer

considers the likelihood to be **Possible**.

11.5.6 Overall rating

The Delegated Officer has compared the consequence and likelihood rating described above for the Risk Criteria and determined that the overall rating for the risk of noise emissions is **Medium**.

11.5.7 Acceptability of Risk Event

As per DWER's acceptability and treatment of Risk Events the Delegated Officer has determined that the risk event is tolerable, and will be subject to regulatory controls.

11.5.8 Regulatory controls

The controls stated by the Licence Holder are required to mitigate risks associated with noise emissions to sensitive receptors and will be applied, where appropriate, as regulatory controls under the Licence.

Conditions will also be included within the reviewed licence that require the Licence Holder to restrict the use of tonal alarms and use alternatives such as broadband alarms.

Operational hours are specified in the development approval for the Premises and will not be duplicated in the licence.

11.6 Risk Assessment – Odour

11.6.1 Hazard characterisation and impact

Landfills have the potential to cause odour emissions through the decomposition of putrescible materials and other odorous wastes, inadequate covering and decomposition of waste over time causing amenity impacts outside the Premises. Odour may be generated from the acceptance, storage, movement and disposal of putrescible and volatile wastes. The frequency, intensity, duration, offensiveness and distance to receptors are all factors which may affect the impact of odour on sensitive receptors. Residences are located between 500 m to > 2 km from the Premises with some separated by native vegetation. Potential sources of odour emissions during the operation of the landfill include:

- The acceptance, movement and disposal of wastes;
- Decomposition of accepted and deposited waste
- Un-capped or exposed operational areas of the landfill including the active tipping face;
- Leachate storage ponds should they become anaerobic;
- Recirculation of leachate on to landfill liner;
- Irrigation of leachate to aid evaporation;
- Fugitive landfill gas emissions;
- Landfill gas not being effectively controlled; and
- Landfill gas engines and flares not operating effectively.

The Department's management of odour emissions at landfills is therefore, directly related to these matters and primarily consists of requiring:

- The volume of exposed freshly deposited waste that can emit odour to be minimised by limiting the size of the operational tipping area and requiring all waste to be covered as soon as possible and always by the end of every working day;
- Highly odorous incoming wastes to be buried and immediately covered;
- To install and operate active extraction of landfill gas to minimise and control odorous emissions from the anaerobic decomposition of waste in completed cells in a timely manner;
- Leachate ponds to be designed to be able to be maintained in an aerobic state; and
- Complaints to be investigated to determine root cause and corrective actions to be implemented to address cause.

The Minister's decision on the appeal received for the Cell 7 licence amendment was published on 31 August 2021. The Minister's decision was to allow the appeal to the extent that additional conditions are imposed on the licence relating to odour requiring:

- Odour from the premises does not unreasonably interfere with the health or wellbeing of persons not on the premises;
- Highly odorous waste be immediately buried and covered; and
- The active tipping area be limited to an area no greater than 1,800 m², or two areas no greater than 1,800 m² each for periods of up to three months when transitioning between cells.

The Minister otherwise dismissed all other grounds of appeal. On 30 September 2021 a DWER initiated amendment was granted to give effect to the appeal decision.

In completing the risk assessment, the Department has had regard to odour complaints originating from the Dardanup Waste Precinct. The Department investigated the source of these complaints and determined that they were likely to be primarily related to emissions originating from another prescribed premises within the precinct rather than the Premises. This conclusion is consistent with reports provided to the Department by the Shire of Dardanup's Principal Environmental Health Officer.

11.6.2 Criteria for assessment

There are no set threshold or concentration criteria for odour assessment. Under section 49(5) of the EP Act, it is an offence to emit or cause to be emitted, an unreasonable emission from any premises.

An unreasonable emission is defined in the EP Act (section 49(1)) as an emission or transmission of noise, odour or electromagnetic radiation which unreasonably interferes with the health, welfare, convenience, comfort or amenity of any person.

11.6.3 Applicant/Licence Holder controls

This assessment has considered the Applicant's proposed controls set out below:

- Controlling loads managing highly odorous loads by immediate filling and covering;
- Placing, compacting, and covering all other waste types in a timely manner;
- Limiting the number of active disposal areas at the site;
- Minimising the size of the working face(s);
- Operating and maintaining an active landfill gas management system;
- Identifying and correcting point sources of odours;
- Limiting disturbance of previously filled waste;
- Not depositing waste into standing water; and
- Maintaining an odour complaint register.

11.6.4 Consequence

Taking into consideration the Applicant's proposed controls, and the waste types included in this assessment if odour emissions occur from the general landfilling operations, the Delegated Officer has determined that the impacts to amenity would be low level on a local scale. Therefore, the Delegated Officer considers the consequence of odour emissions to be **Minor**.

11.6.5 Likelihood of Risk Event

The Delegated Officer has determined that the release of odour emissions during operations causing a Minor consequence could occur at some time. Therefore, the Delegated Officer considers the likelihood to be **Possible**.

11.6.6 Overall rating

The Delegated Officer has compared the consequence and likelihood rating described above for the Risk Criteria and determined that the overall rating for the risk of odour emissions is **Medium**.

11.6.7 Acceptability of Risk Event

As per DWER's acceptability and treatment of Risk Events the Delegated Officer has

determined that the risk event is tolerable and will be subject to some regulatory controls.

11.6.8 Regulatory controls

The Delegated Officer has determined that the odour controls stated by the Licence Holder are required to control the risk of odour emission impacts on sensitive receptors and that the controls stated by the Licence Holder will be applied, where appropriate, as regulatory controls under the Licence.

The conditions imposed through the Minister's determination of the Cell 7 licence amendment will be carried forward into the reviewed licence. Further regulatory controls will be included in the licence to manage the risk of odour and will include:

- Timely handling, compaction and covering of incoming waste;
- Immediately covering highly odorous waste;
- Limiting the size and number of active tipping areas;
- Controls on the excavation of previously deposited waste;
- Final capping plans;
- Progressive installation of horizontal and vertical landfill gas management system;
- Operating and maintaining the landfill gas management system; and
- Implementation of a complaints management system which records details of complaints received, and action taken in response to the complaint.

11.7 Risk Assessment – Landfill Gas

11.7.1 Hazard characterisation and impact

Landfill gas emissions can result in fire and explosion and result of asphyxia at high concentrations. Landfill gas such as hydrogen sulphide generates odour and can also have toxic effects on the health and wellbeing of flora, fauna and human receptors. The Delegated Officer considers the receptor most likely to be at risk from the migration of landfill gas to be the Dardanup Conservation Park. Landfill gas could potentially migrate horizontally below the interim landfill cover and/ or confining soil layers and express from land adjacent to the Premises.

In development of the risk assessment, the Department has had regard to information received from DBCA relating vegetation health in the Dardanup Conservation Park. DBCA states that the the vegetation within the Conservation Park is of an 'Very Good to 'Excellent' condition as per the Keighery (1994) vegetation condition scale.

11.7.2 Criteria for assessment

Impact to the Dardanup Conservation Parks can be assessed against the general provisions of the EP Act. Section 50A of the EP Act makes it an offence for a person who causes, or allows to be caused, material environmental harm.

11.7.3 Applicant/Licence Holder controls

This assessment has considered the Applicant's proposed controls set out below:

- Management of waste in discrete cells and use of landfill liners, cover and capping.
- Establishment of a landfill gas management system that incorporates the infrastructure listed below:
 - $\circ~$ A 2,000 m³/ hour capacity enclosed flare with a minimum operating throughput of 400 m³/ hr;
 - Existing landfill gas management system infrastructure and monitoring as described in Section 7.8
- Progressive installation of the landfill gas management system as the landfill develops.

11.7.4 Consequence

Taking into consideration the Licence Holder's controls the Delegated Officer has determined that specific consequence criteria for landfill gas emissions impacting to the Dardanup Conservation Park would be met. Therefore, the Delegated Officer considers the consequence of landfill gas emission impacts to be **Slight**.

11.7.5 Likelihood of Risk Event

The Delegated Officer has determined that a correctly functioning landfill gas management system will reduce the volume of fugitive emissions from the premises and that correctly functioning landfill liners will reduce the likelihood of off-Premises migration. Due to these reasons and the distance to receptors, the Delegated Officer considers the likelihood to be **Unlikely**.

11.7.6 Overall rating

The Delegated Officer has compared the consequence and likelihood rating described above for the Risk Criteria and determined that the overall rating for the risk of landfill gas emission to be **Low**.

11.7.7 Acceptability of Risk Event

As per DWER's acceptability and treatment of Risk Events the Delegated Officer has determined that the risk event is acceptable.

11.7.8 Regulatory controls

The Delegated Officer has determined that the controls stated by the Licence Holder should be adequate to control the risk of landfill gas emission impacts on sensitive receptors and that the controls stated by the Licence Holder will be applied, where appropriate, as regulatory controls under the Licence.

To ensure the risk associated with landfill gas remains low, the Delegated Officer considers that additional controls on the licence are required as follows:

- Requirement to install active landfill gas control in Cells 3, 4, 4B, 12 and the eastern and southern sections of Cell 5 within a specified time;
- Requirements to progressively install active landfill gas control in any future cells within a specified time following the cell reaching capacity; and
- Periodic assessments of the on-going suitability of the landfill gas flare to manage the landfill gas generation volumes and flow rates from connected Cells.

11.8 Risk Assessment – Windblown waste

11.8.1 Hazard characterisation and impact

Litter from landfilling of waste may be spread over a wide area by wind movement and potentially into the surrounding native vegetation (east and south), and also into surrounding private lands (west and north). Windblown waste can interfere with the health, welfare, convenience, comfort or amenity of private land holders and users of the Dardanup Conservation Park. Interference with native flora and fauna (ecosystem services) is possible along with the contamination of surface waters.

Sources of windblown waste from the Premises include:

- Vehicles transporting waste into the landfill;
- The active tipping face;
- Exposed surfaces of the landfill; and
- Movement of waste from birds and animals.

DBCA provided information to DWER that windblown debris/rubbish and movement of bulkier rubbish by birds into the Conservation Park continues to occur. The remnant vegetation along the eastern boundary of the Lot 2 is currently serving as a buffer absorbing the windblown and fauna transported rubbish. DBCA noted that Cleanaway have a program in place to regularly collect rubbish, however it is a continuing problem.

11.8.2 Criteria for assessment

Litter deposited onto land or into waters may be an offence under the *Litter Act 1979*. Amenity impacts caused by windblown waste can be assessed against the general provisions of the EP Act, specifically whether emissions unreasonably interferes with the health, welfare, convenience, or comfort of any person.

11.8.3 Applicant/Licence Holder controls

In 2019 the Licence Holder developed and is now implementing a Windblown Waste Management Plan. The key factors of this management plan were considered in the risk assessment of the previous capacity increase (December 2019). This assessment has considered the Applicant's proposed controls set out below:

- Requirement for all loads to be covered to avoid loss of loads across the premises;
- Timely handling, compaction and covering of waste;
- Use of litter nets and mobile litter screen to catch any windblown waste leaving the tipping face and active cell;
- Monitoring wind speed and wind direction to ensure mitigation and collection of windblown waste is undertaken effectively;
- Routine collection of litter from the litter control screens, perimeter fence, areas of vegetation and access roads;
- Selecting working areas based on meteorological conditions;
- Undertaking progressive capping following completion of each cell; and
- Maintenance of a complaints register for reporting any issues relating to litter.

11.8.4 Consequence

Given the impact to amenity, the number of reports to pollution watch and submissions received during the community consultation process, the Delegated Officer has determined that the impact of windblown waste to be **Moderate**.

11.8.5 Likelihood of Risk Event

The Delegated Officer has determined that the release of windblown waste causing a moderate impact could occur at some time. Therefore, the Delegated Officer considers the likelihood to be **Possible**.

11.8.6 Overall rating

The Delegated Officer has compared the consequence and likelihood rating described above for the Risk Criteria and determined that the overall rating for the risk of windblown waste emissions is **Medium**.

11.8.7 Acceptability of Risk Event

As per DWER's acceptability and treatment of Risk Events the Delegated Officer has determined that the risk event is tolerable and is likely to be subject to some regulatory controls.

11.8.8 Regulatory controls

The Delegated Officer considers it necessary for the licence holder to implement the following regulatory controls to manage the potential impacts from windblown waste emissions:

- Install and maintain litter nets around the active cell;
- Install and maintain mobile litter screens at the active tipping face to capture windblown waste;
- Install fencing around the perimeter of the Premises to limit any windblown waste leaving the premises and to prevent the ingress and egress of wildlife that can spread waste to areas outside the premises.
- Ensure timely covering of waste and reducing once received at the tipping face;
- Limiting the size of the active tipping face to reduce the potential windblown waste;
- Collection of windblown waste from the landfill area, controls screens, perimeter fencing, roads and vegetated areas and areas outside the premises if control measures are breached; and
- Maintaining appropriate quantities of cover material at the tipping face.

These controls generally replicate the Applicant's proposed controls and are considered appropriate by the Delegated Officer to manage the risk of windblown waste.

11.9 Risk Assessment – Vermin/Pests

11.9.1 Hazard characterisation and impact

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

Non-native flora (weeds) may also establish on cleared ground and impact on surrounding native vegetation habitat.

Vermin may be transported in wastes received at the site or may be attracted to the area due to the presence of waste (food source). Weeds may be transported on vehicles and may establish due to the disturbed nature of the land around the Premises. The presence of vermin may be a nuisance to residential premises and may impact on native ecosystem function.

11.9.2 Criteria for assessment

Amenity impacts and impacts to ecosystems from pests and vermin can be assessed against the general provisions of the EP Act.

11.9.3 Applicant/Licence Holder controls

This assessment has considered the Applicant's proposed controls set out below:

- Placing waste in thin layers and regularly compacting and covering the waste throughout the day;
- Limiting the size of the active landfilling area and tipping face;
- Placing, compacting, and covering the waste in a timely manner;
- Eliminating or minimising areas of standing water;
- Using bird scarers and deterrents;
- Maintaining a vermin complaint register;
- The use of insecticides and pesticides as a final option where required; and
- Undertake noxious weed eradication as required, typically biannually.

11.9.4 Consequence

If vermin/pests and/or weeds occur, then the Delegated Officer has determined that the impact will be a low-level impact to amenity on a local scale with the impact on native ecosystems being low-level offsite impact at a local scale. Therefore, the Delegated Officer considers the consequence of vermin/pests and/or weeds to be **Moderate**.

11.9.5 Likelihood of Risk Event

Taking into consideration the distance and nature of sensitive receptors and the Applicant's proposed controls, the Delegated Officer has determined that until such time that the entire perimeter of the premises is fenced, moderate consequences of vermin/pest could occur at some time. Therefore, the Delegated Officer considers the likelihood of vermin/pests and/or weeds impacting public health and amenity to be **Possible**.

11.9.6 Overall rating

The Delegated Officer has compared the consequence and likelihood rating described above for the Risk Criteria and determined that the overall rating for the risk of vermin/pests and/or weeds is **Medium**.

11.9.7 Acceptability of Risk Event

As per DWER's acceptability and treatment of Risk Events the Delegated Officer has determined that the risk event is tolerable and is likely to be subject to some regulatory controls.

11.9.8 Regulatory controls

The Delegated Officer considers it necessary for the licence holder to implement the following controls to manage the potential impacts from vermin/pests and weeds:

- Install and maintain fencing around the entire premises boundary to prevent animals entering the facility;
- Install and maintain a skirt/apron around the base of the southern and eastern premises boundary fence to prevent animals entering the facility from the Dardanup Conservation Park;
- Maintain entrance gates that prevents cats and foxes from entering the premises;
- Undertake appropriate eradication measures when required including baiting and trapping;
- Inspect the premises monthly for the presence of weeds, record observations made and management measures undertaken;
- Regular covering of waste with cover material; and
- Maintain appropriate quantities of cover material onsite.

11.10 Risk Assessment – Smoke/Fire

11.10.1 Hazard characterisation and impact

Normal operations are unlikely to cause fire and smoke emissions. Storage of waste at the Premises provides a fuel source for a potential fire. There is also the potential for spontaneous combustion of flammable wastes where wastes are exposed to oxygen (i.e. left uncovered) for extended periods of time, from the mixing of incompatible waste types and from the presence of contaminants such as lithium batteries in the waste stream. The Delegated Officer considers the receptor most likely to be at risk from smoke/fire emissions to be residential receptors (smoke) located between 500 m to >2 km from the Premises, groundwater (leachates) and the Dardanup Conservation Park (fire).

Landfill fires, in particular deep fires are difficult to address and can require significant quantities of water to be used to extinguish the fire. Firewater can run-off the site and lead to leachate and stormwater storage capacities being exceeded and/or leachate levels building up in the landfill cells.

Without effective containment measures, leachate has the potential to infiltrate to soil and groundwater or flow into surface water bodies. This may lead to adverse environmental impacts or affect the beneficial use of these resources.

During a landfill fire, there is potential for the landfill infrastructure, particularly the liner system to be damaged. Such damage is difficult to repair and can allow leachate and contaminated fire water to be released into groundwater, surface water systems and nearby ecosystems.

As outlined in Section 4.3.6 a number of landfill fires have occurred at the premises. As a result of the fires, an investigation was undertaken to ensure the integrity of the liner system was not compromised.

In the event of a fire event, smoke and particulates would be released. This may cause amenity and public health impacts for human receptors. The inhalation of particulate matter can cause respiratory distress. The burning of waste and vegetation surrounding the landfill can cause damage and impact to terrestrial habitat.

Fire within the waste body may impact the liner integrity which could give rise to leachate emissions. The risk of leachate emissions under normal operations has been assessed separately in Section 11.2.

11.10.2 Criteria for assessment

There are no specific consequence criteria for smoke emissions or damage to terrestrial ecosystems. The general provisions of the EP Act make it an offence to cause or allow unreasonable emissions that unreasonably interfere with the health, welfare, convenience, comfort or amenity of any person. Additionally, Section 50A of the EP Act makes it an offence for a person who causes, or allows to be caused, material environmental harm.

11.10.3 Applicant/Licence Holder controls

This assessment has considered the Applicant's proposed controls set out below:

- Adherence to the site Emergency Management Plan, Fire Control Procedure;
- Undertake waste acceptance screening for hot loads to ensure no hot loads are received at the tipping face;
- Timely handling, compaction and covering of waste to remove voids/spaces in landfill;
- Use of 15 kL water cart for fire suppression as required;
- Maintenance of a minimum of 50,000 kl within the storage tanks at all times to be

available for firefighting efforts;

- Monitoring of landfill gas parameters to ensure a landfill fire is not occurring;
- Maintain cover material that can entirely cover waste within the tipping area and all faces should a fire within the Dardanup Conservation Park and Boyanup State Forest present a material risk to the Premises;
- Ensure that no waste is burnt at the Premises at any time; and
- Ensure that the site is secure and that security systems are maintained.

11.10.4 Consequence

Landfill fire - smoke emissions residential receptors

If a landfill fire were to occur, then the Delegated Officer has determined that the impact of smoke emissions could result in low level or occasional medical treatment as well as low-level impacts to amenity on a local scale. Therefore, the Delegated Officer considers the consequence of smoke emissions from a landfill fire to be **Moderate**.

Landfill fire - leachate emissions

If an unauthorised fire occurs within the landfill and damages the integrity of the liner, then the Delegated Officer has determined that the impacts to groundwater and surrounding ecosystems will be mid-level on a local scale. Therefore, the Delegated Officer considers the consequence of fire impacts to be **Major**.

Fire emissions – Ecological receptors

If fire emissions occur from the Premises, then the Delegated Officer has determined that the impact of fire emissions to surrounding conservation category flora and fauna will be mid-level on a local scale. Therefore, the Delegated Officer considers the consequence of fire emissions to native flora and vegetation to be **Major**.

11.10.5 Likelihood of Risk Event

Landfill fire - smoke emissions residential receptors

The Delegated Officer has determined that smoke emissions from a landfill fire impacting public health and amenity at a moderate level will probably not occur in most circumstances. Therefore, the Delegated Officer considers the likelihood to be **Unlikely**.

Landfill fire - leachate emissions

Taking into consideration the Applicant's proposed controls, the Delegated Officer has determined that the likelihood of a fire occurring resulting in damage to the landfill liner and potential contamination of groundwater and associated ecosystems at a major consequence level would only occur in exceptional circumstances. Therefore, the Delegated Officer considers the likelihood to be **Rare**.

Fire emissions – Ecological receptors

Taking into consideration the Applicant's proposed controls, the Delegated Officer has determined that the likelihood of fire spreading to surrounding vegetation including flora and fauna in the Dardanup Conservation Park and having a major consequence would only occur in exceptional circumstances. Therefore, the Delegated Officer considers the likelihood to be **Unlikely**.

11.10.6 Overall rating of smoke/fire event

Landfill fire - smoke emissions residential receptors

The Delegated Officer has compared the consequence and likelihood rating described above for the Risk Criteria and determined that the overall rating for the risk of smoke emissions from a landfill fire at the premises is **Medium**.

Landfill fire - leachate emissions

The Delegated Officer has compared the consequence and likelihood rating described above for the Risk Criteria and determined that the overall rating for the risk of damage to landfill liner integrity due to a fire in the landfill at the Premises is **Medium**.

Fire emissions – Ecological receptors

The Delegated Officer has compared the consequence and likelihood rating described above for the Risk Criteria and determined that the overall rating for the risk of fire emissions at the Premises is **Medium**.

11.10.7 Acceptability of risk event

As per DWER's acceptability and treatment of Risk Events the Delegated Officer has determined that the risk event may be tolerated and may be subject to multiple regulatory controls.

11.10.8 Regulatory controls for smoke/fire event emissions

The Applicant will be required to implement the following controls to manage the potential impacts of fires:

- Infrastructure controls including maintenance of the water cart and sufficient water available in the event of a fire;
- Operational controls including having sufficient cover material available onsite and regular covering and compaction of all waste across all active tipping areas;
- Inspect waste loads accepted at the premises for hot loads and no unloading of hot loads within the active landfilling areas; and
- Undertaken landfill gas monitoring to facilitate the prevention and early detection of fires, enable balancing of the gas field and to ensure that landfill gas is being extracted efficiently.

These controls generally replicate the Applicant's proposed controls. The Applicant will also be required to adhere to the requirements of the *Bush Fires Act 1954* which includes the maintenance of fire breaks.

12. Determination of Revised Licence conditions

The conditions in the Revised Licence have been determined in accordance with the *Guidance Statement: Setting Conditions*.

DWER notes that it may review the appropriateness and adequacy of controls at any time and that DWER may initiate amendments to the licence under the EP Act.

13. Applicant's comments

The Licence Holder was provided with the draft Decision Report and draft Licence on 13 October 2021. The Licence Holder provided comments on 19 October 2021 which are summarised, along with DWER's response, in Appendix 3. The Licence Holder was provided with a revised draft Licence reflecting DWER's consideration of their comments on the initial draft on 25 October 2021. The Licence Holders' comments, provided on 26 October 2021 along with DWER's response on the second referred draft are also included in Appendix 3.

The Licence Holder waived the remainder of the 21 consultation period.

14. Conclusion

This assessment of the risks of activities on the Premises has been undertaken with due consideration of a number of factors, including the documents and policies specified in this Decision Report. Based on this assessment, it has been determined that the Revised Licence will be granted subject to conditions commensurate with the determined controls and necessary for administration and reporting requirements.

This Review was based on existing Premises operations and did not undertake a risk assessment for future development of the landfill. The Delegated Officer considers that any changes have the potential to change the risk profile for the Premises and therefore require assessment under a works approval or licence amendment.

The revised Licence requires a large number of actions and submissions within specified time periods. On receipt of this information, DWER will review the risk assessment included within this document and determine whether further changes to the Licence are required.

RUTH DOWD SENIOR MANAGER WASTE INDUSTRIES

Delegated Officer under section 20 of the Environmental Protection Act 1986

Appendix 1: Summary of direct interest stakeholders comments – Licence Review

A total of 29 submissions were received from direct interest stakeholders within the licence review consultation period. All submissions have been considered in the Department's review. A summary of the items raised and DWERs response is set out below.

Summary of direct interest stakeholder comment	Number of submissions	DWER response
Potential impacts to groundwater	23	DWER recognises the significant concerns that stakeholders have in relation to the potential impacts to aquifers beneath the premises.
		DWER's review has identified that some data gaps exist in hydrogeological setting of the premises and that no quantitative groundwater assessment has been undertaken at the premises that considers degradation of landfill engineering systems and long- term groundwater impacts during both operation and post closure. The Delegated Officer acknowledges that landfill liners degrade over time, however landfill leachates also decrease over time. Landfill leachate is greatest in the initial years of waste
Cell structures and liner integrity	8	breakdown. The final landfill cover functions as a way to keep water out of the landfill cell thus reducing leachate generation.
		Groundwater monitoring undertaken to date indicates that the premises is not impacting the environmental values of the superficial or Leederville aquifers. The Department's risk assessment has identified the risks to groundwater to be Medium. The Amended Licence includes conditions to address the data gaps identified by DWER and to ensure that on-going monitoring of groundwater is undertaken to verify containment systems continue to be effective.
Potential impacts to surface water	1	DWER's review identified that the nearest Palusplain wetland is approximately 400m west of the premises with the nearest open water body (Crooked Brook) located over 1 km to the southwest of the premises. The Department's risk assessment determined that a potential impact to the identified wetlands and surface waters is unlikely to occur given the distance to the receptors.
		Engineering controls operated at the premises include engineered lined landfill cells, the capture and management of all leachate and stormwater generated at the premises, enhanced leachate evaporation and the timely closure and rehabilitation of

Summary of direct interest stakeholder comment	Number of submissions	DWER response
		completed landfill cells to mitigate leachate generation.
		The Delegated Officer notes that additional conditions have been included in the licence to ensure that risks from leachate and stormwater emissions to surface waters are appropriately managed.
Potential impacts to soil	2	DWER review identified that there is potential for direct infiltration/seepage and vertical migration of impacts into the underlying soil profile due to the failure of leachate or stormwater containment and conveyance infrastructure. The Department's review identified that groundwater is the receptor most likely at risk and that soil is a pathway and transport mechanism for potential contaminants. The department determined that it is unlikely that a risk event resulting in unacceptable leachate emissions to soil will occur given the ongoing use of the site as a landfill and the engineering controls in place to manage leachate emissions. The Delegated Officer notes that additional conditions have been included in the licence to ensure that risks from leachate and stormwater emissions to surface waters
		are appropriately managed.
Dust & Air Quality		DWER recognise the significant concerns that stakeholders have in relation dust emissions and air quality.
	21	DWER's review identified that whilst dust particulate concentrations typically remained below the NEPM criteria there has been no quantitative measure of dust composition undertaken at the premises. Due to this data gap there is currently insufficient data available to characterise with certainty, potential consequences associated with dust emissions from premises. In order to address this uncertainty and validate the risk assessment undertaken to date, the Delegated Officer considers that analysis of the dust composition is an important consideration.
		Based on the information currently available, the Department's risk assessment has identified the risks to sensitive receptors from dust to be Medium. The Amended Licence includes conditions to address the data gaps identified by DWER. The Applicant will also be required to implement further controls to manage the potential impacts from dust emissions.

Summary of direct interest stakeholder comment	Number of submissions	DWER response
Noise impacts to surrounding receptors	6	DWER recognise the concerns of nearby residential receptors have in relation to noise emissions. In addition to reviewing noise assessments and modelling undertaken for the premises, DWER undertook noise monitoring at nearby properties in response to noise complaints. DWER's monitoring and review of information determined that noise levels from the premises comply with the Noise Regulations. However, there is some concern associated with the tonality and noise emissions and the requirements of the Noise Regulations. The Delegated Officer has added conditions to the Amended Licence to address this.
Radiation impacts from the acceptance of Titanium Dioxide Slurry	9	DWER acknowledges the concerns that stakeholders have in relation to radiation risks associated with the acceptance and disposal of titanium dioxide tailings. The waste contains low levels of naturally occurring radioactive materials (NORM) including uranium and thorium. DWER does not have carriage of the regulation of radiation risks at the Premises.
		The <i>Radiation Safety Act 1975</i> is administered by the Radiological Council, an independent statutory authority advising and responsible to the Minister for Health. As detailed in this decision document, DWER sought advice from the Radiological Council. The Radiological Council confirmed that the site is regulated under the Radiation Safety Act for radiation, however as the content of the natural radionuclides in the waste is low, it presents a low radiological risk.
		The Radiological Council stated that under the Radiation Safety Act, Cleanaway is required to ensure that the dose to members of the public, including for locations offsite, does not exceed the public dose limit. From the monitoring requirements imposed on the premises under the Radiation Safety Act, the Radiological Council has confirmed that there have been no issues of non-compliances to date.
Siting of the landfill	18	The location of the landfill has been approved under statutory planning processes. DWER regulates the premises to ensure emissions and discharges do not present an unacceptable risk to the environment or public health. The siting of the premises, in relation to geology, hydrogeology, meteorology and identified sensitive receptors are key consideration in the assessment of premises under Part V of the EP Act and have been reviewed and considered as part of the DWER's risk assessment.

Summary of direct interest stakeholder comment	Number of submissions	DWER response
		The Delegated Officer considers that taking into account the siting of the premises, that all emissions expected from the premises can be adequately controlled to ensure they do not present an unacceptable risk to the environment and public health.
Size of the landfill	17	DWER recognize the concerns of the community stakeholders regarding the size of the premises and the aesthetic impacts. The location and previous expansion of the landfill has been approved under statutory planning processes which are able to consider a broader range of issues beyond emissions and discharges.
Aesthetic impacts		In accordance with DWER's Regulatory Framework, DWER's statutory powers and therefore the licence review is limited to impacts arising from emissions and discharges from the premises. DWER does not have statutory powers under Part V of the EP Act to assess aesthetic impacts.
Traffic impacts	10	DWER's review identified that ongoing complaints have been received by both the Shire and community in regards to noise from truck movements, road degradation and operating hours. Truck/traffic movements on public roads does not fall within the remit of the department under Part V of the EP Act and is generally managed within local government planning regulations.
Increased risk from fire 11	11	DWER recognises that fires are a significant concern of stakeholders and in particular the potential damage to engineered liner systems at the premises. DWER's review identified that landfill fires at the Premises occurred on 12 January 2020, 27-28 January 2020 and 5 March 2020. Investigations undertaken following the landfill fires identified that the fires did not impact the integrity of the liner system.
	DWER's review identified that landfill gas monitoring parameters were found to be unreliable and not a true indicator of a landfill fire occurring at the premises. A more	

Summary of direct interest stakeholder comment	Number of submissions	DWER response
		accurate indicator of a landfill fire within a landfill is the measurement of landfill gas temperature at the gas extraction well.
Damage to liners due to fires		Cleanaway provided an Emergency Management Plan and Fire Control Procedure to DWER as part of the document submission to support the licence review. These documents have been considered during the risk assessment process in determining the likelihood and consequence of a risk event.
Emergency plan	3	The Department's risk assessment identified risks from smoke/fire to be Medium. The amended licence includes revised landfill gas monitoring conditions and additional controls related to the acceptance of hot loads, maintenance of a water cart and sufficient water available in the event of a fire and ensuring sufficient cover material available at the tipping face. The licence holder will also be required to adhere to the requirements of the <i>Bush Fires Act 1954</i> which includes the maintenance of fire breaks.
Odour impacts to surrounding receptors	6	DWER acknowledge community concerns regarding odour emissions. In development of the risk assessment, the Department has had regard to odour complaints originating from the Dardanup Waste Precinct. The Department investigated the source of these complaints and determined that they were likely to be primarily related to emissions originating from another prescribed premises within the precinct rather than the Premises. The licence for that premises has also been subject to a review to address the odour issues. This conclusion is consistent with reports provided to the Department by the Shire's Principal Environmental Health Officer. The Department's risk assessment identified risks from odour to be Medium and additional regulatory controls have been included in the opended licence to menage
		the risk.
Impact to land prices in the area	8	DWER acknowledge stakeholder concerns regarding potential or perceived impact to land prices in the area and impacts to tourism.

Summary of direct interest stakeholder comment	Number of submissions	DWER response
Impacts to tourism in the area	14	DWER does not have the power under Part V of the EP Act to consider impacts associated with land prices and tourism. In line with our powers under the EP Act, the licence review was limited to impacts from emissions and discharges from the premises.
	6	DWER recognise the concerns that stakeholders have in relation litter and vermin/pests and fencing of the premises.
Increase vermin numbers and impact to native wildlife		As detailed in this decision document, DWER sought advice from the DBCA regarding impacts to the Dardanup Conservation Park and the spread of windblown waste. DBCA provided information to DWER that windblown debris/rubbish and movement of bulkier rubbish by birds into the Conservation Park continues to occur. The remnant vegetation along the eastern boundary of the Lot 2 is currently serving as a buffer absorbing the windblown and fauna transported rubbish. DBCA noted that Cleanaway have a program in place to regularly collect rubbish, however it is a continuing problem.
		The Department's risk assessment identified risks from litter and vermin to be Medium and that additional regulatory controls have been included in the amended licence to manage the risk:
		Installation of litter nets around the entire active cell;
		Use of litter screens at the active tipping face to capture windblown waste;
		 Installation of fencing around the perimeter of the Premises to limit any windblown waste leaving the premises and to prevent the ingress and egress of wildlife that can spread waste to areas outside the premises;
		 Install and maintain a skirt/apron around the base of the premises boundary fence to prevent animals entering the facility;
		Maintain entrance gates that prevents cats and foxes from entering the

Summary of direct interest stakeholder comment	Number of submissions	DWER response
Litter impacts to the Dardanup Conservation Park and the surrounding private land	8	 premises; Timely covering of waste and reducing once received at the tipping face; Limiting the size of the active tipping face to reduce the amount of windblown waste; Collection of windblown waste from the landfill area, controls screens, perimeter fencing, roads and vegetated areas; Undertake appropriate eradication measures when required including baiting and trapping; and
		 Inspect the premises monthly for the presence of weeds, record observations made and management measures undertaken.
The risk associated with the Darling Fault	9	DWER acknowledge stakeholder concerns regarding seismic activity and the Darling Fault. As part of the review the department sought input and advice from Geoscience Australia, the national public sector geoscience specialists in order to understand the potential seismic activity and history. DWER's review determined that the closest fault line is 1,680 m east of the premises with no definitive evidence to suggest that the Darling fault (or related structures) are currently seismically active. DWER determined that the risk of permanent ground deformation relating to a surface-rupturing earthquake is considered to be very rare and that infrastructure at the premise are unlikely to be impacts by seismic activity.
Stormwater management and erosion impacts	14	DWER recognises the significant stakeholder concerns regarding stormwater management and erosion impacts. DWER's review identified that in mid-2019 the stormwater drain along the southern boundary of the premises was observed to be failing at a number of locations along its length. The failures were primarily due to erosion of the drain formation, resulting in surface water flowing into the adjacent conservation park. A licence amendment was issued on 28 May 2021 to allow the construction and operation of the southern stormwater drain.

Summary of direct interest stakeholder comment	Number of submissions	DWER response
		DWER's review identified that the stormwater management system installed at the premises is designed to manage a 1 in 100 year ARI rainfall event whilst minimising erosion and ensures that stormwater that contacts the waste does not cause an adverse impact on surface water or groundwater.
		Uncertainty remains in relation to the potential for normal operating water levels in stormwater pond 1 and stormwater pond 2 to impact the ability of the stormwater management system to contain a 1 in 100 year ARI rainfall event of a 7 day duration. Additional controls have been included in the licence to address this.
		The Delegated Officer determined that until the southern stormwater infrastructure has been completed and deemed to adequately constructed, the likelihood of stormwater emissions impacting the Dardanup Conservation Park is considered to be Possible. Therefore, the Department's risk assessment identified risks from stormwater impacts to be Medium.
		Additional conditions have been added to the licence to allow for the assessment any damage to the southern stormwater drain, the adjacent fire track and the measures taken to rectify any damage and ensure against reoccurrence does not occur.
Impacts to the Dardanup Conservation Park	13	As part of the licence review DWER has considered and risk assessed impacts to the Dardanup Conservation Park from windblown waste, stormwater, erosion, landfill gas, leachates, smoke/fire, vermin/pests, dust and noise. In undertaking the risk assessment DWER has had regard to advice provided by DBCA in relation to the health of and impacts to the conservation park.
		Reference should be made to the individual risk assessments to determine the risk assessment outcome and the conditions added to the amended licence to mitigate the potential impacts to the Dardanup Conservation Park.
Concerns and impacts as a result of the hours of operation	3	DWER recognise the impacts that extended operating hours can have on the community. Planning approvals govern the hours of operations at the premises and as such, DWER will not seek to duplicate the regulation of operating hours.
Impact on farming and livestock	2	DWER acknowledge stakeholder concerns regarding potential impacts to farming and livestock. DWER regulates the premises to ensure emissions and discharges do not

Summary of direct interest stakeholder comment	Number of submissions	DWER response
		present an unacceptable risk to the environment or public health.
		Noting that groundwater may be being used for stock watering, DWER has identified that the premises is not impacting the environmental values of the superficial of Leederville aquifers. The Department's risk assessment has identified the risks to groundwater to be Medium. The Amended Licence includes conditions to address the data gaps identified by DWER and to ensure that on-going monitoring of groundwater is undertaken to verify containment systems continue to be effective.
Regional Water Source Zone located 2.5 km northwest of the premises	3	DWER recognise the concerns that stakeholders have in relation to the potential impacts to aquifers beneath the premises and the regional water source protection zone located 2.5 km northwest of the premises.
		DWER's review identified that some data gaps exist in hydrogeological setting of the premises and that no quantitative groundwater assessment has been undertaken at the premises that considers degradation of landfill engineering systems and long term groundwater impacts during both operation and post closure. Groundwater monitoring undertaken to date indicates that the premises is not impacting the environmental values of the superficial or Leederville aquifers.
		The closest down-gradient groundwater abstraction bore is 1.5 km to the west of the site. Using a conservative calculation, DWER's review identified that groundwater from the beneath the premises would take approximately 250 years to reach the closest abstraction bore. This calculation assumed the hydraulic conductivity of silty sand, which is worst case scenario, as the lithological material matrix beneath the premises is a silt-clay mix, which is considered less permeable. A Senior DWER hydrogeologist provided an estimated groundwater flow rate for silt, assuming a hydraulic conductivity of 0.1 m/day for silt. This calculated flow rate for silt estimates that it would take approximately 12,500 years for groundwater to reach the nearest abstraction bore.
		The Department's risk assessment identified the risks to groundwater to be Medium. The Amended Licence includes conditions to address the data gaps identified by DWER and to ensure that on-going monitoring of groundwater is undertaken to verify containment systems continue to be effective.
Light spill impacts to surrounding receptors	1	Light spill has the potential to cause amenity impacts to receptors should activities be

Summary of direct interest stakeholder comment	Number of submissions	DWER response
		undertaken outside of the normal operating hours. The Department's risk assessment identified that it is unlikely that a risk event for light spill will occur given the distance to receptors and the short periods that lighting is required at the premises during normal operations. Hours of operation are currently regulated via development approvals.
Land use planning matters	5	DWER assesses all application and licence review's in line with statutory processes noting that land use planning is a separate statutory processes. In assessing an application, the Department may:
		 Decline to make a regulatory decision on an application where a planning decision prevents implementation of the application while that decision has effect;
		Seek comment from Local Government Authorities;
		 Assess concurrently with applications for planning approval; and
		 Consider the duration of any planning approval when determining the duration of the works approval or licence to be granted (in accordance with the Guidance Statement: Licence Duration)
		The Department has had regard to the above information in determining whether to grant the amended licence. The premises currently hold all appropriate development applications to operate the landfill (including the operation of Cell 8).
		It is important to note that an instrument granted by the Department only provides a defense for the occupier for offences under Part V, Division 3 of the EP Act, provided the conditions contained within the licence have been complied with, and not for any offences under planning legislation.
Lack of a complete Environmental Impact Assessment	2	While the activities at the premises to date have not been subject to an Environmental Impact Assessment under Part IV of the EP Act, they have been regulated and subject to assessment under Part V of the EP Act.
		In terms of future landfill capacity, on 1 April 2021, Cleanaway referred a proposal to the EPA under Part IV of the EP Act for consideration. The proposal was for the continuation of existing activities and the establishment of additional landfill cells within the existing premises boundary. The Proposal did not propose an increase to the

Summary of direct interest stakeholder comment	Number of submissions	DWER response
		existing approved throughput or the removal of any remnant native vegetation. On 5 August 2021, EPA made a determination to assess the proposal stating that there is potential to impact on:
		• Inland Waters from stormwater runoff and leachate seepage into groundwater;
		 Social Surroundings from interference with amenity values;
		Generation of Greenhouse Gas emissions from flaring; and
		Air Quality from dust and odour.
		DWER understand that the EPA is awaiting additional information required for EPA to undertake their assessment.
Cleanaway's integrity	10	DWER notes stakeholder concerns regarding the licence holder and previous licence breaches at the premises.
Licence Breaches	7	In line with DWER's <i>Guidance Statement: Risk Assessment</i> , DWER's review has considered operator history, previous licence breaches, complaints received in relation to the Premises, results of compliance inspections and the content of Annual Audit Compliance Reports (AACR) and Annual Environmental Reports within the risk assessment.
		DWER will continue to undertake periodic inspections at the premises to assess compliance with the reviewed Licence.
Regulatory inconsistencies	3	DWER conducts all assessments in accordance with the Regulatory Best Practice Principles, which can be found on the Department's website. Under this framework, DWER applies a risk-based approach to regulatory functions to prevent an unacceptable risk of harm to public health or the environment. Licensing and approval decisions, including conditions contained within the amended licence will be commensurate to the level of risk (likelihood and consequence) that the activity poses to public health and the environment.
Was not invited to the consultation	1	DWER wrote to registered stakeholders as part of the community consultation process and advertised the licence review in line with normal statutory processes. The list of registered stakeholders used during the community consultation process was

Summary of direct interest stakeholder comment	Number of submissions	DWER response
		generated through the review of previous submissions, complaints and correspondence received by the department. DWER apologises if any stakeholders were omitted from the invite. Stakeholders had a number of opportunities to provide input to the licence review including making a submission to the public advertising of the licence review.
Waste acceptance practices	7	The licence holder can only accept waste according to those outlined within the licence. The licence holder has been issued prosecution notices and prevention notices where non-compliances have been identified.
Unknown materials in landfill		The licence review identified that improved waste acceptance controls have been implemented at the premises by the licence holder. These controls have been added to the reporting requirements conditions to ensuring that compliance with waste acceptance processes are followed.

Appendix 2: Summary of direct interest stakeholders comments – Cell 8

A total of 8 submissions were received from direct interest stakeholders within the consultation period for the Cell 8 amendment. All submissions have been considered in the Department's review. A summary of the items raised and DWERs response is set out below.

Summary of direct interest stakeholder comment	DWER response	
Clerical errors within the application	DWER acknowleges stakeholder concerns regarding the clerical errors made in the licence amendment application form. The Licence Holder applied for an amendment to give effect to the construction of Cell 8 which was completed in April 2021 and for the acceptance of waste into the cell. Following receipt of the amendment application, DWER sent correspondence to Cleanaway requesting further information to address the identified errors. Cleanaway responded to the request for further information and confirmed that clerical errors in the application should read:	
	 Section 4.7 and 4.8 should read: Category 64 – 350,000 tonnes per annual period; and 	
	• Section 4.9 should read: to allow for the operational use of Cell 8.	
	DWER can confirm that no changes to waste acceptance or categories were proposed as part of the Cell 8 Licence Amendment.	
Hours of operations list in the application form	DWER recognise the stakeholders concerns regarding hours of operations at the premises. DWER can confirm that the 24 hours a day, 7 days a week, referenced by the stakeholder forms part of the application template and has not been completed by the applicant. Section 4.7 of the application form is used to determine a prescribed premises maximum production or design capacity.	
	DWER confirms that the Cell 8 Licence Amendment Application does not propose an increase to the waste acceptance that is currently approved for 350,000 tonnes per annual period.	

Summary of direct interest stakeholder comment	DWER response	
No further approvals or amendments should be permitted whilst there are outstanding legal proceedings involving breaches to the Licence, and these issues have been resolved.	In accordance with DWER's Guideline: Risk Assessment (section 5.5), the department has taken operator history into consideration in assessing the risks the existing operations and the proposed operation of Cell 8 present to the environment and public health.	
Whether it is appropriate to assess the Cell 8 Amendment application in parallel to the licence review.	In accordance with DWER's Guideline: Decision Making (section 5.14), the department is able to amalgamate its decision making on multiple assessments. The department considers in this case, that it was appropriate for the licence review and Cell 8 to be assessed at the same time.	
The community have repeatedly requested the opportunity for feedback and fairness in being provided with genuine stakeholder participation in the process. It is disappointing that this has not occurred.	The EP Act does not include a statutory requirement for DWER to consult on licence amendments, however given the community interest in the premises, DWER referred the application for Cell 8 to registered stakeholders.	
	In line with statutory processes, DWER's determination will be advertised and community stakeholders will be notified of the outcome. The Delegated Officer notes that any amendments to the licence made by DWER as a result of the licence review will be subject to appeal provisions under the EP Act in line with normal statutory processes.	
	In relation to the licence review, DWER advertised the review on our website and sought comments from all stakeholders. DWER also wrote to all registered stakeholders and sought comments from the community, including at the Community Engagement Session held on 27 January 2021. All comments received will be considered as part of the licence review and that upon completion of the licence review.	
	DWER considers that the community have had a number of opportunities to provide input into the regulatory process.	
Community concerns that the application may be an effort to allow for Lithium Tailings disposal at the premises.	The department is not aware of any plans for Banksia Road to be used for the storage of Lithium Tailings. The EPA Assessment Report (Report 1700) states that Lithium Tailings from the recently constructed Covalent Lithium Hydroxide Refinery will be disposed of to an approved waste facility located at the Earl Grey Lithium – Mt Holland Mine.	
	Any proposal for changes to waste acceptance at the premises will be required to be	

Summary of direct interest stakeholder comment	DWER response	
	sought though an application under the <i>Environmental Protection Act 1986.</i> Should an application be received, DWER will consult with the public and key stakeholders in line with normal statutory processes.	
Is the huge illegal stockpile of potentially contaminated soil on land outside of the prescribed Premises (Lot 81) emanated from the construction of this Cell?	DWER understand that during the construction of Cells 6, 7 and 8, native soil material was stockpiled on the adjacent Lot 81 Marginata Close Crooked Brook (Lot 81) in two stockpiles. DWER understand that the Shire of Dardanup has requested the stockpiles be removed from Lot 81 by February 2023. DWER has reviewed historical aerial images to confirm that that landfill operations have not previously occurred at the location where the stockpiled soils were excavated. No evidence has been provided to DWER to indicate that the stockpiled soils are contaminated.	
Generally oppose any amendment to the Licence due to Licence Breaches and the siting in an area for tourism, close to farming and Dardanup townsite.	As detailed in this decision report, DWER's licence review has considered operator history, previous licence breaches, complaints received in relation to the Premises, results of compliance inspections and the content of Annual Audit Compliance Reports (AACR) and Annual Environmental Reports within the risk assessment. In addition, and as noted in Appendix 1, the location and previous expansion of the landfill has been approved under statutory planning processes which are able to consider a broader range of issues beyond emissions and discharges. DWER regulates the premises to ensure emissions and discharges do not present an unacceptable risk to the environment or public health.	
The application was not ticked as a major project.	 DWER can confirm that the application does not meet the definition of a major project being: A State Development Project, where the lead agency is the Department of Jobs, Tourism, Science and Innovation (including projects to which a State Agreement applies); or A Level 2 or 3 Major Resource Project, as defined in the Lead Agency Framework. 	
Has proposal obtained all relevant planning approvals.	The application was referred to the Shire of Dardanup who confirmed that the construction and operation of Cell 8 was approved on 14 December 2016 and that the Shire has no objections to the licence amendment.	

Summary of direct interest stakeholder comment	DWER response	
Pages 16 to 19 not filled out. This needs to be addressed	The proposed licence fee, registration fee, and prescribed fee for clearing permit sections do not apply to the licence amendment application and are not required to be completed.	
Concerns regarding drinking water and the consumption of groundwater by livestock.	As previously discussed, groundwater monitoring undertaken to date indicates that the premises is not impacting the environmental values of the superficial or Leederville aquifers. The Department's risk assessment has identified the risks to groundwater to be Medium. The Amended Licence includes conditions to address data gaps identified by DWER and to ensure that on-going monitoring of groundwater is undertaken to verify containment systems continue to be effective.	

Appendix 3: Summary of applicant's comments on risk assessment and draft conditions

Condition	Summary of Licence Holder comment	DWER response
Condition 1 - Solid waste acceptance	Request rewording of the waste type to remove "Total Waste Management"	The requested change does not change the risk of the acceptance of processed septage waste. The condition has been reworded as requested.
Condition 5 - Solid waste processing	The Licence Holder requested disposal specifications for Special Waste Type 1 and Special Waste Type 2 be added to the licence to allow for a dedicated disposal area for Special Waste Types.	Reworded as requested to allow for a dedicated disposal areas to be established within an active landfilling cell which represents recommended practice for these waste streams.
Condition 5 - Solid waste processing Table 4 (DWER considers it likely Cleanaway meant condition 19, Table 12)	Requested rewording of requirement to: "All waste to be covered with inert waste by the end of the day. Floc only to be used in wet/moist periods and used for traction".	Not actioned as requested. All waste, other than clean fill is required to be covered by the end of the working day. This is consistent with current licence conditions and standard practice for this type of landfill. The purpose of the licence review is to assess existing approved activities and not to approve additional activities. Should Cleanaway wish to use shredder floc in a manner that does not align with licence conditions, they should submit a licence amendment application so that it can be assessed by DWER. Any licence amendment application should include appropriate supporting documents including the characterisation of the shredder floc proposed to be used.
Condition 6 - Solid waste processing	Requested rewording of requirement to: all waste that is uncovered or excavated must be landfilled in accordance with Condition 5 and Condition 19 of this Licence immediately following	Reworded as requested. No additional risk.
Summary of Licence Holder comment	DWER response	
--	--	
installation.		
Requested rewording to include TDS Cell 1 due to settlement and evaporation. TDS Cell 1 currently has approximately 19% capacity remaining before final contours are achieved.	Reworded as requested. Note requirements for requirements in condition 21 relating to the completion and capping of TDS Cells.	
Requested rewording of requirement to include "leachate can be directed to a leachate pond or bund within a lined cell" allowing the option to utilise the bund/liner as an evaporation mechanism for leachate.	 Not actioned as requested. Controls have been placed in the amended licence that require the Licence Holder to: Undertake investigations to determine the current levels of leachate within the landfill cells and propose leachate head management levels for all active and closed landfill cells; and Provide an action plan for achieving (if required) and maintaining leachate levels below leachate head management levels; Until leachate head within the landfill cells are understood, the associated risk of the proposed changes cannot be assessed and have therefore not been approved. As above, the purpose of the licence review is to assess existing approved activities and not to approve 	
Requesting a change to 500mm freeboard in TDS Cell 1 Leachate Pond.	Not actioned as requested. The infrastructure and freeboard requirements of TDS Cell 1 Leachate Pond has been assessed under this licence review and under works approval W5096/2012/1. Any changes to conditions must be requested through a licence amendment application.	
	Summary of Licence Holder Comment installation. Requested rewording to include TDS Cell 1 due to settlement and evaporation. TDS Cell 1 currently has approximately 19% capacity remaining before final contours are achieved. Requested rewording of requirement to include "leachate can be directed to a leachate pond or bund within a lined cell" allowing the option to utilise the bund/liner as an evaporation mechanism for leachate. Requesting a change to 500mm freeboard in TDS Cell 1 Leachate Pond. Requesting clarity of the required specification.	

Condition	Summary of Licence Holder comment	DWER response
	"DWER has previously requested assessment to 1% AEP events (Annual Exceedance Probability), similar to the average occurrence interval (ARI) events of 1 in 100 year but not exactly the same".	specifications have been converted to equivalent AEP specifications.
Condition 13 – Leachate containment infrastructure Specification (a)	Requested wording of requirement to <i>"delete recirculation"</i> to allow for the recirculation of TDS as designed and previously approved.	Reworded as requested. Conditions included to set out the requirements for recirculation.
Condition 14 – Landfill gas management infrastructure Table 10	Requesting to include as built horizontal landfill gas extraction wells.	Reworded to include as built horizontal landfill gas extraction wells. Plan 3 of Schedule 3 has been updated to include horizontal landfill gas extraction wells.
Condition 15 - Landfill gas management infrastructure	The positioning of the vertical landfill gas wells in Cells 3, 4, 4B,12 & 5 has been reviewed & updated since the plan reviewed and approved by DWER in December 2020.	DWER has reviewed the changes to landfill gas extraction well locations and the additional horizontal extraction well details. Reworded and Plan 3 of Schedule 3 has been updated to reflect the changes as requested.
Condition 16 – Stormwater management infrastructure Table 11	Requesting clarity of the required specification. "DWER has previously requested assessment to 1% AEP events (Annual Exceedance Probability), similar to the average occurrence interval (ARI) events of 1 in 100 year but not exactly the same".	Reworded as requested. All reference to ARI specifications have been converted to equivalent AEP specifications.
Condition 19 - Daily and interim cover Table 12	Request rewording of the waste type to remove "Total Waste Management"	The requested change does not change the risk of the acceptance of processed septage waste. The condition has been reworded as requested.
Condition 19 - Daily and interim cover	Request change to interim cover depth requirement for all waste types (excluding Titanium Dioxide Tailings) to 500mm.	Not actioned as requested. Until the leachate head levels within cells has been confirmed and the risks associated with these leachate levels assessed through the quantitative hydrogeological risk

Condition	Summary of Licence Holder comment	DWER response
Table 12		assessment, a reduction in controls is not appropriate.
	Request change to timeframe to prepare Rehabilitation and Closure Plan for TDS Cells due to timeframes to undertake investigations, gather relevant information and develop the plans. For Tronox Cells in situ physical settled material assessment required after an extended period of evaporation & settlement has occurred to be able to confidently design Tronox capping therefore additional time is requested to develop confidence in both data and design.	An additional condition was added to the licence (21) requiring a Rehabilitation and Closure Plan be developed for the TDS Cells. Timeframe for this Plan specified in consideration of the supporting documentation provided by Golder Associates to allow for testing and reporting to be undertaken.
Condition 20 – Final capping	Request change to the requirement for the updated Rehabilitation and Closure Plan to include a capping schedule to ensure completed landfill and TDS Cells are capped within a specified timeframe.	Condition amended to include submission of a proposed schedule and timeframes to achieve the final waste contours as per the final contour plan, with prioritisation of the completion of cells where waste disposal has taken place prior to the commencement of disposal in new cells. Condition amended to remove TDS Cells due to the timeframes required to achieve final contours, achieve settlement and undertake testing required to develop a rehabilitation and Closure Plan.
Condition 21 – Dust emissions	Requested change to completion date due to the southern haul road not being used to access Cell 8 initially.	Condition reworded to remove the completion date and include that the southern haul road must be extended prior to accessing/exiting Cell 8 from the southern haul road.
Condition 22 – Dust emissions	Requested rewording of requirement to: • "All unsealed roads", and	Not actioned as requested. In DWER's experience, dust lift off from sealed roads can be significant. DWER considers the conditions as imposed are required to effectively mitigate the risks associated with

Condition	Summary of Licence Holder comment	DWER response
	"Keep damp as reasonably practicable".	dust emissions from the premises.
Condition 23 – Dust emissions	Requested rewording of requirement to "20km/hr on unsealed roads".	Not actioned as requested. As above, condition is required to effectively mitigate the risks associated with dust emissions from the premises.
Condition 25 – Dust emissions	Requested renaming of <i>"Storm water Pond 1 and Storm water Pond 2</i>	Reworded as requested.
Condition 31 – Noise emissions	Requested rewording to <i>"all site operational vehicles and contractors, plus waste delivery vehicle carrying CWY waste".</i>	The suggested wording does not change the intent of the condition. Not actioned as requested.
Condition 34 – Stormwater emissions Specification (a)	Requesting clarity of the required specification. "DWER has previously requested assessment to 1% AEP events (Annual Exceedance Probability), similar to the average occurrence interval (ARI) events of 1 in 100 year but not exactly the same".	Reworded as requested. All reference to ARI specifications have been converted to equivalent AEP specifications.
Condition 35 – Stormwater emissions Specification (a)	Requested rewording to include <i>"erosion requiring maintenance".</i>	Not actioned as requested. DWER considers that damage caused by erosion on the southern boundary needs to be rectified.
Condition 38 – Windblown waste	Requested rewording to <i>"500m of 6m fencing positioned to best mitigate windblown waste by Nov 2022'.</i>	Reworded, with some changes, as requested.
Condition 40 – Windblown waste	Requested date change to 30 June 2022.	Date changed to align with the completion date of Condition 43 (31 March 2022). DWER considers that March 2022 provides a reasonable period in which to undertaken the required works.
Condition 41 – Fire /smoke emissions	Requested rewording of requirement to "Storm water Pond 1 and Storm water Pond 2	Reworded as requested.

Condition	Summary of Licence Holder comment	DWER response
Condition 42 – Vermin/pest	Requested date change to allow completion.	Date changed to align with the completion date of Condition 40 (31 March 2022).
Condition 49 - Leachate monitoring Table 16	Requested rewording to weekly as there is no significant difference in daily monitoring for the additional administrative burden added.	Not actioned as requested. DWER considers that daily inspections of critical containment infrastructure is required, especially those where the risk of overtopping is directly related to weather conditions.
Condition 51 - Leachate head monitoring requirements	Requesting rewording to remove cells that are gravity fed and do not contain leachate sumps.	Reworded as requested. Additional condition added to include investigation options, timeframes and monitoring methodologies proposed to assess and monitor leachate levels in TDS Cells and all landfill Cells that do not contain leachate sumps.
Condition 53 – Landfill gas	Requested rewording to monthly with a well balancing plan developed after review of the monitoring data.	Reworded as requested. Aligns with previous licence conditions and risks associated with landfill gas are such that monthly is considered acceptable.
Table 19	Requested rewording to include field tests for Carbon monoxide due to cross-contamination issues with landfill gas monitors.	Reworded as requested to clarify original intent.
	Requested rewording to remove 'flare' and replace with 'well'.	Reworded as requested, noting this was an error.
Condition 54 Landfill gas trigger levels	Requested rewording to "target level".	Not actioned as requested. Trigger levels are those where action will be required if levels are exceeded which is the case here.
Table 20	Requested changes to temperature trigger level asper the Landfill Gas Management Plan.	Reworded as requested based upon literature review and review of landfill gas monitoring for the Premises.
	Requested changes investigation levels for landfill gas parameters, including:	Reworded as requested based upon literature review and review of landfill gas monitoring for the Premises. In order to identify abnormal conditions, the upper

Condition	Summary of Licence Holder comment	DWER response
	Carbon dioxide: >25% by Volume Methane: >30% by Volume Nitrogen: <25 % by Volume	limits have been retained for Carbon dioxide and Methane with the lower limit retained for Nitrogen
	Requested changes to landfill gas volume trigger level. The flare is designed with 1:10 turn down - acceptable flow range should be 200-2000 m ³ /hr.	Not actioned as requested. A review of the Landfill Gas Management Plan and the initial Works Approval W5301/2012/1 states the technical specifications of the flare to have a turndown of 1:5 with an acceptable flow range of 400-2000 m ³ /hr.
Condition 58 – Groundwater monitoring/Hydrogeological Risk Assessment	Requested date change to 30 June 2022	Not actioned as requested. Date amended to 31 March 2022 to align with Condition 53. DWER considers that March 2022 provides a reasonable period in which to undertaken the required works.
Figure 1, Schedule 1	Request TDS Cell 1 unloading area be added to the figure.	Updated as requested.
Figure 2, Schedule 1	Updated groundwater monitoring well figure supplied to include additional wells installed and replaced in 2021.	Updated as requested.
Comments on revised draft Licence		
Condition 55 – Dust composition monitoring	Not considered reasonable to require Cleanaway to place dust monitors next to receptors where they cannot be controlled due to them being in inherently dust locations where they could be influenced by other	Condition 55 has been amended to require dust monitors to be placed in locations that will collect any dust that is emitted from the Premises and allow an interpretation of impacts on receptors.
	sources and where Cleanaway cannot ensure the security of results. HiVol samplers require a power source which limits	DWER understands that HiVol samplers can be battery operated and therefore that access to a power source does not limit their potential locations.
	their potential locations. Need guidance on potential contaminants of concern.	Asbestos fibres, heavy metals and PM ₁₀ have been specified as analytes that require assessment.

Condition	Summary of Licence Holder comment	DWER response
	Suggested changes to licence condition proposed.	Dust monitoring has also been reduced from 6 months to 3 months to reflect the higher risk summer/dry season where dust emissions are more likely.

Appendix 4: Reviewed Licence L8904/2015/1