Government of Western Australia
Department of Water and Environmental Regulation

Amendment Report

Application for Licence Amendment

Part V Division 3 of the *Environmental Protection Act 1986*

Licence Number	L8904/2015/1
Licence Holder	Cleanaway Solid Waste Pty Ltd
ACN	120 175 635
File Number	DER2015/001648-1~27
Premises	Banksia Road Putrescible Landfill Banksia Road CROOKED BROOK WA 6236 Legal description – Part of Lot 2 on Deposited Plan 65861 As defined by the coordinates in Schedule 2
Date of Report	3 February 2025
Decision	Revised Licence granted

Grace Heydon

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MANAGER WASTE INDUSTRIES
an officer delegated under section 20 of the *Environmental Protection Act 1986* (WA)

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1. Decision summary

Licence L8904/2015/1 is held by Cleanaway Solid Waste Pty Ltd (licence holder) for the Banksia Road Putrescible Landfill (the premises), located on Banksia Road, Crooked Brook in the Shire of Dardanup.

This amendment report documents the assessment of potential risks to the environment and public health from proposed changes to the emissions and discharges during the operation of the premises. As a result of this assessment, a revised version of licence L8904/2015/1 will not be granted.

2. Scope of assessment

2.1 Regulatory framework

In completing the assessment documented in this Amendment 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.

2.2 Application summary

On 29 April 2024, the licence holder applied to the department to amend licence L8904/2015/1 under section 59 and 59B of the *Environmental Protection Act 1986* (EP Act). The following amendments are being sought:

- The licence holder is proposing a licence amendment to update the freeboard requirement in titanium dioxide slurry cell 2 (TDS Cell 2), from a vertical freeboard to a "volumetric freeboard". Specifically, the amendment is proposed to Specification (d) in Table 8 of Condition 11, which currently requires 1.8 m freeboard to be always maintained in TDS Cell 2.
- The wording proposed by the licence holder is *"maintain a minimum volumetric freeboard of 31,630 m^3 (equivalent to the design rainfall event = 0.5 m freeboard*)".
- The licence holder requests this change to allow greater flexibility in managing water in TDS Cell 2 due to some uncertainty involved with future tailings beach slopes.
- Additionally, it is noted that the second bullet point in Condition 11(d) is no longer applicable, as TDS Cell 2 is now a single cell. The licence holder requests that this item be removed for correctness.

On 7 May 2024 a request for additional information to support the application was sent to the licence holder, with additional information received on 18 June 2024.

The requested amendment is limited only to changes to Category 5 activities from the existing licence. No changes to the aspects of the existing licence relating to category 61 or 64 have been requested by the licence holder.

Table 1 below outlines the proposed changes to the existing licence.

Table 1: Proposed design changes.

Category	Current design capacity	Proposed design capacity	Description of proposed amendment
5	350,000 tonnes per annual period	350,000 tonnes per annual period	Change specification (d) in Table 8 of Condition 11 from a vertical freeboard of 1.8 m to a "volumetric freeboard" of 31,630 m^3 monitored using remote drone surveys and the Propellor™ software system.

For noting: The Delegated Officer considers that the term "volumetric freeboard" used in the application is an inaccurate term, as freeboard inherently relates to a vertical height. Herein, the term used to describe the vertical freeboard alternative will be *contingency volume.*

2.3 Overview of current operations

Waste slurry is discharged from one of five spigots around the perimeter of TDS Cell 2. This deposited slurry will settle as it flows across the facility, forming a gently sloping beach at an expected gradient of around 1:60, with supernatant (and any collected rainwater) accumulating against the western embankment. This water will be removed by pumping, as required, to maintain a pond of appropriate size. Supernatant is removed using a single duty centrifugal self-priming KSB Etanorm 150-125-400 pump, capable or removing 34.5m^3/hour of water. The pump is housed in a floating "turret" intake system – operational with a small water volume on the surface.

2.4 Proposed amendments

2.4.1 Background

The required freeboard for the TDS Cell 2/Tronox 2 (formerly known as Cristal Cell 2) was determined as part of the preparation of the of the document ***Golder Associates document titled Cristal Cell 2 and Associated Leachate Pond Design dated October 2019, ref. 1660424-012-R-Rev1*** (Golder, 2019). An earlier version of this document was submitted to the department to support the works approval associated with the construction of TDS Cell 2. A revised version of this report was referred to as a supporting document for this amendment application and was provided to the department to justify the amendments sought through this application.

Golder Associates Pty Ltd (Golder) was commissioned by the licence holder (then Cleanaway Waste Management Pty Ltd) to undertake engineering design studies for pigment waste deposition into a new lined waste repository cell at Banksia Road. This included design of an associated leachate pond, referred to as the "Cristal Pond" (but labelled as "TDS Cell 1 Leachate" and Tronox Leachate Pond (TLP) in the current licence), intended to contain discharges from Cristal Cell 2 (CC2) (now referred to as TDS Cell 2 (and TDS Cell 2A) in the current licence) and (temporarily) from the now inactive Cristal Cell 1 (CC1, also referred to previously as the *Millenium Cell*, and referred to in the current licence as CP1, TDS Cell 1 and Tronox Cell 1 Tailings Storage Facility). For ease of reference, the cells will therein be referred to throughout this document as 'TDS Cell 1', 'TDS Cell 2' and the 'TLP' in line with current terminology in use at the premises.

A freeboard assessment was carried out to estimate the storm event storage capacity of TDS Cell 2 and the TLP throughout the various stages of operation. A storage-area-elevation relationship for the facility was developed. For TDS Cell 2, beach contours were developed

using AutoCAD Civil 3D software and the area and storage volume for each metre of height increase were calculated.

TDS Cell 2 was designed to accommodate 5 years of slurry (post mid-2019), equating to approximately 350, 000 m^3. The following assumptions were used when determining the water balance for the above infrastructure, which was used in the freeboard assessment:

- Maximum operational surface areas of approximately 62,000 m^2 (TDS Cell 1), 55, 000 m^2 (TDS Cell 2), and 9,300 m^2 (TLP).
- Average, pigment waste particle density of 2.85 t/m^3 (based on laboratory test work).
- An average in situ dry density for the pigment waste of 0.35 t/m^3.
- A design slurry density of 14.2% solids by mass.
- A waste slurry deposition rate of approximately 160,000 to 180,000 mm/year, based on monthly BOM statistics data for the area.
- Negligible groundwater inflow and/or seepage through the liner system.
- A specific gravity (SG) of 1.0 for the slurry water.
- An estimated supernatant pond size of about 10% of the waste beach area in TDS Cell 2 during normal operations.
- No stormwater run-off will be received from areas outside the facilities and inflow precipitation is a result of rainfall within each enclosed area only (i.e. average pond catchment area of about 9,300 m^2.
- Runoff coefficient of 1.0 on the entire facility.
- Evaporation coefficients of 0.25 for TDS waste slurry, and 1.0 for the pond.
- A maximum decant pumping rate from TDS Cell 2 to the TLP of 345 m^3/day, i.e. average pump rate of 34.5 m^3/h over hours of duration.
- A delay of one month before water can be pumped from TDS Cell 2 (leachate and supernatant) at the commencement of both Stage 1 and Stage 2.
- An initial water storage of 20% of the TLP's capacity prior to TDS Cell 2 becoming operational.
- A maximum water return rate of 490 m^3/day, i.e. the same as the waste slurry delivery rate.

Design storm events based on Water Quality Protection Note WQPN 26 - *Liners for containing pollutants, using synthetic membranes* (WQPN-26) and Australian National Committee On Large Dams (ANCOLD) 2012 guidelines (ANCOLD 2012) were used to estimate the required storage allowances.

WQPN-26 provides:

> *"All lined storage compounds should have stormwater control facilities to minimise embankment erosion. They should also have sufficient freeboard (at least 50 cm) maintained to prevent unintended overflow of water from storms with an average return frequency of at least 20 years, plus capacity to store rainfall resulting from a 90 percentile wet season, after allowance for any evaporative water loss and the effects of any water reuse recovery system".*

Where *freeboard* refers to the vertical height between the crest of the holding dam/pond wall and maximum designed water level.

The consequence category is used to establish the design criteria, including design rainfall events for freeboard assessment. According to the criteria outlined in the ANCOLD 2012 Guidelines, the factors which determine the consequence category of a tailings dam are the *population at risk* (PAR), and the 'severity level' established from potential damages and losses to eth community, environment and the operation in the event of a failure. The Golder 2019 document assigned TDS Cell 2 a consequence category rating of 'Low'. This classification was based on a 'medium' severity classification for potential damages and losses, combined with a PAR of <1. As per the ANCOLD 2012 guidelines, facilities classified as *Low* should maintain

enough freeboard to accommodate a design rainfall event determined by risk assessment. Contingency freeboard to cater for wind wave run-up and additional freeboard are not required under the guidelines for *Low* hazard consequence category facilities.

2.4.2 Storm event storage capacity

In line with the *Environmental Protection Authority Victoria Publication 788.3: Siting, design, operational and rehabilitation of landfills* (EPA Victoria BPEM) requirements, both the TDS Cell 2 and the TLP were designed to contain the 1 in 100 (1%) AEP rainfall event. The TLP has also been designed to contain an extreme storm event resulting from the 1 in 20 (5%) AEP rainfall event plus the 90th percentile wet season, in accordance with the WQPN-26 requirements. At least 0.5 m additional freeboard will be maintained at the lowest point of the perimeter embankments. This additional freeboard will be maintained above the maximum operating level (MOL) plus an allowance for design rainfall, providing no discharge takes place for the duration of the event.

The MOL level for the cell represents the maximum level of the pond under normal operating conditions when water cannot be extracted from the facility (no decant) operational. If the pond reaches the MOL must be initiated to reduce the pond water level.

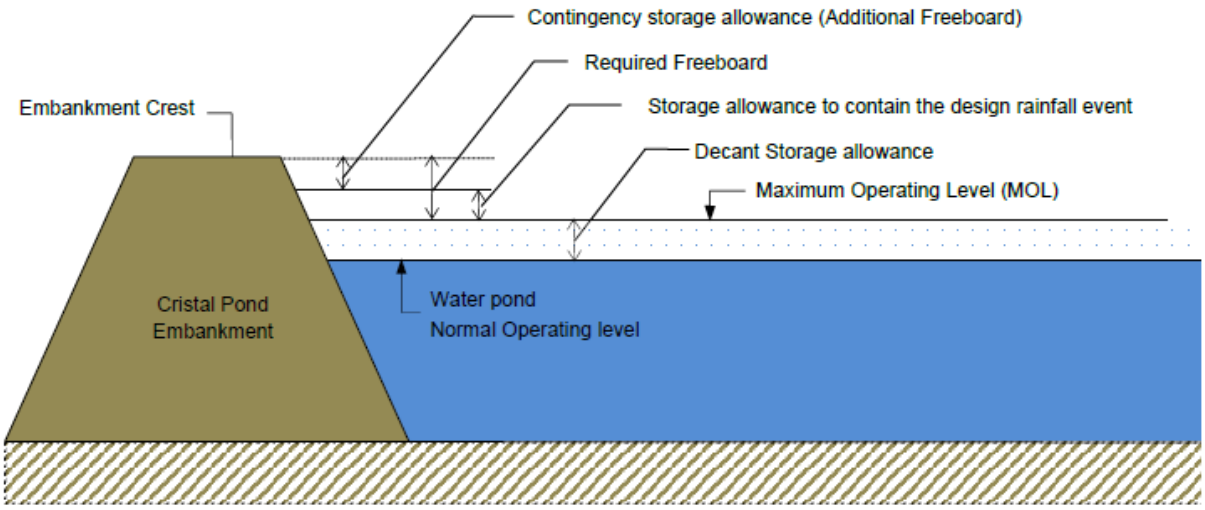

Figure 1: Schematic freeboard requirements for the Tronox Leachate Pond.

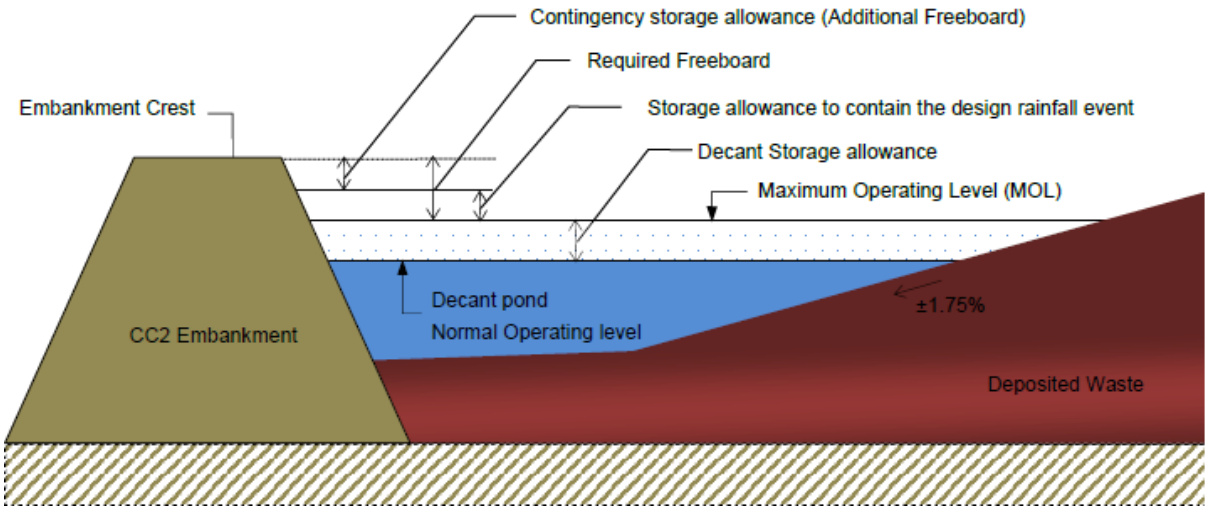

Figure 2: Schematic freeboard requirements for TDS Cell 2.

"Rational Method" used to estimate the storm event discharge in conjunction with rainfall data defining the design rainfall events for the site.

Design rainfall depths for the 1 in 100 (1%) AEP 72-hour rainfall event were derived based on rainfall-intensity-frequency duration (IFD) data for the study area. These were developed using BOM's "computerised Design IFR Rainfall system", which allows automatic determination of a full set of IFD data and associated data for any location in Australia. This approach is consistent with the recommendations outlined in the 2016 edition of Australian rainfall and Runoff published by Geoscience Australia. The expected total rainfall for the 1% AEP 72-hour storm event equates to approximately **179 mm.**

Total rainfall for the 1 in 20 (5%) AEP 24-hour storm equates to about 107 mm. The rainfall depth for the 90th percentile wet season registered at Donnybrook (BOM station 09534) for the years 1901 to 206 equates to approximately 159 mm (on top of the average wet season rainfall). This is equivalent to a total rainfall depth of about 266 mm for the WQPN-26 Design storm as shown in Table 2 below.

Table 2: WQPN-26 design storm (5% AEP + 90 percentile wet season rainfall).

Parameter	Rainfall depth (mm)	Reference
1 in 20 (5%) AEP 24-hour event	107	BOM 2016 IFDS (May 2017)
90 percentile wet season rainfall	815	BOM Station 09534 (May 2017)
50 percentile wet season rainfall	-656	BOM Station 09534 (May 2017)
Total	**266**	-

Note: Wet season taken to be between months of May and August each year.

Assuming a catchment area of about 9,300 m^2, the TLP should have storage capacity of 1,670 m^3 to contain the 1% AEP 72-hour storm event, and 2,480 m^3 for the 5% AEP plus the 90th percentile wet season. TDS Cell 2 has a total catchment area of 55,000 m^2 and will need to have a water storage capacity of **14,630 m^3** (5% AEP plus 90th percentile wet season) when the settled waste beach has reached its maximum elevation. Prior to this time, there will be significantly greater capacity, depending upon the stored volume of waste and water. To avoid overtopping Stage 1 before Stage 2 has been completed, a storage capacity of 7,980 m^3 (5% AEP plus the 90-percentile wet season) is required in Stage 1.

2.4.3 Cell development strategy of TDS Cell 1 (Stage 1) and TDS Cell 2 (Stage 1 and 2)

The construction of the cells was scheduled to be undertaking in the following three phases:

- Phase 1 works – Construction of the TDS Cell 1 Leachate Pond, which includes movement, placement, moisture conditioning, compaction, shaping and finishing of soils; installation of a composite liner on the base and side slopes of the TDS Cell 1 Leachate Pond; return water system including pipe installation and the erection of fencing.
- Phase 2 – Bulk earthworks for construction of TDS Cell 2 (Stages 1 and 2); TDS Cell 2 Stage 1 pre-liner earthworks (i.e. pipe trenches/sump excavations and subgrade preparation), liner works and above liner earthworks (Installation of Stage 1 liner system), concrete works, construction of decant structure, slurry delivery facilities,

stormwater and wastewater management systems and roadworks.

- Phase 3 – TDS Cell 2 Stage 2 pre-liner earthworks (i.e. Trimming and subgrade preparation), liner works and above-liner earthworks (installation of Stage 2 liner system) and installation of pipelines.

As outlined above, TDS Cell 2 was developed in two stages following the commissioning of the TDS Cell 1 Leachate Pond in June 2018. Stage 1 of TDS Cell 2 was projected to take approximately seven months to till, allowing for the deferral of Stage 2 lining until a suitably dry summer (late 2019). Stage 2 of TDS Cell 2 was projected to take approximately 5 months to fill, allowing the two stages to become combined after approximately 12 months. From this point, the facility was projected to have capacity for a further four-year lifespan at the design waste slurry delivery rate.

Table 3: Calculated storage allowance.

Facility	Catchment area (m^2)	5% AEP = (0 percentile Wet Season Storm (m^3)	1% AEP 72-hour Storm (m^3)
TDS Cell 1 (Stage 1)	30,000	7,980	5,370
TDS Cell 2 (Stage 1 and 2 combined)	55,000	14,630	9,850
TLP	9,300	2,480	1,670

The ANCOLD 2012 guidelines to not require a wave allowance for Low hazard facilities, wind wave run-up with eth corresponding annual exceedance probability of 1 in 10 (10% AEP) has been calculated for the facilities. According to the *Australian Standard on Structural Design Actions, Part 2, Wind Actions* (AS 1170.2), the wind speed of the 10% AEP is about 34 m/s (122 km/h). Wave run-up assessments indicate that 150 mm of freeboard is required for the 10 AEP wind. This is less than the 0.5 m required by the WQPN-26, and hence an additional freeboard of 0.5 m above the design storm is considered sufficient.

Results of the freeboard assessment indicate that the MOL of TDS Cell 2 should not be less than 2.2 m below the lowest point of the perimeter embankment crest. During Stage 1, before Stage 2 has been completed, the MOL should not be less than 2.4 m below the diversion embankment crest. These levels include an allowance for additional freeboard of 0.5 m above the design storm event, as shown in Table 8 below.

Table 4: Freeboard requirements.

Design rainfall	Total storm depth (m)			Additional freeboard (m)	Minimum freeboard above MOL (m)		
	TDS Cell 1 Stage 1	TDS Cell 1	TLP		TDS Cell 1 Stage 1	TDS Cell 1	TLP
1 % AEP 72-hour storm depth	1.3	1.2	0.3	0.5	1.8	1.7	0.8

5% AEP plus wet season	1.9	1.7	0.5	0.5	2.4	2.2	10

Considering the current deposition plan and the water balance assessment, the freeboard capacity of the TLP and TDS Cell 2 is deemed sufficient to contain the 1% AEP 72-hour design rainfall event, and the 5% AEP plus the 90th percentile wet season, at all stages of development. However, the water level in the facilities should be managed to be below the MOL at all times to ensure sufficient capacity is maintained to contain the design storm event with 0.5 m additional freeboard without overtopping.

2.4.4 Current freeboard requirements

TDS Cell 2 has been designed such that tailings supernatant and stormwater accumulates at the lowest elevation, along the western embankment of the cell. Consequently, this is where the prescribed freeboard measurement is taken. At this point, tailings will be at reduced level (RL) 61 m AHD, and the crest of the embankment is at 63.3, so allowing for the 1.8 m freeboard, the MOL will need to be maintained at or below 61.5 m AHD.

2.4.5 Contingency volume specifications

As per the Golder 2019 document, the 1.8 m freeboard was designed to contain the design rainfall and wind wave run up. Section 6.6.3 of the Golder 2019 document presents the calculations for the design rainfall. It considers all the relevant guidelines and estimates the design rainfall to be equivalent to 14,630 m^3. Section 6.6.4 of the Golder 2019 document presents the assessment of the additional freeboard for wind wave run up and recommends a 0.5m freeboard to contain the wave action, which is equivalent to 17,000 m^3. The combined volume of design rainfall and wave action freeboard equals 31,630 m^3 of required storage capacity, which is the figure which the licence holder is requesting be inserted into the licence as the contingency volume.

The Golder 2019 document calculates the design rainfall event in m^3 as a volume, and then converts it to depth, based on the design beach profile. As shown on Figure 3, within that 1.8m freeboard, the actual storage capacity for water is relative to the beach slope, with a flatter beach slope resulting in a larger storage capacity and a steeper beach slope resulting in a smaller storage capacity.

The licence holder has advised that the beach slope in TDS Cell 2 is highly variable and so, to maintain the actual storage capacity, is requesting this stipulated volume applied to the licence as a more accurate way to measure available contingency volume within the cell.

The licence holder has provided the following analysis of the required containment capacity for TDS Cell 2.

Table 5: Water storage capacity in TDS Cell 2.

Proposed rainfall event containment volume requirements	**Contingency volume (m^3)**	**Maximum operating level (m AHD)**
5% AEP rain event	5,885	As required to achieve total available water storage volume.
90% percentile wet season	8,745	
0.5 m freeboard (below minimum embankment crest)	17,000	
Total	**31,630**	

The licence holder has provided the Delegated Officer with a copy of the Environmental Management Plan (EMP) prepared by Cleanaway and Tonkin Consulting for the Banksia Road Landfill. The EMP outlines the TDS Cell 2 Environmental Action Plan (EAP) enacted to maintain supernatant at the maximum operating level (MOL). Figure 3 below details where measurement is to be taken from, given a background of top of waste profile within the cell. Measurement is to be a visual measuring device down the batter.

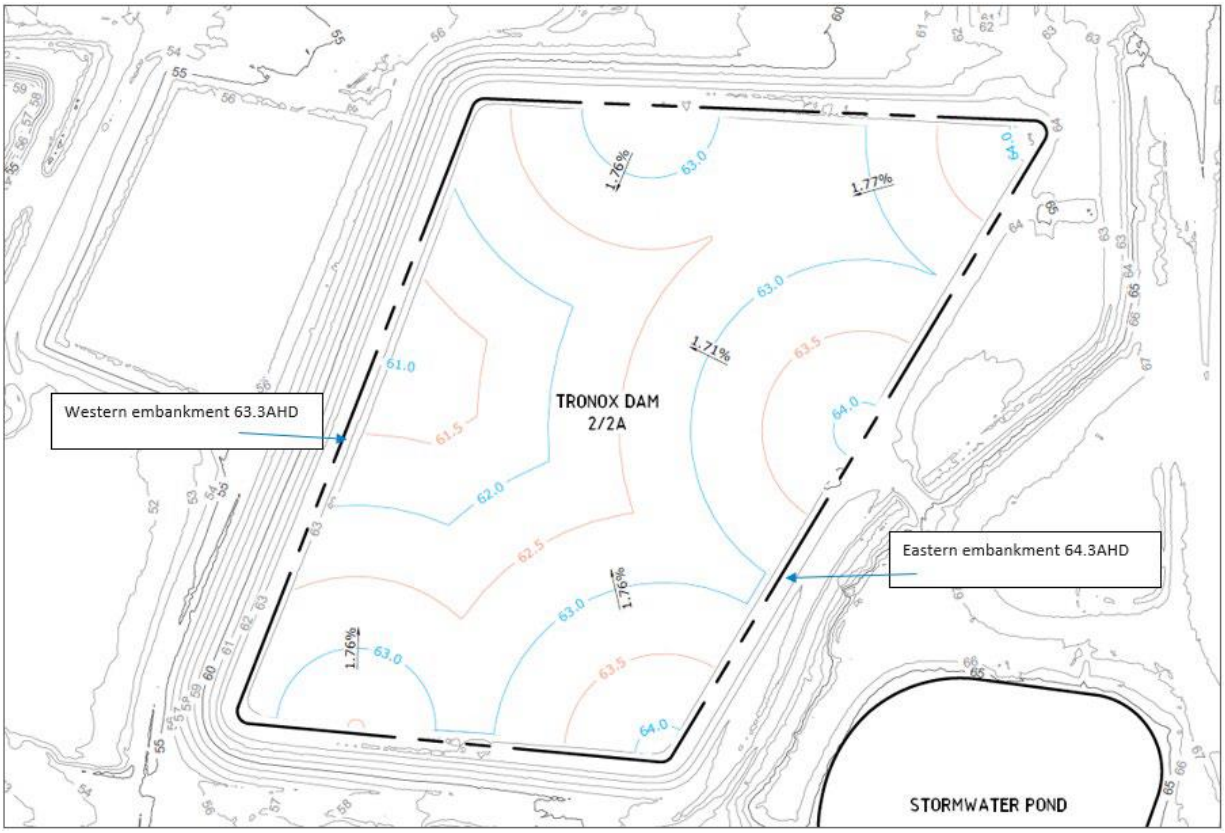

Figure 3: Visual freeboard measurement location.

The below Diagram 2 details the MOL as a cross section at the position of measurement, per the basis of design (not to scale).

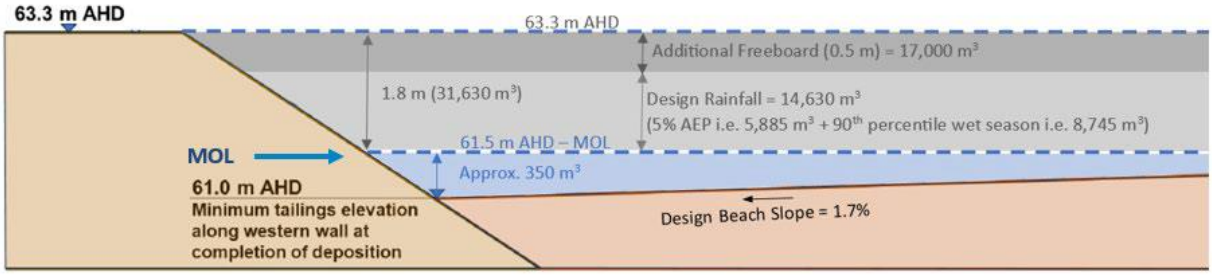

Figure 4: Conventional freeboard measurement method.

Where the MOL is exceeded, the EMP requires the following actions are undertaken:

1. Discontinue receiving inbound volume immediately,
2. Work with Customer to maximise outbound volume of leachate,
3. Pump volume from TDS cell into leachate cell to a maximum 1 m freeboard, and
4. Forecast weather dependant – assess taking volume offsite to water treatment facility.

Note: Leachate pond to be managed to 1.5m freeboard (versus licensed 1 m freeboard) creating

~5000 m^3 capacity for point 3.

The licence holder has advised the Delegated Officer that the premises currently employs Propellor™, a cloud-based workspace where users can map, measure, and manage site activity with survey data, to monitor levels within TDS Cell 2. Propellor™ uses the data collected from monthly drone surveys to calculate the remaining capacity to overtopping of the western embankment, exclusive of the 31,630 m^3 contingency volume. The licence holder is also able to incorporate rainfall data collected at the premises into these calculations.

The licence holder has advised that the acceptance of slurry is currently projected to cease in July 2025, and the requested change to a minimum contingency capacity is contended to provide greater flexibility in managing water in TDS Cell 2 due to some uncertainty involved with future tailings beach slopes. However, as part of subsequent requests for information the licence holder is not proposing a change to the original design parameters, including tailings beaching.

For noting: In light of the licence holder's proposed amendments, the Delegated Officer considers the following:

- Programs such as Propellor™ have not been adopted by DEMIRS or DWER as a reliable tool with which to manage compliance with tailings storage facility capacity or freeboard requirements.
- The failure to deploy drones to measure water height during storm and heavy rainfall events, or the potential of failure of software or monitoring systems presents a potential for water levels to not be adequately monitored and maintained.
- Possible cell overtopping in the wake of prolonged, sequential heavy rainfall events coupled with the major consequences associated with damage to the cell wall because of overtopping result in a high level of associated risk in connection to a move away from the actual visual verification of available freeboard.

These items will be further discussed in the applications risk assessment.

2.5 Part IV of the EP Act

Ministerial Statement 1213 was published on 21 November 2023 for Cleanaway Solid Waste Pty Ltd to construct and operate landfill cells 9, 10, and 12A and associated infrastructure at the Banksia Road Landfill. Ministerial Statement 1213 is not applicable to current application and assessment.

2.6 Stakeholder comments

The department referred the licence holder's amendment application to the Department of Energy, Mines, Industry Regulation and Safety (DEMIRS) for comment on 31 July 2024, as DEMIRS have regulatory oversight of traditional tailings storage facilities under the *Mining Act 1978.*

Comments from DEMIRS, along with the departments response to these comments, are outlined in Table 6 below.

Table 6: DEMIRS stakeholder comments and DWER response

DEMIRS comment	DWER response
The use of unmanned aerial vehicle (UAV's or drones), fitted with appropriately calibrated sensors and data that has been quality assured, processed and validated could be accepted as it is the new emerging technology. The applicant should demonstrate to DWER how this method compares to other physical measurement methods.	The licence holder has provided DWER with screen shots from the Propeller™ system software which is currently employed at the premises to monitor levels within the TSF, with the system able to calculate the remaining capacity to the top of wall (TOW), or the contingency capacity available.
DEMIRS note that the original design also had the decant pond on the western embankment and if there is a significant change of water column height, then there could be some impacts on embankment stability. Under such circumstances it would be advisable for the applicant to review its geotechnical engineering risk assessment of this design change on the embankment.	Noted. The original design for TDS Cell 2 allowed for 350,000 m^3 of storage capacity for tailings, and 31,630 m^3 of storage capacity for rainfall (the volume requested as the volumetric freeboard, and referred to herein and in the licence as contingency volume). There is no proposed change to the original design parameters. As there is no proposed change to loading conditions on the perimeter embankments from the original design, it follows that there will be no impact on stability.
Beaching could be diverse regarding the tailings properties and its operational management. As described above, it would be advisable for the applicant to assess its influence (if any?) on the embankment.	Noted. There is no proposed change to the beach profiles as part of this amendment, however the basis of the requested amendment is the "uncertainty involved with future tailings beach slopes". Beach design and slopes were set out in the Golder 2019 document. The discharge spigots were to be managed such that a gently sloping beach (roughly 1 in 60) is achieved across the basin, forming a semi-circular pond against the western embankment. A slightly latter beach slope is projected to result from tailings management in the leadup to cell closure. DWER followed up with DEMIRS for further comment as to whether any impact to the embankment would be expected due to changes in the tailings beach, and no specific issues with the proposed alteration in freeboard monitoring and management were noted.

DEMIRS comment	DWER response
Recommended DEMIRS/ANCOLD 2012 freeboard management guidelines will apply immaterial of the beaching profiles etc. The applicant should translate volumes into height considering the area and define the height required for the freeboard management.	Noted. DEMIRS Guide to Departmental requirements for the management and closure of tailings storage facilities (TSFs) references daily and monthly inspections of TSF freeboard. In the original design, WQPN-26 and the ANCOLD 2012 guidelines were used to estimate the required storage capacity to contain collected stormwater. In the original design, the design rainfall event was calculated as a volume in cubic metres, and then converted to depth based on the design beach profile to determine freeboard requirements. The licence holder is requesting that the conditions of licence require the maintenance of a minimum contingency volume within the cell, as they believe it provides a more accurate way to measure the actual storage capacity. The requested contingency volume is the original volume calculated during the design of the cell. The licence holder seeks this amendment on the basis that the footprint and depth of the supernatant in the cell is variable, and the Propellor™ offer greater accuracy then a visual measurement of a vertical freeboard.

Key Finding: The Delegated notes comments from DEMIRS outlining that the DEMIRS / ANCOLD 2012 guidelines will apply immaterial of the beaching profiles etc., which requires the daily and monthly monitoring of a traditional freeboard.

Whilst it is ultimately the licence holder's responsibility to ensure that all requirements, including those set by other government agencies, are met prior to commencing operations at a premises, DWER will give regard where other approvals are required, and how other approvals will impact the operation of a prescribed premises.

3. Risk assessment

The department assesses the risks of emissions from prescribed premises and identifies the potential source, pathway, and impact to receptors in accordance with the *Guideline: Risk assessments* (DWER 2020).

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.

3.1 Source-pathways and receptors

3.1.1 Emissions and controls

The key emissions and associated actual or likely pathway during premises operation which have been considered in this amendment report are detailed in Table 7 below. Table 7 also details the proposed control measures the licence holder has proposed to assist in controlling these emissions, where necessary.

Table 7: Licence holder controls.

Emission	Sources	Potential pathways	Proposed controls
Supernatant contaminated stormwater	Overtopping of pond during heavy or prolonged rainfall events.	Seepage to soils and groundwater	Maintenance of a permanent 31,630 m^3 contingency volume using the Propellor™ software program to prepare monthly forecasts based on projected rainfall and recorded supernatant levels.

3.1.2 Receptors

In accordance with the *Guideline: Risk assessments* (DWER 2020), the Delegated Officer has excluded employees, visitors, and contractors of the licence holder from its assessment. Protection of these parties often involves different exposure risks and prevention strategies and is provided for under other state legislation.

Table 8 below provides a summary of potential human and environmental receptors that may be impacted because of activities upon or emission and discharges from the prescribed premises *(Guideline: Environmental siting* (DWER 2020)). The proximity between the premises boundary and the closest sensitive human receptors is illustrated in Figure 5.

Table 8: Sensitive human and environmental receptors and distance from prescribed activity.

Human receptors	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. • 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.
Environmental receptors	**Distance from prescribed activity**
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.

Geomorphic wetland: Multiple use Palusplain and Dampland (flat, seasonally waterlogged)	Approximately 400 m southwest through to the northwest of the premises boundary.
Crooked Brook (significant stream)	Located approximately 1,100 m south/southwest of the premises boundary flowing in a generally east/west direction. Flows into Preston River which is located approximately 5 km downstream.
Preston River	Approx. 5 km 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 20 m to 30 m below ground level. It is also possible that further isolated perched aquifers occur under the Premises 15 – 20 m below ground level. The permanent, confined Leederville aquifer has been encountered at the site between 35 mbgl and 40 mbgl. Groundwater flows in a north-westerly 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. • Dairying. • Irrigation of pasture. • Domestic usage.
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 southeast corner of the premises and approximately 180 m south of the premises • Priority 4 flora species - approximately 160 m east of the premises.
Threatened fauna – Baudin's black cockatoo (*Zanda baudinii*), Carnaby's black-cockatoo (*Zanda latirostris*) and the forest red-tailed black-cockatoo (*Calyptorhynchus banksii naso*)	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.

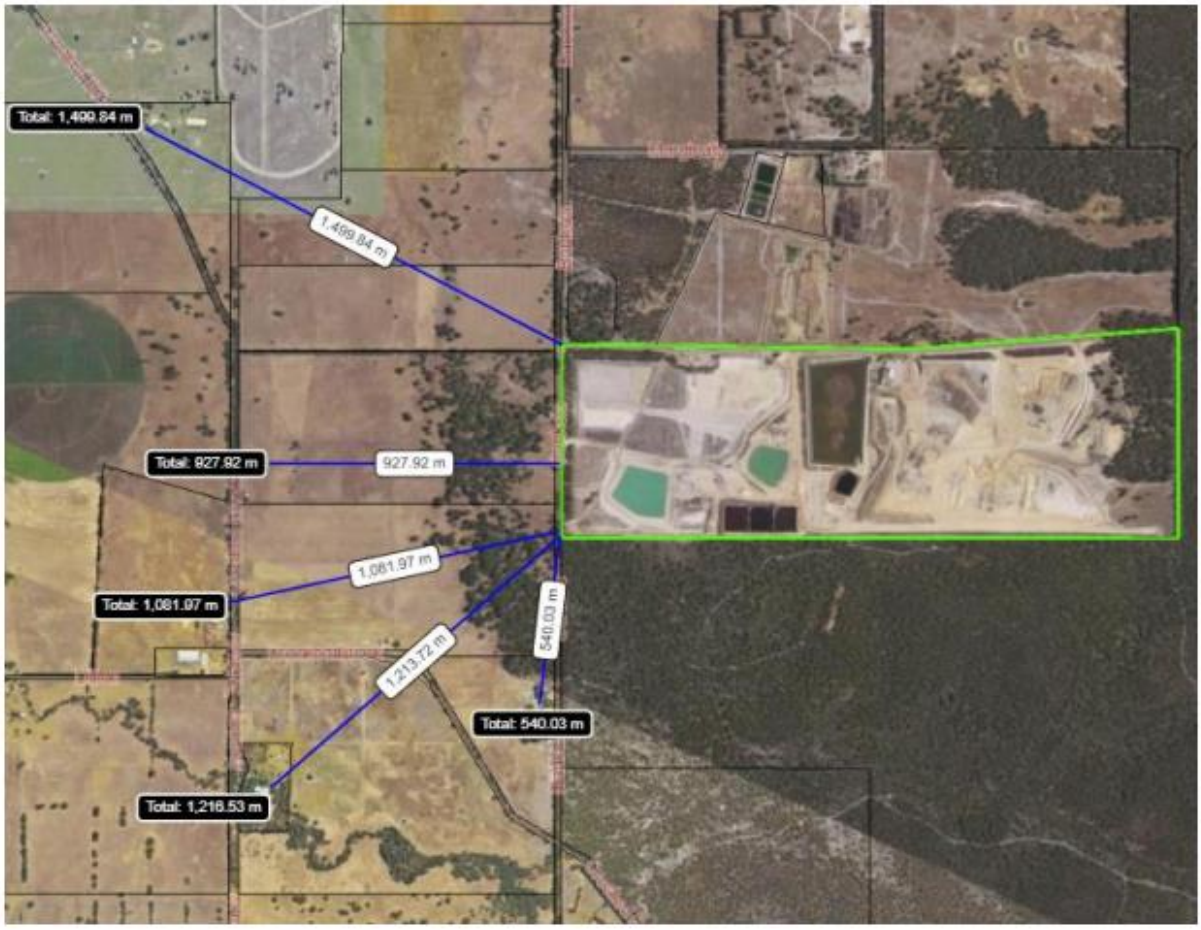

Figure 5: Relative proximity of premises (green polygon) to closest sensitive human receptors.

3.2 Risk ratings

Risk ratings have been assessed in accordance with the *Guideline: Risk Assessments* (DWER 2020) for those emission sources which are proposed to change and considers potential source-pathway and receptor linkages as identified in Section 3.1. Where linkages are in-complete they have not been considered further in the risk assessment.

Table 9. Risk assessment of potential emissions and discharges from the premises during operation.

Risk Event					**Risk rating[1]** **C = consequence** **L = likelihood**	**Licence holder's controls sufficient?**	**Conditions[2] of licence**	**Justification for additional regulatory controls**
Source/Activities	**Potential emission**	**Potential pathways and impact**	**Receptors**	**Licence holder's controls**				
Novel TDS Cell 2 supernatant management using drone surveys and software program rather than visual inspections.	Supernatant contaminated stormwater	Overland runoff and infiltration through soil profile potentially causing ecosystem disturbance or impacting groundwater water quality Damage to containment infrastructure.	Groundwater and beneficial users of groundwater	Refer to Section 3.1.1	C = Possible L = Major **High Risk**	N	Existing conditions 11, 12, and 49	Refer to section 4.

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

Note 2: Proposed licence holder's controls are depicted by standard text. **Bold and underline text** depicts additional regulatory controls imposed by department.

4. Detailed risk assessment

The licence holder is proposing to update the current freeboard requirement for TDS Cell 2 from a vertical freeboard measurement to the calculation and maintenance of a contingency volume within TDS Cell 2. In reviewing the specifications surrounding this proposed amendment, the Delegated Officer considers the following:

- The program proposed for the calculation of the contingency volume (Propellor™) has not previously been adopted by DEMIRS or DWER as a reliable tool with which to manage compliance with tailings storage facility capacity or freeboard requirements.
- There is the potential that drones could not be deployed during adverse weather to measure water height during storm and heavy rainfall events, which is a critical time in determining how much water will be in TDS Cell 2 to prevent overtopping.
- The reliance on software and drones for the calculation of a contingency volume creates a risk for potential failure of software or monitoring systems, leading to water levels not being adequately monitored and maintained.
- Comments from DEMIRS have indicated that the DEMIRS / ANCOLD 2012 guidelines will remain applicable to the management of TDS Cell 2, which require daily and monthly monitoring of a traditional freeboard. The licence holder's proposed methodology for contingency volume calculations will also not provide a daily reading.

Possible cell overtopping in the wake of prolonged, sequential heavy rainfall events coupled with the major consequences associated with damage to the cell wall because of overtopping result in a high level of associated risk in connection to a move away from actual visual verification of available freeboard.

Additionally, whilst it is ultimately the licence holder's responsibility to ensure that all requirements, including those set by other government agencies, are met prior to commencing operations at a premises, DWER will give regard where other approvals are required, and how other approvals will impact the operation of a prescribed premises.

As such, the Delegated Officer has determined that the calculation and maintenance of a contingency volume within TDS Cell 2 will be permitted through this amendment application, contingent on the licence holder continuing to monitor a vertical freeboard in line with current licence conditions.

On review of current Licence conditions relation to compliance reporting, the Delegated Officer has determined that monthly Propellor™ software calculations demonstrating the remaining capacity to the top of wall (TOW), or the contingency volume available for TDS Cell 2 should be submitted to DWER in the Annual Environmental Report.

5. Consultation

Table 10 provides a summary of the consultation undertaken by the department.

Table 10: Consultation.

Consultation method	Comments received	Department response
Application advertised on the department's website (25/07/2025)	No comments received.	n/a
Local Government Authority advised of proposal (25/07/2024)	No comments received.	n/a

Department of Mines, Industry Regulation and Safety (DMIRS) advised of proposal (31/07/2024)	Refer to Section 2.6	Refer to Section 2.6
Dardanup Environmental Action Group (DEAG) advised of proposal (25/07/2024)	Refer to Appendix 1	Refer to Appendix 1
Licence holder was provided with draft decision on (14/01/2025)	*Please progress with the issue of the Licence as Cleanaway chooses to waiver the 21-day period.*	Noted.

6. Conclusion

Based on the assessment in this Amendment Report, the Delegated Officer has determined that a revised licence will be granted, subject to conditions commensurate with the determined controls and necessary for administration and reporting requirements.

6.1 Summary of amendments

Table 11 provides a summary of the proposed amendments and will act as record of implemented changes. All proposed changes have been incorporated into the revised licence as part of the amendment process.

Table 11: Summary of licence amendments.

Condition no.	Proposed amendments
11, Table 8,	Reference to 'TDS Cell 2A' removed to reflect that TDS Cell 2 is only one cell. Freeboard amended to 1.7m for TDS Cell 2 to ensure consistency is maintained across the cell with freeboard measurement. Requirement for monthly contingency volume calculations using the Propellor™ software to be undertaken inserted. ***Note: If a breach of the 1.7 m freeboard was to occur, the licence holder must demonstrate that the 31,630 m^3 contingency volume required to contain a 1% AEP rainfall event was been maintained at the time of the breach.***
71, Table 8	Requirement to submit monthly contingency volume calculations from the Propellor ™ program as part of AER inserted.
Definitions	Freeboard definition inserted. *means the distance between the maximum water surface elevations and the top of retaining banks or structures at their lowest point.*
	TDS definition inserted: "means titanium dioxide slurry (TDS) comprising Titanium Dioxide Tailings from the rom the titanium dioxide processing and finishing plants (Part V licence numbers L6046/1967/15 and L8870/2014/1).

References

1. Department of Environment Regulation (DER) 2015, *Guidance Statement: Setting Conditions*, Perth, Western Australia.
2. Department of Water and Environmental Regulation (DWER) 2020, *Guideline: Environmental Siting*, Perth, Western Australia.
3. DWER 2020, *Guideline: Risk Assessments*, Perth, Western Australia.
4. *Golder and Associates 2019, Golder Associates document titled "Cristal Cell 2 and Associated Leachate Pond Design" dated October 2019, ref.1660424-012-R-Rev1.*
5. *Department of Water (DoW), now Department of Water and Environmental Regulation (DWER), August 2013. "Liner for containing pollutants, using synthetic membranes". Water Quality Protection Note – 26 (WQPN-26).*
6. Australian National Committee On Large Dams (ANCOLD) May 2012. *"Guidelines on Tailings Dams; Planning, Design, Construction, operation, And Closure.*
7. Environmental Protection Agency (EPA) Victoria, August 2015. "*Siting, design, operation, and rehabilitation of landfills",* Best Practice Environmental Management (BEPM) Publication 788.3.
8. Cleanaway and Tonkin Consulting March 202. *Environmental Management Plan Banksia Road Landfill Crooked Brook*, WA 6236 Licence Number: L8904/2015/1 version 4.

Appendix 1: Summary of Dardanup Environmental Action Group (DEAG) member comments on proposed amendments

DEAG member submission	Submission summary	DWER response
Content Manager reference number *DWERDT982961*	Does the Cell as it stands now, not have the capacity for Tronox to operate without the risk of diminished freeboard and possible overflow? Within the Amendment application in section 9.1 it states that Electromagnetic Radiation is present and noted that a Report would be attached as required, but no report is attached. The WSP Australia report does not give any information as to how Cleanaway can achieve higher volume and not diminish the freeboard safely. The figures in the report from Golder gives data from 2017 rainfall and yes should be updated. But WSP have only done an estimate on old figures. The Response to RFI gives us a month rainfall number that is far from sufficient and in a year that we had a record dry April & May. DWER should be requiring an increased freeboard requirement for Cells that contain mineral and chemical waste.	The licence holder had selected this emission type in error. Electromagnetic radiation relates to electromagnetic waves emitted by electrically charged particles undergoing acceleration. The radiation of relevance to the premises is low level naturally occurring radioactive materials (NORMs) including uranium and thorium are contained within the slurried tailings from the titanium dioxide processing plant. As part of a 2021 licence review, DWER sought advice from the Radiological Council on tailings handling at the premises. 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, the licence holder 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. There is no proposed increase in dam supernatant volume/capacity, only the means by which a contingency volume for stormwater accumulation is monitored. The design of the cell was based on the assumptions and calculated freeboard requirements detailed in Table 2 . The rainfall data used therein was current at the time of design. The determined MOL is considered sufficient to manage stormwater up to this point, and through the cell closure process.
Content Manager reference number *DWERDT982086*	What is the meaning of the terms “freeboard measurement” and “titanium dioxide cell”?	The Department of Primary Industries and Regional Development’s Pond Freeboard fact sheet) defines freeboard as “the vertical height between the crest of the holding pond wall and maximum designed water level. Several guidelines specify minimum standards of freeboard height, but these vary across industries.” With respect to tailings storage facilities (TSFs), freeboard is defined as "the vertical height between the lowest point on the crest of the perimeter

DEAG member submission	Submission summary	DWER response
		embankment of the TSF and the normal operating pond level plus an allowance for an inflow corresponding to the 1:100 year 72-hour duration rainfall event falling in the catchment of the pond, assuming that no uncontrolled discharge takes place for the duration of the rainfall event". A definition of freeboard has not been previously provided in L8904/2015/1, and a premises specific definition has been included as part of this amendment process. The various TDS cells are defined in the definitions table. However, a definition of TDS (Titanium dioxide slurry) is not included. I.e. Titanium dioxide slurry comprising Titanium Dioxide Tailings from the Tronox facility. A definition of TDS should be inserted as part of any future licence amendment.
Content Manager reference number *DWERDT985042*	Not opposed to changes in the way the freeboard is measured but have reservations in relation to how the freeboard requirement has been calculated. These calculations require further assessment. Measurement of the area using satellite imagery indicates that the area from the outer crest of the embankment and including the utilities and discharge area is approx. 57,000 m^2, almost 4% more than the 55,000 m^2 given in the supporting documentation. Further, it appears there could be up to another 10,000 m^2 of higher ground between the eastern embankment and the bund/drain around the landfill area with the potential for runoff from this area to flow into Tronox Cell 2. If these areas are included, then the volume of water to be stored would increase from the 14,630 m^3 to as much as 17,800 m^3. Whilst the proposed freeboard of 31,630m^3 would still appear adequate, some other factors need to be considered as discussed below. For operating and management purposes, the real time volume in the Cell will still need to be determined from a level gauge board. The pond does not have a spillway so in the case of an unforeseen event, the risk of failure should the Cell wall overtop is significantly increased. Overtopping will cause erosion of the outer wall and flow north from the site into irrigation channels, and either Preston or Ferguson Rivers. Changing to a volumetric freeboard only complicates the real time measurement and management of the freeboard. In a rainfall event it will be an on-the-spot physical reading of water level	Noted. The Delegated Officer has referred the application to the Department of Energy, Mining, Industry Regulation, and Safety for comment on the associated risk and practicality of measurement using remote sensing technology (refer to Appendix 1). Based on the uncertainty around efficacy of the proposed methodology to inform management actions in real-time, the Delegated Officer has determined that a vertical freeboard will be maintained in addition to the inclusion of the calculation of a contingency volume for TDS Cell 2. This will ensure a two fold calculation is undertaken to demonstrate freeboard / cell holding capacity has not been exceeded and that overtopping in heavy rainfall events will not occur. There is no proposed increase in dam supernatant volume/capacity, only the means by which a contingency volume for stormwater accumulation is monitored.

DEAG member submission	Submission summary	DWER response
	that informs what the freeboard is. Is a volumetric freeboard actually a measurable and enforceable target or condition, or is it just an unnecessary complication which will make management and enforcement of freeboard more complex and difficult? If it is accepted as appropriate, then the licence needs to **include a condition on how that volume is calculated and how often the volumetric conversion chart needs to be updated**. It does not appear if a risk assessment has ever been carried done to determine if the bunds and drains around the landfill areas are adequate to cope with a 1 in 20, or a 1 in 100 rainfall event and to determine what additional runoff may flow to the Tronox Cell should a drain overflow or a bund breach. A risk assessment or hazard and operability study type assessment is recommended to ensure active management of freeboard in response to rainfall and prevent overtopping in the event of successive heavy rainfall events.	