



Review of Existing Licence

Division 3, Part V *Environmental Protection Act 1986*

Licence Number	L6831/1997/12
Licence Holder	Shire of Collie
File Number	DER2017/000540-1
Premises	Gibbs Road Putrescible Landfill Site Gibbs Road COLLIE WA 6225 Legal description - Lot 500 on Deposited Plan 76826
Date of Report	5 July 2021
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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
Acceptance Criteria	has the meaning defined in the Landfill Definitions
ACM	means Asbestos Containing Material and has the meaning defined in the <i>Guidelines for Assessment, Remediation and Management of Asbestos Contaminated Sites, Western Australia</i> (DOH, 2009)
AEP	means Annual Exceedance Probability
AER	Annual Environmental Report
AHD	means the Australian Height Datum
Annual Period	means a 12 month period commencing from 1 January until 31 December in the same year.
Asbestos	means the asbestiform variety of mineral silicates belonging to the serpentine and amphibole groups of rock-forming minerals including actinolite, amosite, anthophyllite, chrysotile, crocidolite, tremolite, or any mixture of these
AS/NZS 5667.1	Australian/New Zealand Standard AS/NZS 5667.1 Water Quality – Sampling Guidance on the Design of sampling programs, sampling techniques and preservation and handling of samples
AS/NZS 5667.4	Australian/New Zealand Standard AS/NZS 5667.4 Water quality – Sampling Guidance on sampling from lakes, natural and man-made
AS/NZS 5667.6	Australian/New Zealand Standard AS/NZS 5667.6 Water quality – Sampling Guidance on sampling of rivers and streams
AS/NZS 5667.11	Australian/New Zealand Standard AS/NZS 5667.11 Water quality – Sampling Guidance on sampling of groundwaters
BTEX	Benzene, ethylbenzene, toluene and xylenes
Category/ Categories/ Cat.	Categories of Prescribed Premises as set out in Schedule 1 of the EP Regulations
CEO	means Chief Executive Officer. “submit to / notify the CEO” (or similar), means either: Director General Department administering the <i>Environmental Protection Act 1986</i> Locked Bag 10 Joondalup DC WA 6919 or: info@dwer.wa.gov.au
Clean Fill	has the meaning defined in the Landfill Definitions
Condition	means a condition to which the Licence is subject under s.62 of the EP Act.
CS Act	<i>Contaminated Sites Act 2003</i> (WA)
Decision Report	refers to this document.
Delegated Officer	an officer under section 20 of the EP Act.

Term	Definition
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.
Discharge	has the same meaning given to that term under the EP Act.
DWER	Department of Water and Environmental Regulation
EFN	Environmental Field Notice
EFR	Environmental Field Report
Emission	has the same meaning given to that term under the EP Act.
EPN	Environmental Protection Notice
EP Act	<i>Environmental Protection Act 1986 (WA)</i>
EP Regulations	<i>Environmental Protection Regulations 1987 (WA)</i>
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
Green Waste	means waste that originates from flora and which does not contain or has not been treated or coated with, preserving agents, biocides, fire retardants, paint, adhesives or binders
Hazardous Waste	has the meaning defined in the Landfill Definitions
ICMS	Incident and Complaint Management System; internal departmental system used to log and record incidents and complaints relating to pollution incidents, non-compliances and potential breaches of legislation.
Inert Waste Type 1	has the meaning defined in the Landfill Definitions
Inert Waste Type 2	has the meaning defined in the Landfill Definitions
Landfill Definitions	means the document titled <i>Landfill Waste Classification and Waste Definitions 1996</i> published by the Chief Executive Officer as amended from time to time
Licence Holder	Shire of Collie
LoW	Letter of Warning
LPMP	Leachate Prevention and Management Plan
NATA	means the National Association of Testing Authorities, Australia
NATA accredited	means in relation to the analysis of a sample that the laboratory is NATA accredited for the specified analysis at the time of the analysis.
NEPM	National Environmental Protection Measure
Pollution	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
Prescribed Premises	has the same meaning given to that term under the EP Act.
Putrescible Waste	means the component of the waste stream likely to become putrid – including wastes that contain organic materials such as food wastes or wastes of animal or vegetable origin, which readily bio-degrade within the environment of a landfill
QAQC	means quality assurance and quality control

Term	Definition
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 <i>Guidance Statement: Risk Assessment</i>
SOP	means standard operating procedure
Special Waste Type 1	has the meaning defined in the Landfill Definitions.
Special Waste Type 2	has the meaning defined in the Landfill Definitions.
Waste	has the same meaning given to that term under the EP Act.
Waste type	has the meaning given to that term in the Landfill Definitions

2. Purpose and scope of assessment

On the 14 November 2016, the Shire of Collie (the Licence Holder) were notified of DWER's intention to review the Gibbs Road Putrescible Landfill Licence (L6831/1997/12) (the Premises) under the *Environmental Protection Act 1986 (WA)* (EP Act). While the review originally commenced in 2016, it was postponed on several occasions due to other departmental priorities.

The decision to undertake a licence review was driven by concerns and observations which led to the issue of an Environmental Protection Notice (EPN – dated 30 October 2009 – see Appendix 3), several Environmental Field Notices (EFN) and several formal Letters of Warning (LoW). As a result, this review will give regard to matters raised in previous enforcement notices/actions (refer to Section 3.1 and 5.1.4 for a summary of the EPN and the compliance history related to the premises).

In-light of the licence review being finalised and associated specified actions completed, the department may revoke the EPN that is currently in place against the Licence Holder for the Premises. The department considers that all matters outlined in the EPN have been considered in this review and are more effectively addressed by a revision to the operational requirements imposed on the Licence Holder through the issue of a Revised Licence.

2.1 Scope of the Review

The scope of this Review will be based on the matters raised in the EPN, EFNs and LoWs issued since 2009, and will primarily consider:

- leachate generation, migration and management;
- the understanding of local and site-specific hydrogeological conditions;
- monitoring of emissions and ambient environment;
- premises operational management;
- geotechnical stability and waste landform management during operations, closure and rehabilitation;
- other identified risks related to operations at the Premises including landfill gas generation, management of asbestos and stormwater management.

During this Review, it was identified that some conditions relating to other aspects of the Existing Licence do not reflect current standard conditions imposed on landfills or that some of the existing operations at the Premises, such as Hazardous Waste acceptance, were not reflected in the Existing Licence conditions. The relevant conditions were amended to provide consistency with the contemporary licensing approach but were not considered in the risk assessment. It is intended that a complete review of the Premises will take place following completion of actions required as part of the licence amendments made as a result of this Review.

The risk assessment in this Review and associated regulatory controls were determined based on the continued operation of the Class II putrescible landfill at the Premises. Different regulatory controls would apply if the Licence Holder decided to close the Class II putrescible landfill and operate the Premises as a Category 62 solid waste depot only within a short-term timeframe (i.e. less than three years). In this scenario, the Licence Holder would still be subject to regulatory requirements under the EP Act and the *Contaminated Sites Act 2003* (CS Act) such as landfill closure and management planning and environmental investigations and monitoring.

2.1.1 Exclusions from scope

This Review is regarded as a limited scope review and does not aim to assess risks related to all activities undertaken on the Premises. Parts of the Existing Licence that are excluded from the risk assessment process undertaken for this Review include:

- Site security;
- Fire management;
- Fugitive dust;
- Odour management;
- Hazardous waste acceptance and storage; and
- Other activities not listed in Section 8.

DWER understands that the Licence Holder is currently considering potential alternative waste treatment technologies to be implemented at the Premises in the future. This Review does not consider potential changes relating to alternative technologies and is limited to considering the current operations and infrastructure at the Premises.

While this Review was under preparation, the Licence Holder engaged ASK Waste Management to prepare a Waste Management Plan (WMP) for the Premises. This document was finalised in June 2019 and provided to DWER on 6 February 2020 ahead of the 2020 compliance inspection. At the inspection, the Licence Holder advised DWER that they had not yet implemented all of the recommendations in the WMP because they were waiting to finalise future plans for the Premises. As DWER is not aware that the Licence Holder has committed to implementing the WMP (or components within), DWER does not consider that any proposed infrastructure upgrades and management controls are a reliable indication of future improvements to site operations. The risk assessment in this Review (Section 8) therefore does not take into consideration the content of the WMP.

The Licence Holder should also be aware that any proposed changes to the Premises to address recommendations of WMP may trigger the need for a works approval or licence amendment and thus any works may need to be assessed by the department prior to implementation (section 53 of the EP Act). Further guidance on changes to prescribed premises can be found in the department's [Industry Regulation Guide to Licensing](#) (DWER, June 2019).

3. Background

The Gibbs Road Putrescible Landfill is a Class II unlined landfill and waste depot located at Reserve 36457 Gibbs Road, Collie; approximately 2.3 kilometres (km) east of the town of Collie in Western Australia (Figure 1).

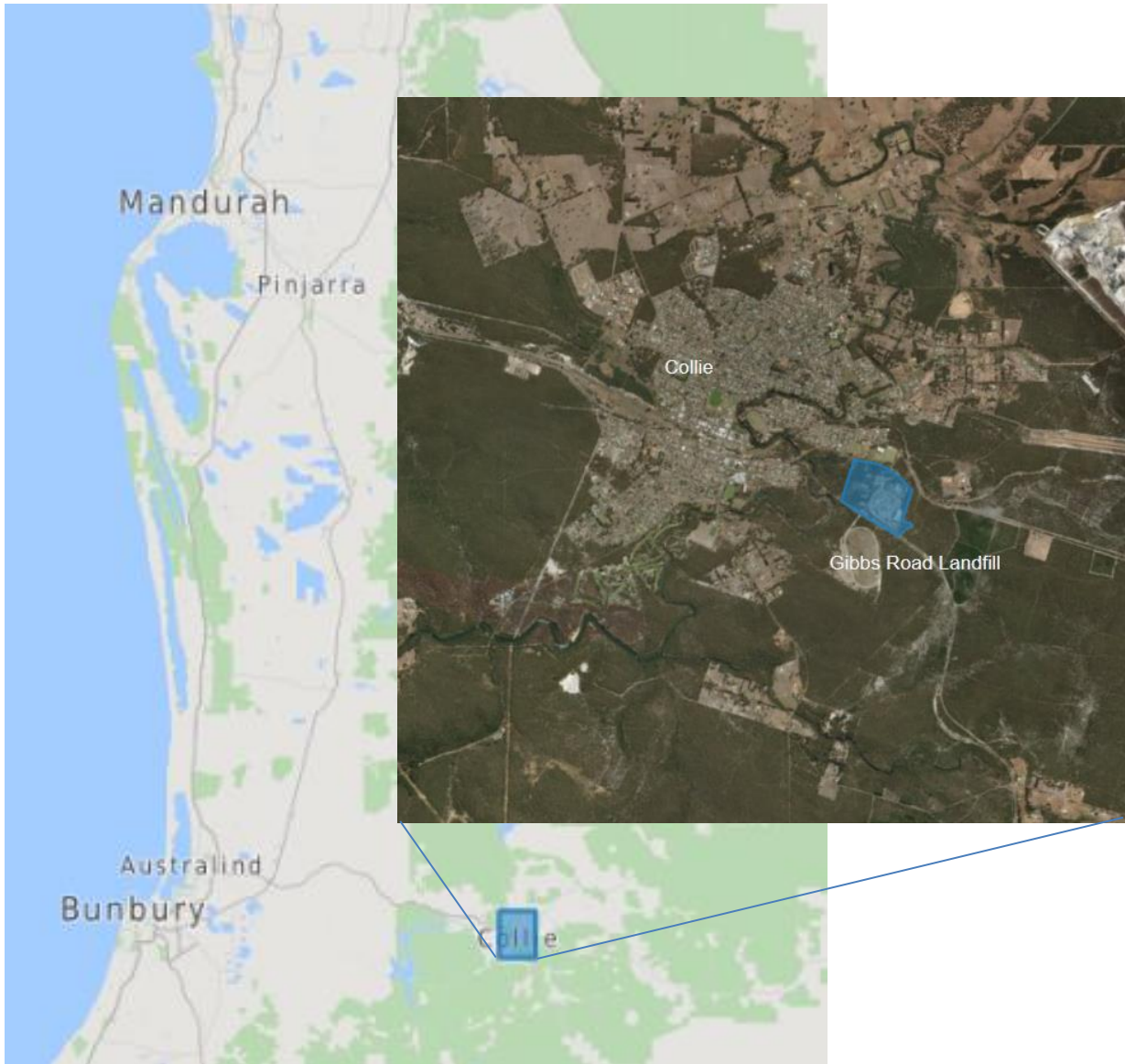


Image source: Esri, DigitalGlobe, Geoeye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRIN, IGN and GIS User Community

Figure 1: Location of Gibbs Road Landfill, Collie, Western Australia

Prior to operation as a landfill, the site on which the Premises is located was operated as a gravel and sand quarry. Following the cessation of quarrying, the site operated as an unmanned landfill from the early 1970s, allowing unregulated disposal of waste into the depression left by the sand extraction quarry.

The activities undertaken at the Premises prior to licensing in February 1997, are largely undocumented, so the dimensions and characteristics of the initial quarry void, and the amounts and types of waste placed at the site are unknown. In 1997, the Shire of Collie constructed a dedicated and manned waste transfer station with set hours of operation and has since managed the Premises as a licensed waste disposal depot and putrescible landfill servicing the residents and industry within the town of Collie and surrounds.

Parts of the former, unlicensed landfill are designated as inactive landfill cells within the putrescible landfill waste mass. Current landfilling of putrescible waste is undertaken using the 'trench and fill' method on 'active' cells, positioned over the pre-existing waste mass. The current landfill height is at least two (2) metres above the natural (pre-quarrying) ground surface.

The Licence Holder holds Existing Licence L6831/1997/12 under the EP Act for the Premises. The Existing Licence authorises activities at the Prescribed Premises for the Categories under Schedule 1 of the *Environmental Protection Regulations 1987 (WA)* (EP Regulations) as listed in Table 2.

Table 2: Prescribed Premises Categories

Classification of Premises	Description	Approved premises production or design capacity or throughput
62	<p>Solid waste depot: premises on which waste is stored, or sorted, pending final disposal or reuse, other than in the course of operating –</p> <p>(a) a refund point (as defined in the <i>Waste Avoidance and Resource Recovery Act 2007</i> section 47C(1)) (a <i>refund point</i>) or</p> <p>(b) a facility or other place (an <i>aggregation point</i>) for the aggregation of containers that have been returned to refund points until those containers are accepted for processing or disposal.</p>	10,000 tonnes per annual period
64	<p>Class II or III putrescible landfill site: premises (other than clean fill premises) on which waste of a type permitted for disposal for this category of prescribed premises, in accordance with the <i>Landfill Waste Classification and Waste Definitions 1996</i>, is accepted for burial.</p>	50,000 tonnes per annual period

The Premises is licensed to accept and bury Putrescible Wastes, Clean Fill, Inert Wastes (Types 1 and 2 – including tyres), Special Wastes (Type 1 and 2 – asbestos and biomedical waste) and other wastes that comply with Class II acceptance criteria as specified in the Landfill Definitions.

3.2 Environmental Protection Notice

An EPN was issued to the Licence Holder on 30 October 2009 (Appendix 3). The EPN issued is consistent with s.65 of the EP Act stating: the CEO suspected on reasonable grounds that there is, and is likely to be, an emission from the Premises in the form of a discharge of leachate and the leachate:

- (a) *has caused and is likely to cause pollution, namely a direct alteration of the environment at Collie to its detriment or degradation by the contamination of:*
 - i. *the atmosphere with odorous gas and vapours;*
 - ii. *soil on the Premises;*
 - iii. *surface water on, and adjacent to, the Premises; and*
- (b) *is likely to cause pollution, namely a direct alteration of the environment at Collie:*
 - i. *to its detriment or degradation by the contamination of groundwater underlying the Premises and adjacent to the Premises;*
 - ii. *to its detriment or degradation by the contamination of the Collie River; and*
 - iii. *to the detriment of an environmental value, being the beneficial use of the Premises, land adjacent to the Premises and the Collie River.*

The EPN specified two primary requirements:

1. *Prepare, submit and implement an authorised Leachate Collection Plan and undertake weekly monitoring of surface water at specific locations for heavy metals, BTEX, hydrocarbons, pH, total phosphorus, total nitrogen, sodium to chloride ratio and estimated flow at sampling locations.*
2. *Prepare, submit and implement an authorised Leachate Prevention and Management Plan (LPMP).*

The Licence Holder was issued a LoW on 1 December 2009 for breach of the EPN (ICMS 16275). The latest correspondence from the Licence Holder dated 27 February 2015 (DWER Record A880777) in relation to the EPN advises that the Licence Holder has only implemented some aspects of the LPMP at the Premises.

The EPN has not been removed from the Premises.

4. Overview of Premises

The landfill facility infrastructure, as it relates to Category 62 and 64 activities, is detailed in Table 3 and shown in Figure 2.

Table 3: Premises infrastructure

Map reference	Infrastructure	Prescribed Premises Category
1	Inactive unlined landfill	64
2	Active Class II unlined landfill	
3	Special Waste Type 1 (Asbestos) disposal area	
4	Green waste storage area	62
5	Reuse shop	
6	Transfer station	
7	Waste oil recycling shed	
8	Green waste drop off area	
9	Scrap metal storage area	
10	Putrescible waste drop off area	
11	Drum Muster compound	
12	Deep excavation area	
13	Vehicle washdown bay	
14	Gatehouse, weighbridge and office	
15	Large shed for vehicles and woodchipper	

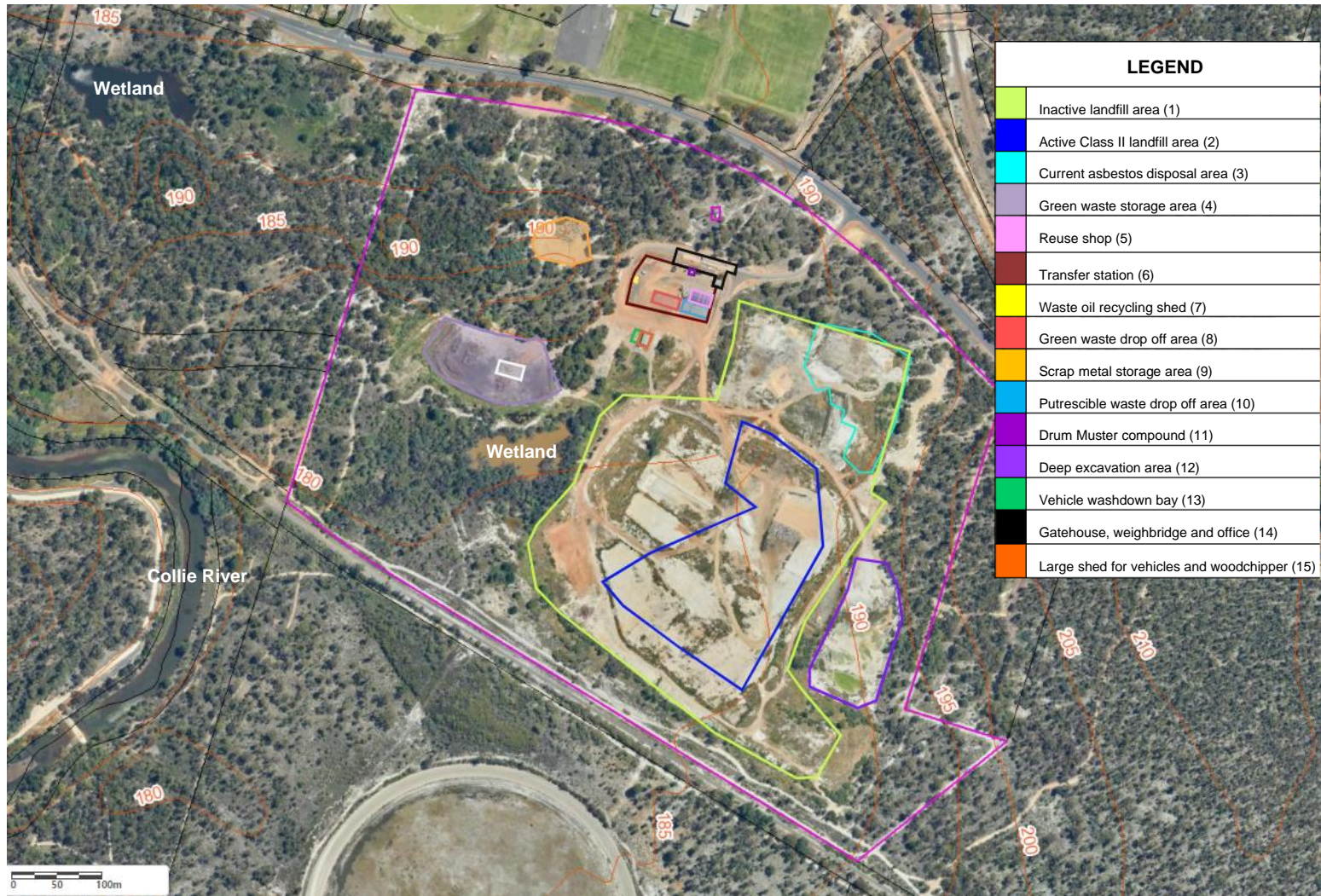


Image source: Created by DWER and presenting aerial photography dated November 2020. Informed by Premises maps provided by the Licence Holder in October 2017 and May 2021 and observations made during the February 2020 inspection.

Figure 2: Approximate layout of premises infrastructure and operational areas.

4.1 Operational aspects

4.1.1 Transfer station

All waste accepted at the Premises (except asbestos and scrap metal) is deposited within the transfer station area which includes the waste oil recycling shed, the putrescible waste drop off area and the green waste drop off area.

The Licence Holder receives a number of waste types at the premises which are stored at the transfer station before being removed off-site to another waste facility. These include tyres (Inert Waste Type 2), comingled recyclables, mattresses, waste oil, paint tins, vehicle batteries, Drum Muster containers, liquefied petroleum gas (LPG) bottles, fire extinguishers, aerosol cans and e-waste (e.g. computers, phones, monitor screens). At the time of the most recent inspection in February 2020, the Licence Holder was in the process of establishing a reuse shop to sell second-hand household items like furniture and sporting goods but excluding electrical goods.

4.1.2 Landfill

The main landfill area encompasses the inactive landfill, the active Class II putrescible landfill area and the asbestos disposal area. The active putrescible landfill cells are not accessible to the general public, however licensed carriers have the ability to deposit waste directly to the active landfill (where directed to do so by the Licence Holder). Waste received from the general public is deposited at the transfer station area and is placed within the active landfill by operational staff.

Special Waste Type 1 (asbestos) is received in wrapped condition and taken directly to the dedicated asbestos disposal area by members of the public or contractors, under the supervision of Premises staff. Asbestos is placed on the ground and landfill staff come to cover it up on the same day, unless staff identify that it is not appropriately wrapped and then cover might occur the next day to allow for wrapping to be repaired. An asbestos register is maintained in the on-site office.

Biomedical waste (Special Waste Type 2) is approved, under the Existing Licence, for disposal to the active landfill area; however, the Licence Holder has stated that no medical waste is currently received for landfilling on-site. Waste receipt records provided to DWER indicate that no Special Waste Type 2 has been received at the Premises.

4.2 Leachate and stormwater management

4.2.1 Leachate management

In response to the EPN (Appendix 3), the Licence Holder constructed a temporary leachate bund in 2009-2010 to control runoff along the western edge of the inactive landfill area (Figure 3 and Figure 4). The bund was constructed of earthen material paddock dumped at the toe of the slope. In December 2009 the Licence Holder also proposed a temporary leachate management system to improve on the existing temporary bund. A Leachate Prevention and Management Plan (LPMP) was then subsequently submitted to DWER in August 2012, which included proposals for temporary and permanent leachate management systems (IWP, 2012).

The temporary leachate management system outlined in the LPMP specified that the temporary bund be raised by 300 mm to increase its collection capacity and additional stormwater diversion works be completed to make the system fit for purpose. The LPMP indicates that these works were completed in February 2010 (IWP, 2012).

To prevent uncontaminated stormwater from entering the leachate collection area behind the bund, the temporary leachate management system also included a diversion bund on top of

the landfill and localised filling to direct flow away from the storage area (IWP, 2012). The temporary leachate management system specified that leachate and contaminated surface water runoff collected behind the bund should be pumped back onto the active landfill area within 24 hours of a rain event (IWP, 2012). It is unclear whether this management measure was implemented at the Premises.

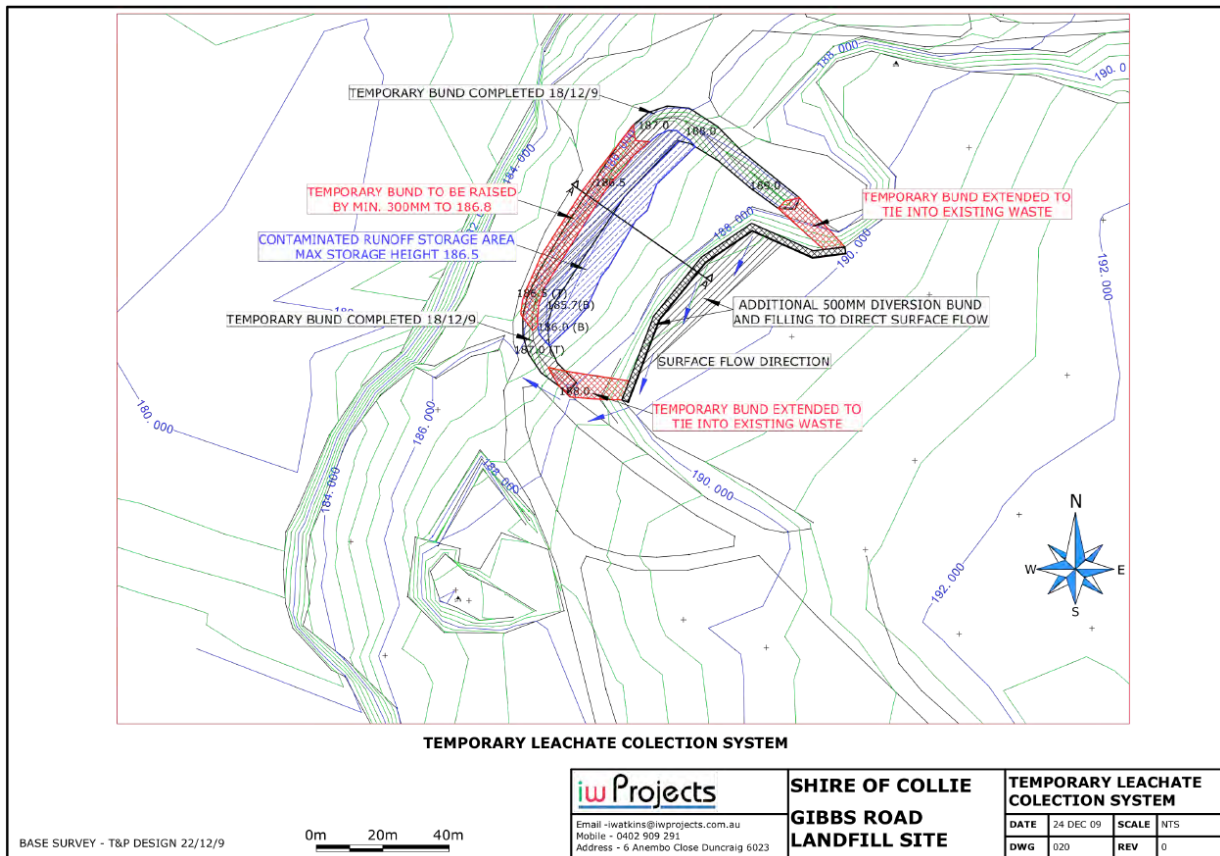


Image source: Appendix 4 of the LPMP (IWP, 2012)

Figure 3: Temporary leachate management system

The permanent leachate management system proposed in the LPMP included capping of the western portion of the inactive landfill area to reduce leachate production and infiltration. The proposed capping design involved placement of 1-1.5 m of silty clay soil, graded to the west to shed stormwater away from the active landfilling area. A permanent 1.5 m cap was proposed to cover a 60 metre (m) wide buffer zone adjacent to the wetland and would require the temporary leachate collection bund to be demolished (IWP, 2012). A temporary 1 m cap was proposed for the adjacent western portion of the landfill until landfilling resumed in this area and the cap was removed (IWP, 2012). The LPMP outlined a proposal for a localised leachate collection system in case there continued to be areas of leachate discharge in the short-term. This comprised a sub-soil leachate drain, pipework and collection tank to allow leachate storage before removal off-site by a liquid waste tanker (IWP, 2012). The LPMP also proposed additional measures to manage leachate including a landfill concept design, waste placement plan and cover procedures (intermediate and permanent) for the active landfill cells (IWP, 2012).

Based on observations made during site inspections, the Licence Holder has not demolished the temporary leachate bund or installed the permanent cap proposed for this area in the LPMP (Figure 4). From observations it appears that the Licence Holder has not implemented most aspects of the permanent leachate management system.

The temporary bund to the west of the landfill was observed during the most recent inspection

in February 2020 (Figure 4). The Licence Holder indicated that it was no longer needed as their changed landfilling practices, such as the use of intermediate cover, had prevented leachate discharge at the downslope edge of the landfill.

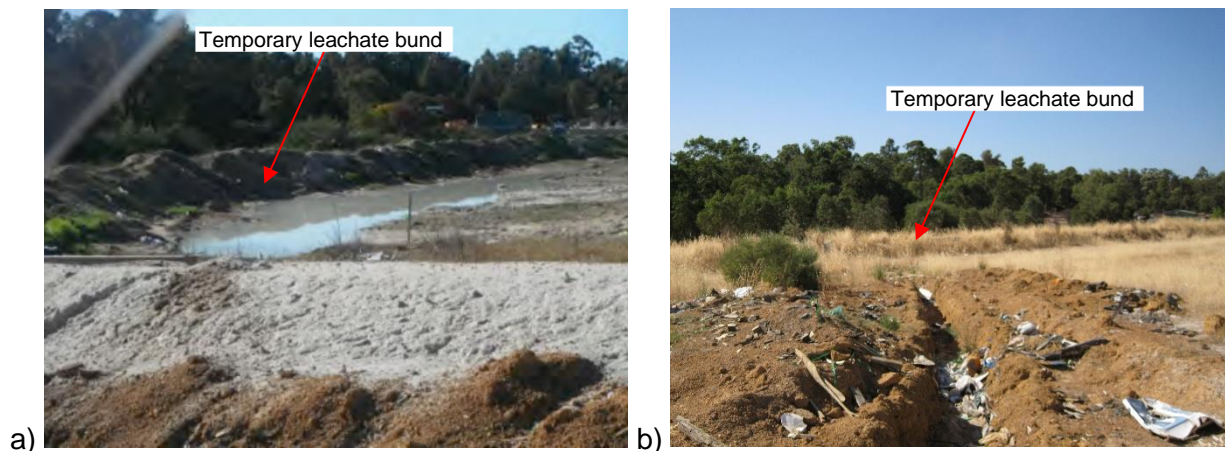


Photo source: a) IWP (2012) and b) photograph taken by DWER Officer on 10 February 2020

Figure 4: Temporary leachate bund on 12 August 2010 (a) and 10 February 2020 (b)

4.2.2 Stormwater management

The Existing Licence outlines requirements for stormwater management around the active tipping areas, maintenance of stormwater drains and retention of contaminated stormwater on the Premises. Earthen bunding is constructed around the active tipping face to minimise stormwater interaction with deposited waste prior to covering.

Stormwater drainage around the Premises is generally uncontrolled, with retention areas bound by earthen bunding. No engineered stormwater drains, or control and retention infrastructure exist on the Premises. The natural wetland to the west of the landfill receives stormwater from some operational areas. A deep excavation area to the east of the landfill also received and stored stormwater runoff in the past and was designated as a 'stormwater collection area' on a Premises map provided to DWER by the Licence Holder in October 2017. DWER understands that the Licence Holder has recently been filling this area to prepare it for putrescible landfilling and does not intentionally use it for stormwater containment.

5. Legislative context

5.1 Part V of the EP Act

The overarching legislative framework of this assessment is the EP Act and EP Regulations. Relevant guidance statement documents which inform this assessment are listed in Appendix 1. The following sections provide a summary of the regulation of the Premises under the EP Act and associated legislation.

5.1.1 Works approval and licence history

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

Table 4: Works approval and licence history

Instrument	Issued	Nature and extent of works approval, licence or amendment
L6831/1	Feb 1997 ¹	Original licence issued
L6831/1997/4	13 June 2000	Earliest instrument record within DWER Industry Licensing System

Instrument	Issued	Nature and extent of works approval, licence or amendment
L6831/1997/12	27 May 2015	Licence re-issue into 'REFIRE' format
L6831/1997/12	29 April 2016	New licence expiry date issued

Note 1: approximate date – original licence date of issue unknown

5.1.2 Compliance inspection history

In response to an odour complaint lodged by an affected nearby resident, a DWER compliance officer completed an inspection of the Premises on 22 September 2009. During the inspection the department identified that odorous leachate was leaking from the western portion of the inactive landfill area. This observation ultimately resulted in the issuance of the EPN (refer to Section 3.1 and 5.1.4 for detail). The DWER officer also identified the following non-compliances with respect to licence conditions:

- G3(ii), (iii), (iv), (v), (vii) and (x) – Management of Waste Depot and Landfill Activities: tipping face in excess of 30 m, exceeded 2 m in vertical height and waste not disposed in a defined trench.
- G5(a) and (b) – Windblown waste: excessive windblown waste on the Premises.
- G6 – Signage: signage not displaying information required by licence condition.
- A2(a) – Green Waste: burnt Green Waste contaminated with metals, glass and plastics etc.
- W2(b) – Protection of groundwater and surface water; surface water body 50 m from the landfill.

Subsequent routine site inspections were undertaken by DWER in 2011, 2014, 2016, 2017 and 2020 and have noted ongoing non-compliances and licence contraventions at the Premises, as summarised in Table 5. The 2020 inspection also identified potential breaches of the *Environmental Protection (Unauthorised Discharge) Regulations 2004* relating to on-site discharges from the vehicle washdown bay sump and inadequate spills management at the Premises.

Table 5: Summary of non-compliances and licence contraventions

Licence condition	Non-compliance
G3(ii) - Management of Waste Depot and Landfill Activities	Waste placed on open ground
G1 - Waste Acceptance and Management	Coal dust stockpiling, treated power pole acceptance and stockpiling, and Hazardous Waste acceptance and storage (e.g. vehicle batteries, paints)
G2(a) – Disposal of Biomedical (Clinical) and Asbestos Waste	Exposed ACM
G2(a)(iii) – Disposal of Biomedical (Clinical) and Asbestos Waste	No asbestos register
G3(iv) and (ix) - Management of Waste Depot and Landfill Activities	Large areas of exposed waste/insufficient cover material
G5(b) – Wind Blown Waste	Excessive windblown waste
W2(a) – Protection of Ground and Surface Waters	Groundwater reported at 0.48 m below ground level (BGL) for bores MW2S and MW2D - inadequate separation.

Licence condition	Non-compliance
W2(a) – Protection of Ground and Surface Waters	Landfilling of Inert Waste Type 1 in the base of a deep excavation (Figure 2) to achieve the minimum separation distance for future putrescible waste landfilling even though waste is not authorised to be used for this purpose.
W4(a) and W4(b) – Groundwater Monitoring	Non-compliant groundwater sampling

5.1.3 Annual Audit Compliance Report and Annual Environmental Reports

Condition G7(a) and G7(b) of the Existing Licence require the Licence Holder to submit an AER and AACR respectively by 31 March each year. A summary of AACR and AER non-compliances recorded from 2011 to 2019 is provided in Table 6.

Table 6: AACR and AER non-compliance summary

Reporting period	Licence condition	Non-compliance
2019	G1 – Waste acceptance	Treated power poles accepted and stockpiled without testing to confirm compliance with Class II acceptance criteria.
	G3(iv) – Covering of waste each day	Waste was not covered each day.
	W2(a) – Separation distance to groundwater	The Licence Holder was landfilling Inert Waste Type 1 in the deep excavation area (Figure 2). Their stated purpose for this was to achieve the minimum separation distance to the water table aquifer to facilitate this area being used for general landfilling in the future. This is not permitted under the Existing Licence because filling occurred with waste and therefore breached the separation distance.
	W4(a) – Groundwater monitoring	2019 groundwater monitoring suites did not include copper and nitrate.
2017	W4(a) – Groundwater monitoring	Biannual groundwater monitoring did not occur in the second half of 2017 as required.
	A2(b)(ii) – Burning of Green Waste	Fire escaped the Designated Burning Area and moved off-site.
2015	A2(b) – Burning of Green Waste	Burning of Green Waste on 16/07/2015 was not compliant with conditions due to an unauthorised fire being lit at the Premises.
	W4(b) - standing water level units required to be reported in metres AHD	Standing water level units for 2015 expressed as mbTOC (metres below top of casing)
2014	W4(a) – Groundwater monitoring	Biannual groundwater monitoring did not occur in the second half of 2014 as required.
	W2(d) – Separation distance from waste to surface water body	Insufficient separation distance between landfill and surface water due to poor planning.
	G3(iv) – Covering of waste each day	Waste not covered sufficiently near the tipping area.

Reporting period	Licence condition	Non-compliance
	A2(d) – Unauthorised fire	Department not notified of unauthorized fire within 14 days.
2013	G7(a) and G7(b) – AER and AACR submissions	Reports were not submitted for the 2013 AACR and AER reporting period
2012	G7(a) and G7(b) – AER and AACR submissions	Reports were not submitted for the 2012 AACR and AER reporting period
2011	G7(a) - Annual Environmental Report	April-May groundwater data was not submitted with the AER
	W4(a) and W4(b) – Groundwater Monitoring	Non-compliant groundwater sampling

5.1.4 Summary of compliance and enforcement action

A summary of compliance monitoring and enforcement action at the Premises is as follows:

- An EPN was issued to the Licence Holder on 30 October 2009; ICMS 16275 (refer to Section 3.1).
- Numerous inspections of the Premises as summarised in Section 5.1.2 describe recurring compliance issues.
- Numerous EFNs have been issued to the Licence Holder since 2009. The majority of the EFNs issued are for the same operational compliance matters but identified at different times:
 - Issued 22/09/2009; ICMS 16275:
 - i. EFN 5858 regarding inadequate covering of waste
 - ii. EFN 5859 regarding exceedance of the maximum tipping face length
 - iii. EFN 5860 regarding stockpiling of sufficient cover
 - iv. EFN 5861 regarding burning of green waste
 - Issued 29/09/2009, EFN 0334 and ICMS 16275 regarding the green waste stockpile being extinguished as soon as possible.
- The Licence Holder has been issued LoWs as follows:
 - LoW issued 1 December 2009 for breach of EPN; ICMS 16275.
 - LoW issued 2 August 2013 as the Licence Holder did not submit the 2012 AER and AACR; ICMS 29409.
- Environmental Field Report (EFR) issued following the February 2020 compliance inspection:
 - Issued 19/02/2020, EFR 6963 and ICMS 56499 regarding unauthorised discharge of liquid from the vehicle washdown sump onto unsealed ground at the Premises.

5.2 Other applicable legislation and approvals

Legislation and approvals other than the EP Act and associated legislation that is relevant to regulation of the Premises is described in Table 7.

Table 7: Other legislation and approvals relevant to the operation of the Premises

Legislation Reference	Legislation	Description of legislative context of the Premises
Contaminated sites	<i>Contaminated Sites Act 2003</i> (CS Act)	The Premises was classified 'Possibly contaminated – investigation required' under the CS Act on 12 January 2007. As a result of additional information submitted by the former Department of Environment and Conservation in 2010 the Premises classification was reviewed on 25 October 2010 and the Premises classification remains 'Possibly contaminated – investigation required'. The basis for the classification of the site is its current and historical use as a landfill. Heavy metals and chloride have been identified in groundwater at the site at concentrations exceeding certain guidelines for aquatic ecosystems, irrigation and/or drinking water. Further investigations are required to delineate the extent of soil and groundwater contamination at the site.
Planning approvals	Shire of Collie Local Planning Scheme	The Shire planning and approvals team have stated that they are unable to find evidence of planning approval for the landfill or transfer station; and that planning approval is likely to not exist as historical approvals for Shire run premises were exempt from the planning approval process.

6. Location and siting

6.1 Siting context

The Premises is located in the Shire of Collie, a town situated in the South West region of Western Australia, approximately 210 km south of Perth and 60 km east of Bunbury. Collie town is located near the junction of the Collie and Harris Rivers, and is surrounded by dense jarrah forest. The region supports tourism, agriculture, forestry, irrigated horticulture, and coal mining. The Premises is located approximately 2.3 km east of the town centre on Crown Reserve land set aside for local government use as a landfill.

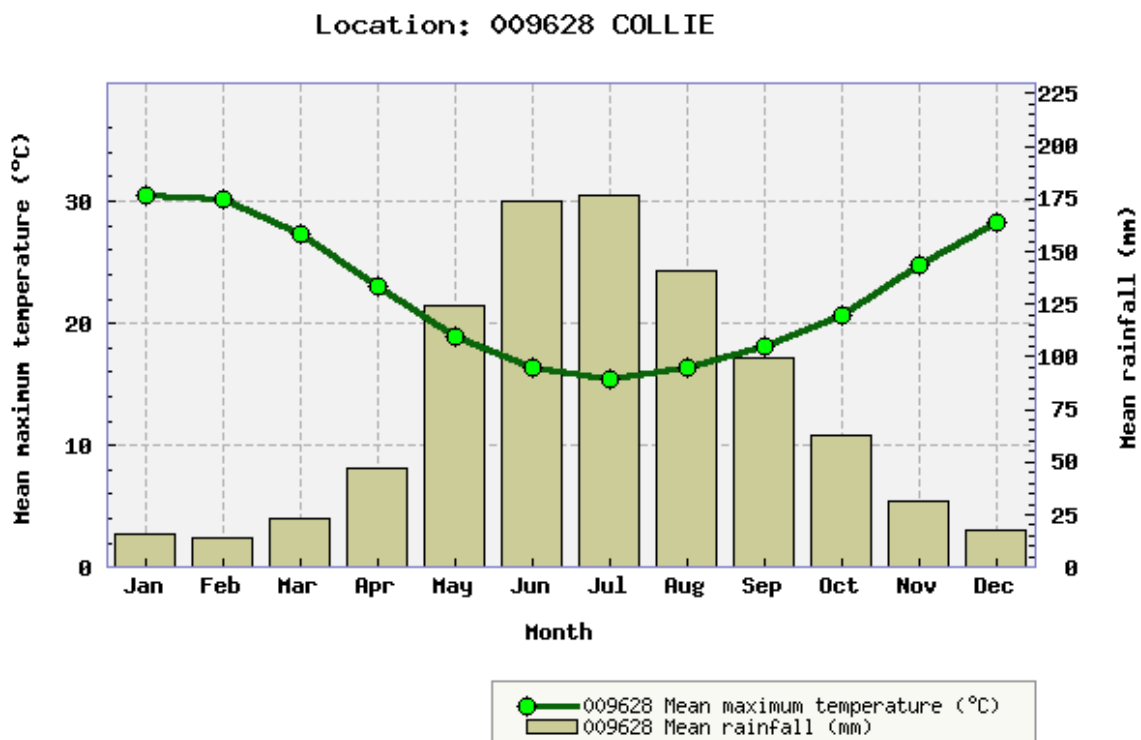
The south western corner of the site is within the Shire of Collie local planning scheme area for flood prone land and most of the Premises is within the 1 in 100 (1%) AEP Floodplain Development Control Area. The surrounding land use includes residential to the north west, State Forest 4 to the east, recreational parkland on Crown Reserve land to the north, Unallocated Crown Land to the east and the Collie Race Club to the south. The Public Transport Authority of Western Australia hold tenure on a historic rail siding to the west of the Premises, which joins the current rail line that borders the south of the Premises.

Collie is located within the Jarrah Forest Interim Biogeographic Region for Australia (IBRA) and South Western Australia Temperate Woodlands Conservation Management Zone. The Jarrah Forest bioregion is dominated by jarrah and marri eucalypt species as tall, open forest in uncleared areas. Land clearing has disturbed much of the pre-European settlement biodiversity, however the region supports a large number of mammal, bird and reptile species, as well as diverse invertebrate fauna and fresh water aquatic ecosystems associated with major water courses, lakes and wetlands.

The following sections describe the identified public health and environmental receptors relevant to the siting of the Premises as determined in accordance with DWER's *Guidance Statement: Environmental Siting*.

6.2 Climate

Collie is located in the south west of Australia. The climate is characterized by mild to warm summers and cold winters. The area is classed as a temperate climate (under the Koppen Climate Classification system) with distinctly dry (and hot summers). Seasonal rainfall is winter dominant (marked by wet winter and dry summer) (BOM, 2019). The Collie weather station (Bureau of Meteorology ID 009628) has recorded rainfall data since 1899 and temperature data between 1901 and 1975. Mean annual rainfall and mean maximum temperature are shown on Figure 5. Mean annual rainfall is 931.8 mm per year, with the majority of rainfall occurring between May and August. Mean maximum temperatures vary from 15.5 °C in July, to 30.5 °C in January. Evaporation data, estimated from climate averages maps, shows pan evaporation in the Collie area is approximately 1400 mm per year, with evapotranspiration rates estimated between 600 and 700 mm per year (BOM, 2019).



Created on Tue 21 May 2019 17:02 PM AEST

Image Source: BOM (2019); station ID 009628

Figure 5: Mean annual rainfall and mean maximum temperature for Collie

Average annual prevailing wind directions vary seasonally. In summer months (November to April), wind direction is dominantly from east to south east in the morning, and from the west to north west in the afternoon. In the winter months (May to October) wind direction is predominantly from the north west. Average annual wind speed varies from 7.0 km/hr in the morning, to 11.0 km/hr in the afternoon.

6.3 Geology and hydrogeology

6.3.1 Regional geology and hydrogeology

Collie is located in the north western part of the Collie Basin. The Collie Basin is a regional

geological feature comprising up to 1,500 m of Permian-aged sediments deposited into a basin structure within the Archean aged granite, dolerite and metasediments of the Yilgarn Craton. The Basin consists of two elongate lobes, or sub-basins which trend northwest-southeast separated by an uplifted section of basement rock, known as the Stockton Ridge. The Premier sub-basin is situated on the eastern side of the Collie Basin and is smaller and shallower than the Cardiff sub-basin, on the western side.

The stratigraphy within the basin comprises laterally continuous sediments and coal measures comprising the Permian aged Stockton Group, which is overlain by the Collie Group. The Stockton Group is thicker within the Cardiff sub-basin and comprises a basal gravel conglomerate and sandstone overlain by a mudstone and tillite. The Collie Group sediments contain the prominent coal-bearing units, the Ewington, Premier and Muja Coal Measures, which have been mined economically through the Collie region. Two major sandstone units within the Collie Group are the basal Westralia Sandstone (66 to 79 m thick), and the Allanson Sandstone (300 to 400 m thick) which separates the Ewington and Premier Coal Measure units.

The Cretaceous Nakina Formation unconformably overlies the Collie Group as a series of sandstone and mudstone deposits up to 30 m thick in the Cardiff sub-basin. Recent surficial deposits are alluvium and colluvium sediments associated with river flow, with minor laterite development.

The Permian Collie Group and Stockton Group sediments within the sub-basins are faulted along north-westerly strike. The faulting deformation pre-dates the deposition of the Cretaceous Nakina Formation sediments, but is important in relation to groundwater movement within the basins (Zhang *et al.*, 2007). Faults are likely to impact vertical and horizontal groundwater movement by the following mechanisms (Zhang *et al.*, 2007):

- Restriction of horizontal movement of groundwater due to the fine grained nature of fault-plane sediments, and the restriction of horizontal continuity of aquifer units;
- Increase of vertical movement of groundwater between aquifers through fault planes, or by restricting horizontal continuity of aquitard layers (which are generally thinner than sandstone water-bearing layers within the stratigraphic column); and
- Causing sub-cropping of basement aquifers on the base of the surficial aquifers (most pronounced near the south-eastern and northern boundaries of each sub-basin) allowing enhanced downward leakage from surficial aquifers in these areas.

The entire Permian sediment sequence includes sandstone groundwater aquifer units (6 to 9 m) that are separated by aquitards (coal, shale, siltstone and mudstone) typically 2 to 5 m thick. Due to variations in grain size and cementation throughout the sand layers, the Permian aquifers display considerable vertical anisotropy; however, pumping tests indicate that there is a high degree of consistency of hydraulic properties between the sandstone aquifers across the Collie Basin (Zhang *et al.*, 2007). Mining and industrial use of groundwater (groundwater abstraction) has altered groundwater levels and flow paths within the Permian aquifers of the Collie Basin (DoW, 2007).

The groundwater depth and flow paths within the Nakina Formation are controlled by topography, seasonal climate and lithology. The regional properties of the Nakina Formation aquifer show that it is in hydraulic connection with the sub-cropping Permian aquifer units and where the Nakina Formation sediments are thin and have a low saturated thickness; it is likely that watertable contours represent hydraulically interconnected zones of both aquifer groups (Varma, 2002; and Zhang *et al.*, 2007).

The salinity of groundwater in the Collie Basin is generally below 1000 mg/L total dissolved solids and water type is characterised as sodium-chloride dominant. The regional groundwater is slightly acidic due to its contact with sulfide-bearing sedimentary rocks (Goldsmith, Brice and Evans, 1995: after Le Blanc Smith, 1993).

6.3.2 Local geology and hydrogeology

The Premises is located in the central part of the northern Cardiff sub-basin. Here the Collie Group Ewington Coal Measures sub-crop beneath a thin, or absent Nakina Formation. Recent sediments are dominated by river derived alluvium and colluvium. Interpretation of the pre-operational geology and hydrogeology of the Premises site has been undertaken based on the regional geology and Nakina Formation isopach maps (Varma, 2002; Zhang *et al.*, 2007), along with the recent site survey data (provided by the Licence Holder).

Prior to landfilling operations, the site was operated as a gravel/sand quarry. Based on the surrounding, un-modified topography, the pre-quarry topography would have sloped gently from the eastern edge of the site (>196 mAHD) to the west-south-west towards the Collie river. The quarried sediment can be seen in the walls on the eastern edge of the deep excavation area (left hand side of Figure 6). The exposed quarry wall shows gently dipping, pale coloured sandstone and siltstone layers, with thin beds of carbonaceous-rich sediment. Based on the weathering pattern of the steep slopes, the layers contain various amounts of dispersive clay, and appear to be typical of the interbedded sediments within the Collie Group coal measures.



Photo source: Photograph taken by DWER Officer on 28 September 2017

Figure 6: Photograph of quarry walls on the eastern edge of the deep excavation area

A relatively thin, orange-beige coloured, unit overlies the pale coloured sediment (Figure 6). This is interpreted to be Nakina Formation sediment. Based on the two bore logs provided in the Groundwater Monitoring Bore Installation Report (Stass, 2010), the upper sediment layer is very thin (<1 m) or absent from the surface to the west and south of the landfill area. This corresponds to the description of the regional outcrop of the Nakina Formation in the northern parts of the Cardiff sub-basin (Zhang *et al.*, 2007), which notes that the sediment layer thins in valleys towards the Collie River.

In the vicinity of the Premises, the dominant major fault dissecting the Permian sediments is the Scottish Fault, which is interpreted to intersect the Collie River to the south west of the site (Zhang *et al.*, 2007). Based on the location of the fault, it is unlikely to impact on vertical or lateral flow of groundwater beneath the Premises, but may influence groundwater movement between shallow and deep aquifers in the vicinity of the fault.

Based on the geology beneath the Premises (Collie Group sediments), and the position of the Collie River, it is likely that pre-operational groundwater table represented interconnection between the shallow Nakina aquifer and underlying Collie Group aquifers. Hydraulic gradient is likely to have mirrored topography, flowing from the north east to the south west across the site and discharging into Collie River (the current understanding of hydrogeological characteristics in the vicinity of the Premises is discussed further in Section 7.7.1). The shallow dip of sand beds shown in exposed quarry walls, and the proximity of the coal bearing units to the surface indicate that the aquifer would have been unconfined in the area of the Premises. The dominant mechanism controlling groundwater flow rates (horizontally) and recharge (vertically) prior to mining and landfilling was likely to be the variability in clay content, and the nature of interbedding between sandy and clay-rich layers within the Collie Group, and because of this, hydraulic conductivity was likely to be low within the aquifer prior to disturbance (by mining and operations at the Premises). The regional groundwater model predicts horizontal hydraulic conductivity values of 0.06 to 0.3 m/day and vertical hydraulic conductivity values of 6×10^{-4} to 3×10^{-3} m/day (Zhang et al., 2007).

6.3.3 Soil characteristics

Regional soil classification data indicates that surficial soils are characterised as leached sands over sandy flats and swamps, with ironstone gravels on gently sloping and some flat areas. Drilling at the Premises indicated that surficial soil is predominantly soft, beige sandy clay, with minor ironstone gravels, and silty clay. The Australian Soil Resource Information System indicates that the Premises is located in an area with an extremely low probability of acid sulfate soils occurrence (CSIRO, 2014).

6.4 Hydrology

6.4.1 Regional hydrology

The Premises is located within the Collie River Central subarea of the Upper Collie Surface Water Area. The Upper Collie Surface Water Area covers over 2,800 km² of land that forms the Collie River catchment above Wellington Reservoir (DoW, 2007). The Collie River is the main watercourse within the Upper Collie catchment. It flows to the north-west (to Leschenault Estuary immediately north of Bunbury) and is fed by two major tributaries, the South Branch, and the East Branch, as well as numerous creeks and ephemeral streams. Discharge of mine dewatering water contributes additional volume to natural flow, to both the South and East Branches of the River (Varma, 2002).

6.4.2 Local hydrology and topography

The operational aspects of the Premises are sited within the historic quarry. The eastern edge of the site is defined by the steep walls that rise to 194 mAHD and mark the extent of pre-operational quarrying. The putrescible landfill is a distinct waste mass, rising steeply from the base of the quarry area to 192 mAHD at the highest point (based on a 2009 site survey). To the west, the landfill waste mass drops steeply to approximately 186 mAHD, where the land surface flattens, and undulates, towards the Collie River. The natural land surface across the rest of the Premises slopes gently from the north east to the south west towards the River. A wetland surface water body is present on the Premises directly west of the landfill (Figure 2).

There are no defined surface water flow paths on the Premises to the area between the Premises and the Collie River; however, aerial photography indicates that drainage from the site (in the form of uncontrolled overland flow) could be influenced by historical infrastructure (rail sidings) and depressions in topography (subsidence features, natural low-lying areas, ephemeral drainage and wetlands) beyond the site boundary which provide surface water flow connection between the Premises and the Collie River.

The south-western corner of the Premises is within the 1 in 100 (1%) Annual Exceedance Probability (AEP) flood fringe area (Figure 7).



Figure 7: 1 in 100 (1%) AEP floodway (yellow area) and fringe (blue area) and floodplain development control area (red hashed area)

6.5 Residential, resource and environmental receptors

6.5.1 Residential and other sensitive land uses

The distances to residential and other public receptors are provided in Table 8.

Table 8: Receptors and distance from activity boundary

Sensitive land uses	Distance from active landfill area	Distance from Premises boundary
Residential premises	1040 m SW	960 m SW
	600 m NW	110 m NW
	910 m W	540 m W
	460 m N	250 m N
Sporting and recreational facilities	220 m N	40 m N
Racecourse	160 m S	100 m S
Industrial zone	440 m E	330 m E

Sensitive land uses	Distance from active landfill area	Distance from Premises boundary
Publicly accessible Crown Land and Unallocated Crown Land (State Forest or parks and recreation areas)	Adjacent to the Premises boundary to the north, east and west.	

6.5.2 Specified ecosystems and environmental values

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 and other relevant environmental values are shown in Table 9.

Table 9: Environmental values

Specified ecosystems	Distance from the Premises
Department of Biodiversity, Conservation and Attractions legislated tenure – Collie State Forest	Adjacent to the eastern Premises boundary and 120 m to the north-east
Biological component	Distance from the Premises
Threatened Flora (Priority 1, 3 and 4)	Within 2 km W, S and SW
Threatened Fauna (Priority 2, 3 and 4, Critically Endangered, Endangered, Vulnerable and Conservation Dependent species)	Within 2 km W, N and S
Other relevant ecosystem values	Distance from the Premises
Collie River (refer to Section 6.5.4)	<100 m SW

6.5.3 Groundwater values

The Premises is within the Upper Collie Groundwater Area, which includes the Collie Coal Basin groundwater resource (DoW, 2007). The part of the Upper Collie Groundwater Area overlying the Collie Coal Basin is proclaimed under the *Rights in Water and Irrigation Act 1914* (RIWI Act) as the Collie Groundwater Area (DoW, 2007).

Recharge to the Upper Collie Groundwater Area is primarily through rainfall, however, sections of the Collie River south and east branches recharge groundwater aquifers seasonally. Groundwater also discharges to the Collie River at various points. The groundwater quality within the Groundwater Area is generally low in salinity; however, industry within the Collie Coal Basin area has resulted in localised variability in pH and salinity (DoW, 2007).

Groundwater uses within the Collie Groundwater Area include abstraction for mine dewatering, and power generation. Non-industrial groundwater use includes domestic water supply (non-potable), garden irrigation, agricultural irrigation (berries, olives) and watering of lawns and recreational sporting fields (DoW, 2007). A total of eight current groundwater users have been identified in proximity to the Premises as listed in Table 10 and shown in Figure 8 below. The majority of allocated licences are for domestic, commercial or recreational water supply. Premier Coal and the Griffin Coal Mining Company own larger groundwater allocation licences for industrial use.

Table 10: Licences for groundwater abstraction

Licence Number	Licence Holder	Aquifer	Distance and direction from Premises
182336	Collie Race Club Inc.	Collie – Lower Collie group	Parcel is 25 m south (drawpoint is 330 m south)
158476	Private owner		1.4 km southwest
95416	Premier Coal Limited		Area adjacent to the western boundary, and <500 m south
168071	The Griffin Coal Mining Company Pty Ltd		1.7 km east
204226	St Brigid's Catholic Primary School	Collie - Stockton	1.9 km north-west
182684	Private owner	Collie – Lower Collie group	2.3 km west
165487	Collie Ridge Motel		2.3 km west
54612	Department of Education (DoE)		2.1 km west

6.5.4 Surface water values

The Premises is located within the Upper Collie Surface Water Area which forms part of the Collie River Irrigation District, a proclaimed area under the RIWI Act.

The Mungalup Dam Catchment Area is the closest Public Drinking Water Source Area (PDWSA) proclaimed under the *Country Areas Water Supply Act 1947* (CAWS Act). It is a Priority 1 area located on a tributary to the Collie River approximately 7.3 km south west of the Premises. The confluence between the tributary and the Collie River is downstream of the Premises.

Since the 1970s surface water management in Collie has been driven largely by the need to restore water quality in the catchment, following salinization of the Collie River after extensive land clearing in the district (DoW, 2007). More recently, industry in the region (mining and agriculture) have also impacted the groundwater and surface water catchments affecting the water quality within the Collie River (sediment loads, nutrients and chemical constituents). A number of abandoned mine shafts in the region provide connection from old coal workings to the Collie River. An abandoned shaft is located on the western bank of the Collie River to the west of the Premises. It discharges water directly to the Collie River from the abandoned Wallsend Colliery at a rate of approximately 0.1 to 0.5 metres per second (DoW, 2009).

Surface water allocation from the Collie River, Central subarea (including Wellington Reservoir and the Collie River upstream of the Reservoir) is allocated to five major licence holders, including the Water Corporation, irrigators (South West Irrigation Management Co-operative Ltd), industry (mining) and the Shire of Collie (irrigation of public open space). Additional smaller allocations are held by private licence holders for horticultural and stock watering purposes, DoE and the Collie Golf Club. A surface water allocation licence (allocation to Premier Coal for 1,500 ML) is situated on the land parcel adjacent to the western Premises boundary (Figure 8).

Social values that are attributed to both the Wellington Reservoir, and the Collie River downstream of the Premises include recreation and tourism, and the maintenance of cultural and aesthetic values. Ecological values and identified habitat for aquatic flora and fauna includes freshwater crustaceans, long-necked tortoises, various frogs, fish, water rats, riparian vegetation and aquatic macro-invertebrates (DoW, 2007).

Wetlands occur in low-lying areas between the putrescible landfill and the Collie River to the west. Some of these wetlands contain water throughout the year and are likely to be in hydraulic connection with groundwater in the shallow aquifer. Additional areas of ephemeral surface water form between the putrescible landfill and Collie River during winter and spring. It is not known whether the wetlands are natural features or if they formed in topographic depressions created from subsidence or abandoned pit/quarry areas associated with historic mining. The wetlands located outside of the premises boundary are likely to have ecological value as habitat for aquatic and terrestrial flora and fauna. The Delegated Officer considers that on-site wetlands are unlikely to sustain significant ecosystem function (aquatic or terrestrial) during operations.

6.6 Impact of historic mining on environmental setting

The Wallsend “Old Proprietary” Colliery was sited on the land immediately surrounding and underlying the Premises. The Wallsend Colliery was the earliest recorded mine in the Collie area, with the initial shaft and decline being put down in 1893 by the Western Australian Government to test the properties of the coal contained within the Ewington Coal measures. The mine was then leased and mined as the “Wallsend Colliery” between 1898 and 1902 after which it was taken over and merged with the Old Proprietary Colliery, and was mined, using open cut and underground mining techniques until 1912.

Early underground mining in the Collie Basin employed the bord and pillar technique, where coal was mined from bords, leaving pillars in place to take the overburden loads. In some instances, coal pillars were stripped during retreat from a mining area (Goldsmith, Brice and Evans, 1995).

The underground workings of the Wallsend Colliery ranged in depth from 8.5 m to 50 m, and were bound by coal roof, and a carbonaceous shale floor. Subsidence of the ground surface has been observed in the eastern parts of the old mine area above the No 2 pit workings (Old Proprietary mine area) and coincides with areas of pillar stripping shown on old mine plans. Based on the field surveys presented in Goldsmith, Brice and Evans (1995) the area in the vicinity of the Premises may be prone to development of localised sinkholes. Trough subsidence was mapped in the area underlying the northern part of the landfill, although it was unclear how the zone of subsidence was delineated, and the map views provided (Goldsmith, Brice and Evans, 1995) are based on corrected GPS coordinates (error range of 8 to 213 m with an average error of 50 m). Visual evidence of subsidence has been noted to the west of the putrescible landfill cells in the form of slumping and concentric ground fractures (Stass, 2011). The Department of Mines, Industry Regulation and Safety (DMIRS) abandoned mine features inventory shows the presence of a number of former mine features to the west of the Premises including an open pit/quarry, areas of subsidence and a rock dump as shown in Figure 9.

The shallow workings of Wallsend Colliery were known to be flooded (Goldsmith, Brice and Evans, 1995). During drilling of SE1 borehole it was noted on the drilling log that the drill hole entered mining stope at 14.5 mBGL, with cold water arriving at surface during drilling (Stass, 2010) indicating that the mine workings beneath the Premises are likely to be flooded. The base of the drill log shows a 4.5 m section of coal/black shale which may be the roof of the underground workings. The drill log for borehole SE2 did not show a thick coal layer at the base of the borehole, indicating that the thickness of the roofing layer of coal may be variable beneath the Premises. It is also possible that the coal strata are discontinuous, fractured, or affected by localised subsidence or collapse within the stopes of the old mine workings.

Based on the subsurface geology, and the likely existence of intact voids in some areas underneath the Premises, it is possible that localised collapse and subsidence within the mine workings has occurred. This may result in enhanced interconnection between water-bearing parts of the subsurface (water filled mine voids and deeper aquifer units) and the near-surface

groundwater aquifers. While interconnection of the groundwater bearing units is likely to have occurred, lateral and vertical hydraulic conductivity is likely to remain low in the vicinity of the Premises due to the presence of flooded mine workings, and varying distribution of coal and clay-rich sandy layers within the aquifer units.

An alternative interpretation of the effect of historic mining on groundwater flow in the vicinity of the premises is that collapse and subsidence within the mine workings has caused compressive compaction of shallow sediments. This process would be expected to reduce the permeability of shallow sediments and impede hydraulic connection between shallow and deeper groundwater.

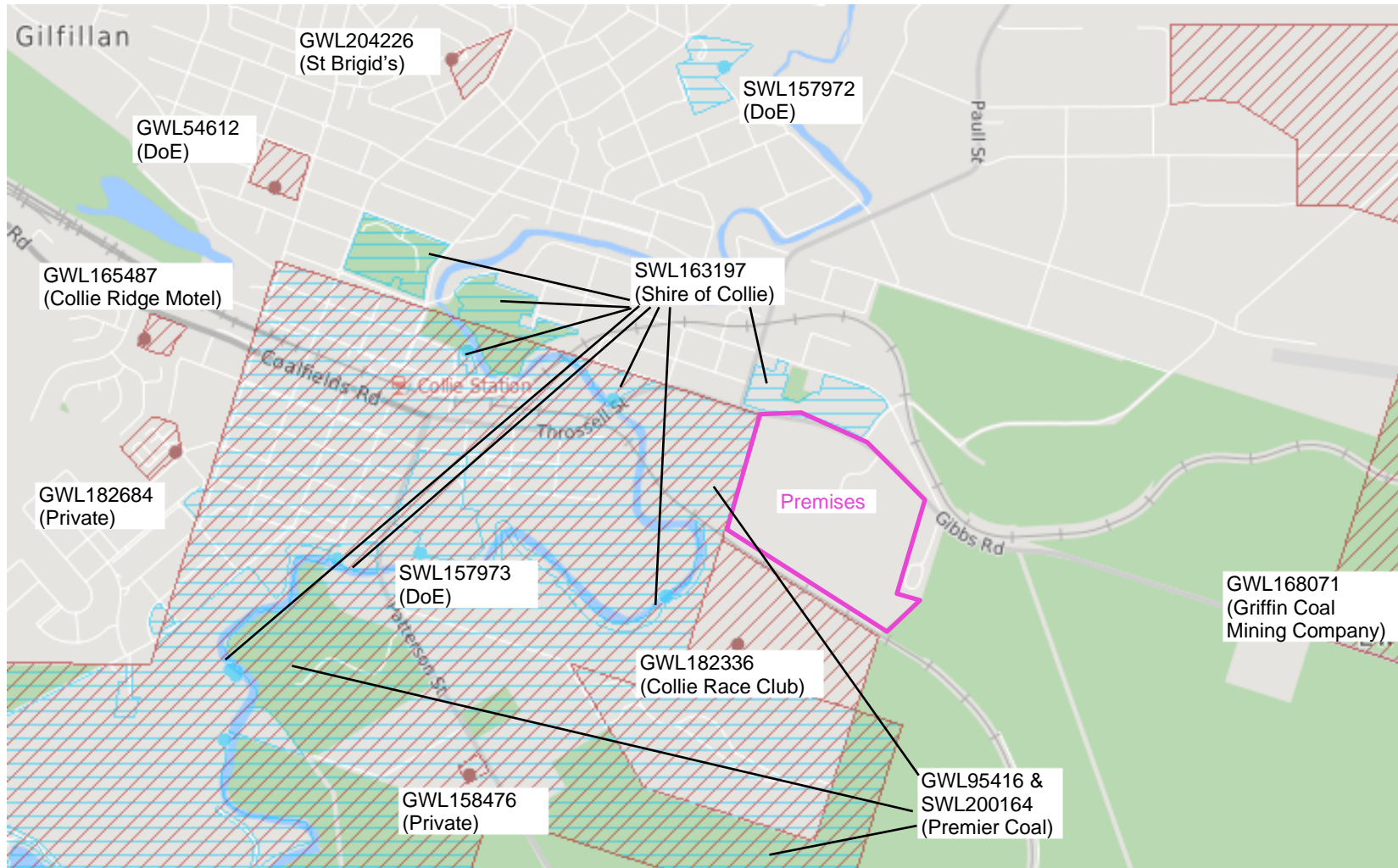


Figure 8: Groundwater and surface water licences in the vicinity of the Premises

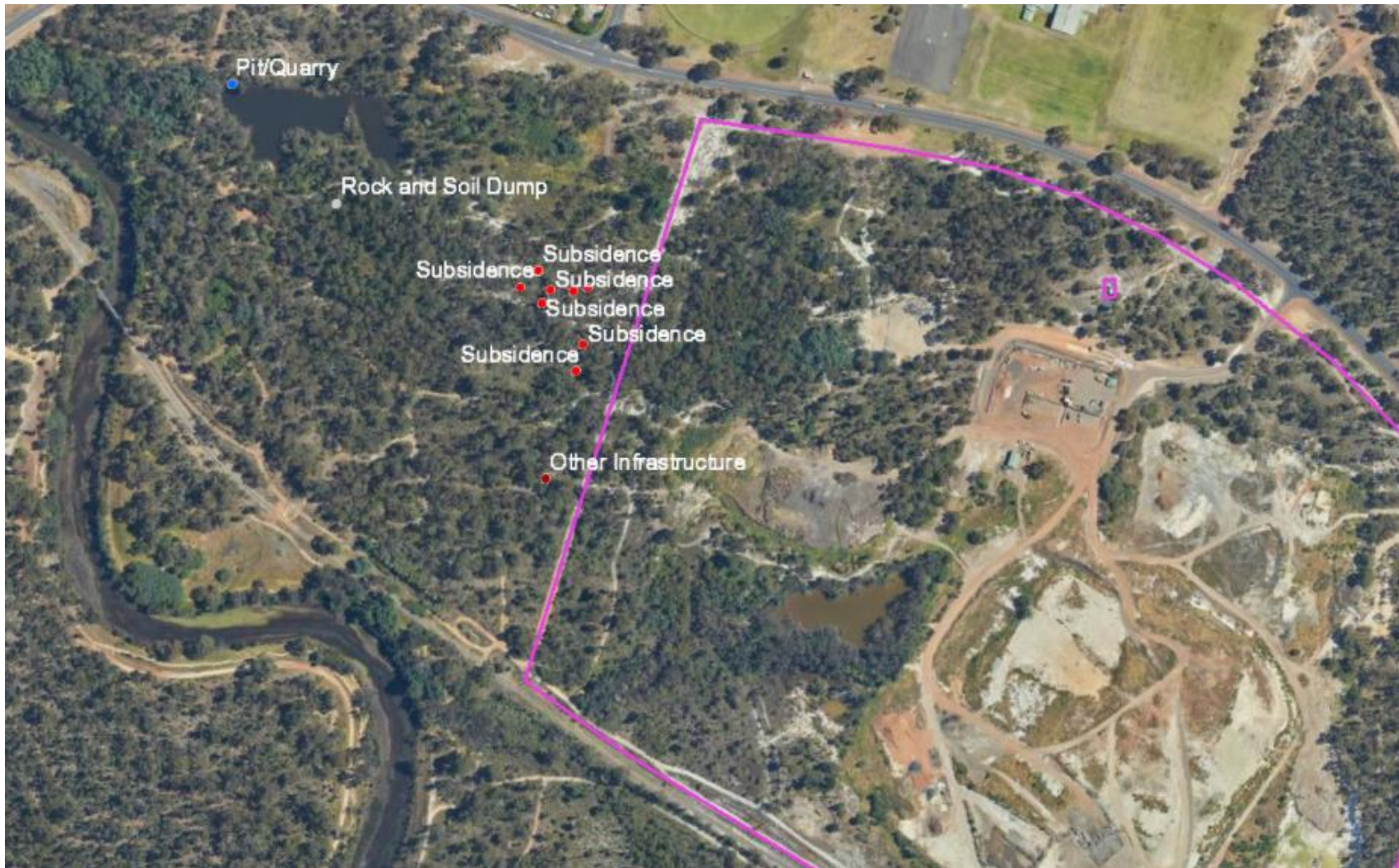


Figure 9: DMIRS WA abandoned mine feature inventory features to the west of the Premises

7. Landfill operation and management

This section describes the current operation and management of the Premises. The information contained in this section is based on key documents provided to DWER (Appendix 1), compliance inspection reports, and observations recorded as part of DWER visits to the Premises to conduct compliance activities, or general site inspections. The most recent site inspections were carried out on 10 February 2020 and 27 September 2017.

7.1 Landfill design and lifespan

There is no known landfill design plan associated with the previous historical construction of the putrescible landfill cells. Historical landfilling mostly occurred on an ad-hoc basis, initially by filling quarrying voids and eventually continuing filling above the original ground level. The development of the landfill has extended the waste mass to approximately 14 hectares in size, with an average waste depth of at least five metres (IWP, 2012).

The Licence Holder submitted a plan of the Premises to DWER in October 2017 showing the active and inactive landfill areas, as shown in Figure 2. This is the landfill design which was used to inform this Review.

Conceptual descriptions of future landfill design and planning were provided in the Leachate Prevention and Management Plan (LPMP) submitted in response to the EPN (IWP, 2012); however, it was noted in the report that the intent of the diagrams was to provide basic guidance to landfill operators, and not to serve as a detailed planning and operational instruction. It is noted in the LPMP that no further waste placement is to occur to the west of the current waste landform, and that future waste placement would occur along the eastern edge of the current waste mass until final waste capacity is reached (IWP, 2012).

The 2019 WMP prepared by ASK Waste Management set out plans for the future landfill development including a final landform design and sequential filling plan (ASK, 2019). Within the WMP the operational lifetime of the landfill was predicted at 40 to 55 years, based on the remaining airspace and current rates of disposal (ASK, 2019). However, ASK considered it likely that landfilling operations would cease earlier due to decreasing disposal rates and increasingly stringent regulation.

The Existing Licence does not provide a maximum design capacity for the landfill, and an approved final waste profile does not currently exist for the Premises. Landfill waste mass slope and underlying sub-base stability is also unknown.

Key findings:

- (1) The Delegated Officer has identified that the future design, lifespan and final landform of the Class II putrescible landfill are unknown. Information is required from the Licence Holder to further inform assessment of the ongoing risk which the landfill represents.

7.2 Landfill management

7.2.1 Waste acceptance

Historically, unknown waste, or waste not allowed to be accepted under the licence has been observed on the Premises (refer to Section 5.1.2). Such wastes include coal dust, bitumen, unknown waste received from mine sites and treated timber power poles.

The 2020 compliance inspection report noted that most of the waste accepted at the Premises is within the allowable types stated on the Existing Licence. However, some Hazardous Wastes (e.g. paints and vehicle batteries) currently accepted at the transfer station are not

approved on the Existing Licence. The inspection also identified that treated timber power poles had been accepted at the Premises without any waste classification sampling results as evidence that they comply with the Class II landfill acceptance criteria. The Licence Holder had intended to use these poles as traffic barricades. Subsequent analysis of this waste indicated that the treated power poles were classified as Class IV contaminated solid waste.

During the February 2020 inspection, the Licence Holder indicated that they only receive contaminated solid waste after a laboratory analytical report is provided to show the waste meets Class II acceptance criteria. If the landfill's operations staff receive queries about contaminated solid waste disposal, they would be referred to the Licence Holder's staff at the main Shire office for advice and instruction.

The Licence Holder has indicated they have some difficulty managing inappropriate wastes put in skip bins such as tyres, mattresses, gas bottles and white goods. The Licence Holder tries to separate these waste types out from skip bins where possible, but this causes occupational, safety and health concerns. They have tried to combat this issue by penalising non-compliant skip bins with penalty fees.

During the February 2020 inspection, the Licence Holder indicated that they do not generally accept Special Waste Type 2 (biomedical waste) but would like to receive sharps containers for storage before removal and transfer to another Premises. In May 2021, the Licence Holder indicated that they do not intend to accept any forms of Special Waste Type 2 at the Premises in the future.

The WMP includes two separate standard operating procedures (SOPs) for waste acceptance and controlled waste acceptance procedures and an additional SOP for managing non-conforming loads (ASK, 2019). It is unclear if these SOPs have been communicated to staff and successfully implemented at the Premises.

The 2019 AACR indicates that during this annual period, 1,300 tonnes of waste was received under Category 62 at the transfer station and 5,312 tonnes of waste was received under Category 64 at the landfill. These waste acceptance rates are well below the approved annual design capacities on the Existing Licence of 10,000 tonnes for Category 62 and 50,000 tonnes for Category 64.

7.2.2 Waste storage, processing and burial

Historically, compliance inspections and notices have identified practices where waste has been placed on open ground and outside of allowable tipping area and tipping face requirements (refer to Section 5.1.2). During a DWER inspection of the site on 27 September 2017 it was observed that progressive landfilling within the active area appeared to be ad-hoc with an active tipping face difficult to define.

During a subsequent DWER inspection on 10 February 2020, it was observed that landfilling was occurring at a clearly defined tipping face with appropriate dimensions and bound on either side by earthen bunds, as shown in Figure 10.



Photo source: Photograph taken by DWER Officer, 10 February 2020

Figure 10: Active tipping area

The WMP provides a SOP for cell development and waste handling which outlines procedures for cell planning, establishing the tipping face, depositing and consolidating waste, compacting waste, and daily and intermediate covers. It is not known to what extent this SOP has been adopted and implemented at the Premises.

During the February 2020 compliance inspection, the Licence Holder indicated that they were filling the deep excavation area in the east of the Premises (Figure 2) with Inert Waste Type 1 (Figure 11). The purpose was to raise the base of the excavation to achieve the minimum separation distance to the water table aquifer of 3 m. Once this was achieved, the Licence Holder intended to commence putrescible waste landfilling in the area (this area is outside of the active Class II putrescible landfill area designated in Figure 2). The Licence Holder ceased this activity following the inspection after being notified by DWER that filling of Inert Waste Type 1 was considered waste disposal and this activity therefore did not comply with Condition W2(a) in the Existing Licence. The Licence Holder advised in the 2019 AACR that they now intended to use the Inert Waste Type 1 to construct cell walls in the main landfill area instead. DWER does not know whether further filling of the deep excavation area with an alternative material has occurred since February 2020.



Photo source: Photograph taken by DWER Officer, 10 February 2020

Figure 11: Waste used to fill deep excavation area

7.2.3 Daily cover

The Existing Licence requires the operator to maintain a daily cover of 150 mm of soil material over the active tipping area for putrescible waste. Previous compliance history indicates that at various times, cover placed over active tipping areas has been absent or inadequate (refer to Section 5.1.2).

The February 2020 compliance inspection identified that waste in the putrescible landfill area was not covered at the end of each day. The Licence Holder indicated that this was a temporary issue due to the excavator breaking down and was not representative of typical conditions at the Premises. No exposed Special Waste Type 1 (asbestos) was observed in the asbestos burial area. The Licence Holder confirmed that asbestos is usually covered on the same day it is received at the Premises, unless staff identify that it is not appropriately wrapped and then cover might occur the next day to allow for wrapping to be repaired.

The Licence Holder uses an imported sandy clay soil from an off-site borrow pit as cover material on the Premises.

7.2.4 Intermediate cover

Following issue of the EPN, the LPMP proposed temporary capping in the western portion of the inactive landfill to mitigate leachate generation in this area (IWP, 2012). The capping layer was intended to promote stormwater runoff away from this part of the landfill, thereby reducing infiltration into the waste mass (IWP, 2012). The capping layer was proposed to be one metre thick, include establishment of grass species and be removed before future waste placement (IWP, 2012). DWER does not know whether the temporary capping layer was installed.

The LPMP also proposed intermediate cover measures to be implemented on an ongoing basis to manage temporarily inactive sections of the landfill (IWP, 2012). The purpose of intermediate cover was to reduce infiltration into the waste mass in areas not used for waste disposal for six weeks or more. The LPMP proposed that intermediate cover should comprise 300 mm of lower permeability soil material and clean, inert fill material could be used for this purpose (IWP, 2012). The LPMP recommended that the intermediate cover be removed before fresh waste disposal where possible (IWP, 2012).

The WMP proposed that an intermediate cover 300 mm thick should be applied to those areas of waste placement which will not be worked on for a minimum of three months (ASK, 2019).

Past observations and compliance inspections (Section 5.1.2) indicated that the extent and depth of existing cover over the inactive landfill areas may have been insufficient. DWER does not know what intermediate cover protocol the Licence Holder currently implements at the Premises.

7.2.5 Final cover and capping

The Existing Licence requires the Premises to maintain a final soil cover of one metre. DWER does not have a clear understanding which sections of the landfill are considered to be permanently closed and to what extent they have received final cover.

Based on the LPMP, the 60 m wide area between the wetlands and the western edge of the inactive landfill has been historically filled with waste (IWP, 2012). The LPMP recommended that no further landfilling occur in this area to prevent further encroachment of the landfill mass towards the wetlands and therefore this area should receive a permanent capping layer (IWP, 2012). The capping layer would comprise 1.5 m of silty clay or 1 m of lower permeability soil. The LPMP specified topsoil, vegetation cover, stormwater control and traffic control measures to be implemented on the permanent capping layer (IWP, 2012). Based on observations made during site inspections, the Licence Holder did not install the permanent capping layer proposed for this area in the LPMP. The LPMP also proposed for an equivalent capping layer to be used for ongoing permanent landfill capping in other parts of the landfill (IWP, 2012).

The WMP indicated that the final capping would comprise an engineered final cover layer being placed over each landfilled area as it is completed (ASK, 2019). However, the specifications of the final capping layer were undetermined because the Licence Holder had not completed a Landfill Closure Management Plan (ASK, 2019).

7.2.6 Record keeping

The September 2017 compliance report notes that wastes received at the site are weighed and inspected in accordance with the licence. Staff are trained in acceptance and management of waste; however, computer records are kept for incoming, weighed loads.

Previous compliance inspections noted a lack of an asbestos waste register (refer to Section 5.1.2). It is understood that a register is now maintained (as a handwritten notebook) by the operator and was sighted by DWER in 2016 and 2020. The Licence Holder also maintains a plan which shows the position of asbestos waste disposed at the landfill.

Key findings:

- (2) While the recent compliance inspection recorded that the management of the transfer station and landfill generally occurred within the requirements of the Existing Licence, the Delegated Officer cannot be assured of the continuation of good management practice without demonstration of written operational procedures to guide operators on acceptable practices on the receipt, storage, burial and recordkeeping associated with operation of the Premises. While the WMP (ASK, 2019) provides some operational procedures for the Premises, it is not clear to what extent these procedures have been implemented at the Premises.

7.3 Transfer station management

7.3.1 Transfer station

The transfer station comprises the putrescible waste drop off area, green waste drop off area, Drum Muster compound, waste oil recycling shed, reuse shop and the broader area surrounding this infrastructure. The putrescible waste drop off and green waste drop off areas are sited on 200 mm thick concrete with steel reinforcement. The eastern portion of the transfer station appears to be sealed with a bitumen surface however its construction specifications are not known and at the time of the February 2020 inspection DWER observed some deterioration and potholes in the surface. It is also not known what hardstand specifications are present beneath the waste oil recycling shed. A concrete pad was observed in the intended location of the reuse shop. The rest of the transfer station area comprises compacted, unsealed ground.

The Premises receives a number of waste types which are stored at the transfer station before being removed to another waste facility. The waste receipt and storage arrangements in place at the transfer station during the most recent DWER Premises inspection on 10 February 2020 are summarised in Table 11.

Table 11: Waste management arrangements in the transfer station

Waste type	Receipt/storage arrangements
Putrescible Waste	Placed at the putrescible waste drop off area and removed daily for landfilling.
Green Waste	Placed at the green waste drop off area and periodically removed to the green waste storage area.
Tyres (Inert Waste Type 2)	Stored on hardstand in the transfer station and periodically collected by a third party.
Comingled recyclables	Placed in designated skip bins in the unsealed portion of the transfer station and periodically collected by a third party.
Mattresses	Stored on the ground in the transfer station.
Household items for reuse (e.g. furniture, sporting equipment)	Stored in a fenced area in the transfer station. The Licence Holder indicated that a reuse shop was in the process of being constructed to allow the sale of suitable second-hand household items excluding electrical goods.
Waste oil	Decanted into a tank inside the waste oil recycling shed by the public and periodically collected by a third-party. The waste oil recycling shed is constructed of mild steel and is self-bunded with an internal tank capacity of 2,200 L and an external tank capacity of 4,800 L based on information provided by the Licence Holder. A number of small (<20 L) oil storage containers were stored on the ground outside of the waste oil shed.

Waste type	Receipt/storage arrangements
Paint tins	Separated into oil and water based and stored in sealed tins on self-banded pallets in the transfer station. Paint is periodically removed from the Premises.
Vehicle batteries	Stored in covered and self-banded pallets in the transfer station and periodically removed from the Premises.
Drum Muster containers	Stored stacked inside a fenced compound on bitumen in the transfer station. The Licence Holder indicated that containers are accepted in clean and dirty forms and dirty containers are typically washed out into the vehicle washdown bay (further discussion in Section 7.3.4). Signs on the compound indicated that it is serviced by Claw Environmental. The Premises is a registered Drum Muster collection site on the Drum Muster website.
LPG bottles and fire extinguishers	Stored loose on the bitumen hardstand in the transfer station. The Licence Holder indicated that LPG bottles which have their valves removed are eventually moved to the scrap metal yard.
Aerosols	Stored on pallets in the transfer station and periodically removed from the Premises.
E-waste (e.g. screens, computers, phones)	Stored on plastic pallets in the transfer station and periodically removed from the Premises.

7.3.2 Green Waste storage and processing

Following receipt within the transfer station drop off area and removal of obvious contamination, Green Waste is transferred to the green waste storage area. During the February 2020 inspection, Green Waste stockpiles were observed to be generally free from gross contamination.

Green Waste is either chipped or burnt, as allowed under the Existing Licence. The woodchipper is brought on-site about once per year and removed once wood is chipped. The Licence Holder has confirmed that the total amount chipped per year is less than 1000 tonnes. The Licence Holder indicated during February 2020 that chipped Green Waste is used as mulch on-site for rehabilitation and is not sold or taken off-site. The Licence Holder indicated that Green Waste burning usually occurs once per year during winter. There was no designated burning area, Green Waste was generally burned in the centre of the storage area with an area of cleared ground around it. The Green Waste is usually set alight and supervised until considered contained and controlled and then it is left to burn itself out for a couple of days.

The green waste storage area is situated on compacted in situ soil which is graded to prevent pooling of stormwater. An earthen bund is present along the southern side of the storage area. Runoff from the area drains, uncontrolled, to the surrounding environment.

The Licence Holder has a separate area on the Premises, on the inactive landfill to the east of the asbestos disposal area, where mulched Green Waste which has already been chipped off-site and brought to the Premises is stockpiled before reuse.

7.3.3 Scrap metal storage

Scrap metal (ferrous and non-ferrous) is transferred to the scrap metal storage area (Figure 12). No processing of scrap metal occurs on-site. Third-party users periodically remove material from the storage area. The area is sited on compacted in situ soil which is graded slightly to the south. Uncontrolled runoff drains to the surrounding environment, to the west of the storage pad.



Photo source: Photograph taken by DWER Officer 10 February 2020

Figure 12: Scrap metal storage area

7.3.4 Vehicle washdown bay

The designated vehicle washdown bay is an unbunded, hardstand area with a sump to collect wash water (Figure 13). During the February 2020 inspection, the Licence Holder indicated that the sump was also used to capture wash water generated when agricultural chemical residues are rinsed out of dirty Drum Muster containers. At the time of the inspection, the Licence Holder was managing the sump by periodically discharging its contents to the unsealed ground to the south of the bay.

DWER issued EFR 6963 (ICMS 56499) on 19 February 2020 to advise the Licence Holder that this activity was a breach of the *Environmental Protection (Unauthorised Discharge) Regulations 2004*. The EFR requested the Licence Holder to i) cease discharging materials immediately and ii) investigate options for appropriately and lawfully disposing of materials from the washdown bay. The Licence Holder subsequently advised that they had stopped using the washdown bay after the inspection and it would not be used again until an approved capture method is in place. A final decision on the operation of the washdown bay will be considered as part of the Licence Holder's investigations into alternative waste treatment technologies and related infrastructure changes at the Premises.



Photo source: Photograph taken by DWER Officer 10 February 2020.

Figure 13: Vehicle washdown bay

7.4 Landfill gas management

Landfill gas recovery, management and monitoring is not currently undertaken at the Premises. In the WMP, ASK considered that landfill gas generation at the Premises is expected to be in small volumes and present a low risk due to the low annual volumes of waste received at the facility (ASK, 2019). The WMP recommended some measures to be implemented at the Premises to ensure any risk associated with landfill gas is minimised, however these have not been discussed in this Review because DWER is not aware of whether the Licence Holder is committed to implementing these aspects of the WMP.

7.5 Stormwater management

Where the natural land surface has not been disturbed by previous or current operations, topography follows the natural land surface dropping from the natural ridge line along the eastern edge of the Premises (approximately 194 mAHD), and higher ground near the office and transfer station (approximately 186 mAHD) down to the Collie River, to the south west of the Premises (less than 180 mAHD). The topography of the operational areas of the Premises is affected by the former quarry operation (excavation along the eastern area of the Premises), placement of waste and cover material, and the construction of access roads and operational areas.

The latest survey of the Premises reviewed by DWER was dated December 2009 and indicated that, at the time, the active landfill landform was just over 192 mAHD in height (IWP, 2012). More recent surveys were completed in March 2017 and December 2018, however DWER has not been provided with the results of these surveys. The proposed height of waste in the final landfill design discussed in the WMP is 208 mAHD (ASK, 2019).

The Existing Licence requires management of stormwater to direct it away from the tipping area, retain water that has come into contact with waste on the Premises and keep stormwater drains clear (Existing Licence conditions W1 (a) to (c)).

Bunding and drains used to manage stormwater around the landfill are generally planned and constructed ahead of the start of winter, but they are not constructed to an engineered design and an assessment of their effectiveness has not been made. Some stormwater drains were observed during the February 2020 inspection and contained significant volumes of waste as

shown in Figure 14.



Photo source: Photograph taken by DWER Officer on 10 February 2020

Figure 14: Stormwater drain on the western edge of the landfill area

The LPMP proposed progressive waste profiling and design to ensure surface water runs in predetermined directions and specifically to direct contaminated water into the landfill and uncontaminated stormwater away from waste.

The WMP documents some stormwater management measures for the Premises (ASK, 2019), however DWER does not know to what extent these have been adopted and implemented. The proposed measures were focussed on directing stormwater to maintain separation between clean and contaminated stormwater and reducing sediment loads by minimising stormwater runoff across disturbed areas.

The eastern portion of the transfer station where most waste is stored appears to be sealed with bitumen which showed signs of deterioration during the February 2020 inspection. The western portion of the transfer station is unsealed. The putrescible waste drop off and green waste drop off areas are constructed of 200 mm thick concrete with steel reinforcement. These areas are graded and maintained to prevent pooling of stormwater; but no engineered drainage infrastructure is in place to manage excess runoff from the transfer station area.

The vehicle washdown bay is an unbunded hardstand area (hardstand specifications and condition unknown) and contains a sump which captures wash water from vehicles. DWER understands that the Licence Holder is not currently using the washdown bay. Further discussion is provided in Section 7.3.4.

Waste storage areas outside of the transfer station area (green waste and scrap metal) are unsealed and at least partially unbunded, allowing uncontrolled flow of stormwater within and beyond the Premises boundary.

The main stormwater collection areas at the Premises in the past were the deep excavation in the east and on-site wetland to the west of the landfill (Figure 2). These areas collected stormwater generated on-site including runoff from the landfill, transfer station, green waste storage area and scrap metal storage area. The Licence Holder has been filling the deep excavation in the east with the intention of eventually using this area for landfilling. It is therefore not known to what extent this area currently captures and stores stormwater from

the Premises.

Bunded stormwater retention areas (non-engineered) have been used in the past to the east and south of the landfill waste mass to retain runoff from the landfill slopes, allow infiltration to ground, or overtopping during high rainfall events. Anecdotal evidence suggests the wetlands and retention areas overtop following rainfall, allowing overland flow off-site towards Collie River.

Key findings:

- (3) The Delegated Officer considers that the current infrastructure and operational practices employed on the Premises do not effectively manage stormwater in accordance with the requirements of the licence.

7.6 Leachate generation and migration

7.6.1 Leachate quality

The Existing Licence does not require regular sampling or characterisation of leachate generated by the putrescible landfill. Waste accepted at the Class II putrescible landfill includes municipal and some industrial waste from the Collie area. Prior to licensing in 1997, disposal of waste at the Premises was unrestricted, and as such, the composition of leachate may be influenced by wastes not typically accepted by a Class II landfill facility. Based on DWER's experience, problematic waste types and contaminants usually found in regional landfills prior to licensing include per- and poly- fluoroalkyl substances (PFAS), pesticides, heavy metals, herbicides and polychlorinated biphenyls (PCBs). The receipt of un-characterised industrial waste (coal ash and mine site waste) under the Existing Licence, may also influence leachate chemistry.

The only samples of leachate collected from the Premises that have been analysed were collected by DWER (formerly DEC) representatives during a compliance inspection, when leachate was observed to be seeping from the landfill area in 2009. Two surface leachate samples were collected and analysed by a National Association of Testing Authorities (NATA) accredited laboratory. Results found leachate had concentrations of heavy metals (Cr, Cu, Ni and Zn) and hydrocarbons (TPH and BTEX) in excess of ANZECC aquatic ecosystems – fresh water guideline values (DEC, 2009).

7.6.2 Leachate generation and migration

The surface expression of leachate has been noted in various documents since 2009, including the LPMP. The LPMP noted that migration of leachate is seasonal and that investigations were being undertaken to determine the impacts of leachate migration on surface water and groundwater (IWP, 2012).

Photographs of the site (taken on 28 September 2017) show localised liquid discharge at the toe of the western slope of the putrescible landfill (Figure 15). The ponded liquid had a visible surface sheen and is considered to be leachate, or leachate impacted surface water runoff. Surface expression of leachate is thought to flow towards the wetland to the west of the landfill. The water quality of the wetland is not monitored.



Photo source: Photograph taken by DWER Officer

Figure 15: Photograph of liquid discharge at Premises (September 2017)

7.6.3 Leachate management

The landfill is unlined and there are no engineered leachate controls present at its base. The LPMP prepared following the 2009 EPN outlined a temporary and permanent leachate management system for the Premises (IWP, 2012). As outlined in Section 4.2.1, some aspects of the temporary management system were implemented, including a temporary leachate bund to contain discharges at the toe of the western landfill slope. However, it appears that most aspects of the permanent leachate management system were not implemented.

The WMP indicates that the strategy for managing leachate is to minimise leachate generation by undertaking measures to reduce stormwater infiltration to the landfill (ASK, 2019).

At the time of the February 2020 inspection, the Licence Holder indicated that the temporary leachate bund present on the western side of the landfill was not needed anymore because their updated landfilling practices had resulted in no leachate being expressed at the downslope edge of the landfill. DWER could not verify the Licence Holder's claim because the inspection took place during a dry period in summer when the leachate generation potential was relatively low.

Key findings:

- (4)** The Delegated Officer considers that the temporary measures adopted to manage leachate discharge from the landfill have been largely ineffective and additional measures are required to manage the generation and migration of leachate on the Premises.

7.7 Groundwater monitoring

7.7.1 Hydrogeological context and understanding

The Existing Licence includes conditions requiring the monitoring of groundwater (Existing

Licence conditions W3 and W4). Groundwater monitoring on the Premises has been undertaken since 2009.

A total of eleven monitoring wells are located on the Premises (Figure 16). Little is known about the construction and installation of the monitoring wells, with the exception of three groundwater monitoring wells installed by Stass Environmental in 2010 (bore construction reports provided in Stass, 2010).

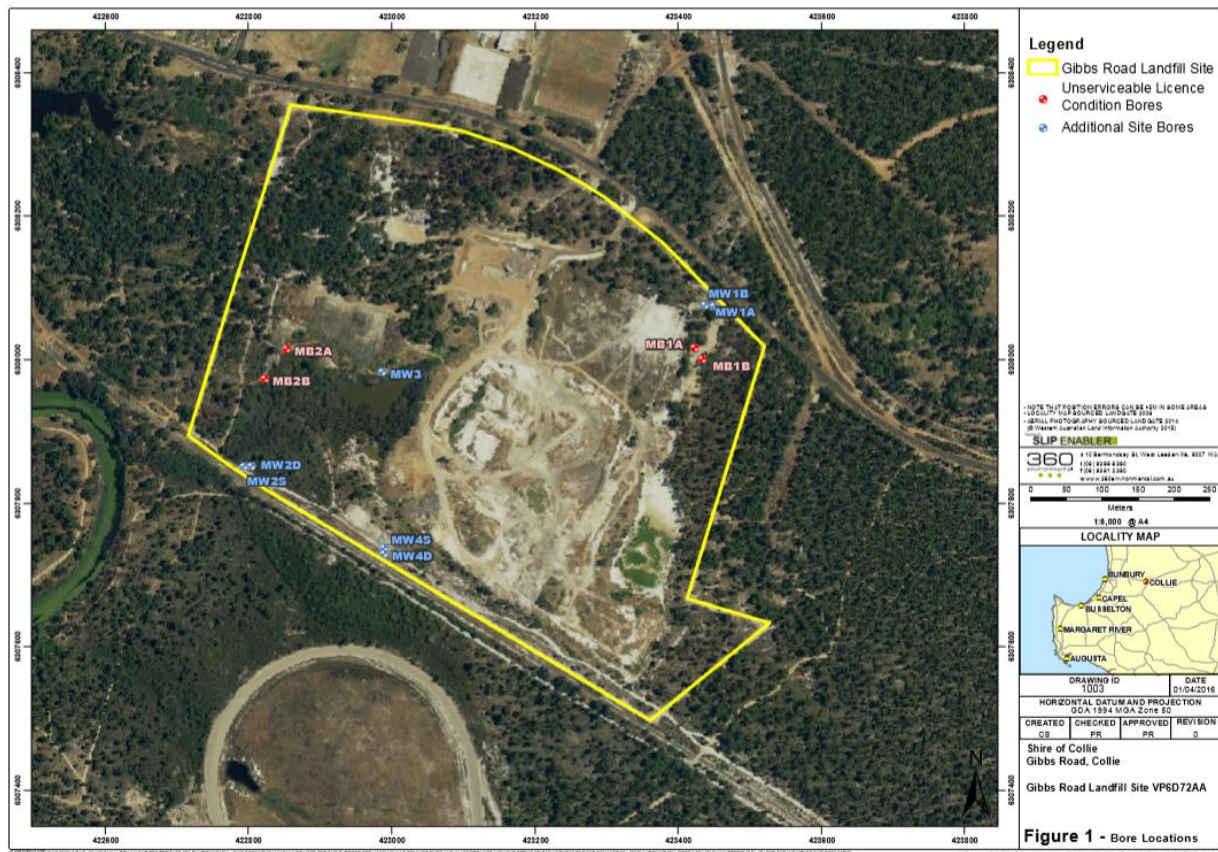


Figure source: replicated from 360 Environmental, 2016

Figure 16: Groundwater monitoring bore network

The original groundwater monitoring wells MB1 (A and B) and MB2 (A and B) are located to the east and west of the landfill respectively (marked in red in Figure 16). The A and B designate shallow and deep, although the total depth of the wells is unknown. The wells are not regularly sampled, and it is unknown whether they have been decommissioned, they were labelled as unserviceable in a 2016 groundwater monitoring program review (360 Environmental, 2016).

Wells MW3 and MW4 (S and D) were installed in February 2010. It is inferred from the locations of monitoring wells and nomenclature used in a 2011 groundwater report (Stass, 2011), that at some time between February and September 2011, MB1 and MB2 nested wells were replaced with MW1A and MW1B, and MW2S and MW2D. Well MW3 was found to be damaged in September 2016 and was unable to be sampled until it was repaired during early 2018 (Cardno, 2018). At the time of the February 2020 inspection, the Licence Holder indicated that all groundwater monitoring bores in the Existing Licence were currently in a serviceable condition. The 2020 Groundwater Monitoring Report (360 Environmental, 2021) indicated that both MW1A and MW1B were blocked at about 1.5 mBGL and were unable to be sampled in August or October 2020.

Some inconsistencies were found between bore completion details (gravel pack and bore cover type) and survey coordinates reported in the bore installation report (Stass, 2010) and

more recent observations (360 Environmental, 2016).

Standing water level has been monitored at well locations since 2009, with wells MW3, MW4S and MW4D only monitored between May 2010 and Feb 2011, and from September 2016 onwards. A bore network summary was included in the 2016 groundwater monitoring programme review (360 Environmental, 2016) and the elevations of the monitoring wells were also re-surveyed. Changes in total depth of some wells (MW1A, MW1B and MW2D) between 2011 and 2016 indicate some silting of the wells may have occurred (up to 0.5 m in some instances). It is unknown if the wells were installed and constructed to relevant standards.

Recent groundwater levels provided to DWER were collected in October 2019 (ESS, 2019) and ranged from:

- 181.2 mAHD (MW4S) to 178.3 mAHD (MW2S); and
- 1.29 mBGL (MW2D) to 15.87 mBGL (MW1B).

A groundwater contour map for March 2017 prepared by 360 Environmental is presented as Figure 17.

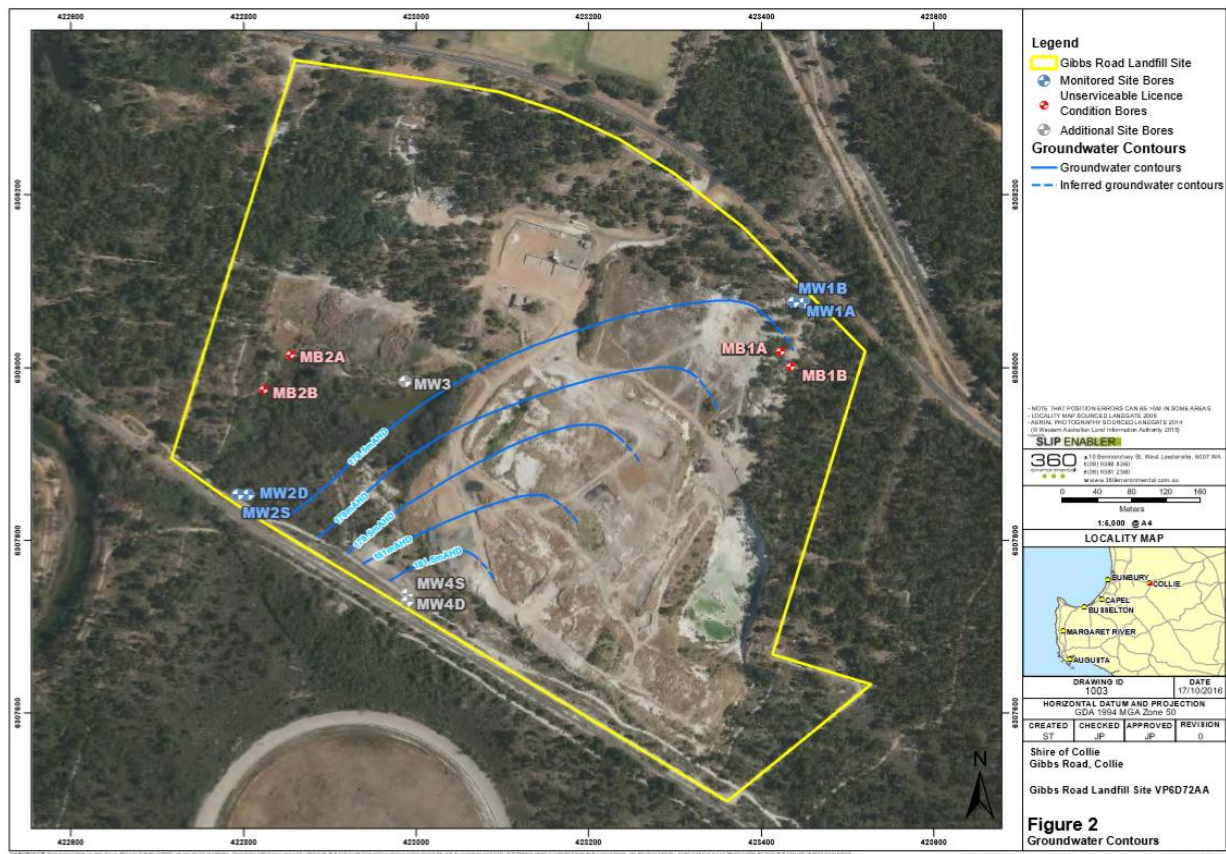


Figure source: replicated from 360 Environmental, 2017

Figure 17: Groundwater level contours (March, 2017)

Various interpretations of groundwater contours on the Premises have been undertaken since the commencement of monitoring. It has been suggested that a “groundwater divide” is present on the western portion of the site (in the vicinity of monitoring well MW4). It is understood that the interpretation of local groundwater contours to date has been undertaken based on the measurements from on-site bores only.

Examination of the DWER Water Information Reporting tool found two groundwater monitoring locations in close proximity to the site, which were drilled by the former Department of Water to understand the Collierie Basin hydrogeology. They are located to the northwest (CRM 24/98)

and south (CRM 33/98) of the Premises (Figure 18). Groundwater levels in the monitoring well to the north west of the Premises vary seasonally between 183 and 187 mAHD (between 1998 and 2007). Groundwater levels in the monitoring well located to the south of the Premises have a declining trend (between 1998 and 2007) from 188 mAHD to approximately 186 mAHD. While these readings pre-date monitoring on the site, the groundwater table elevations give an understanding of local groundwater flow characteristics beyond the site boundary.

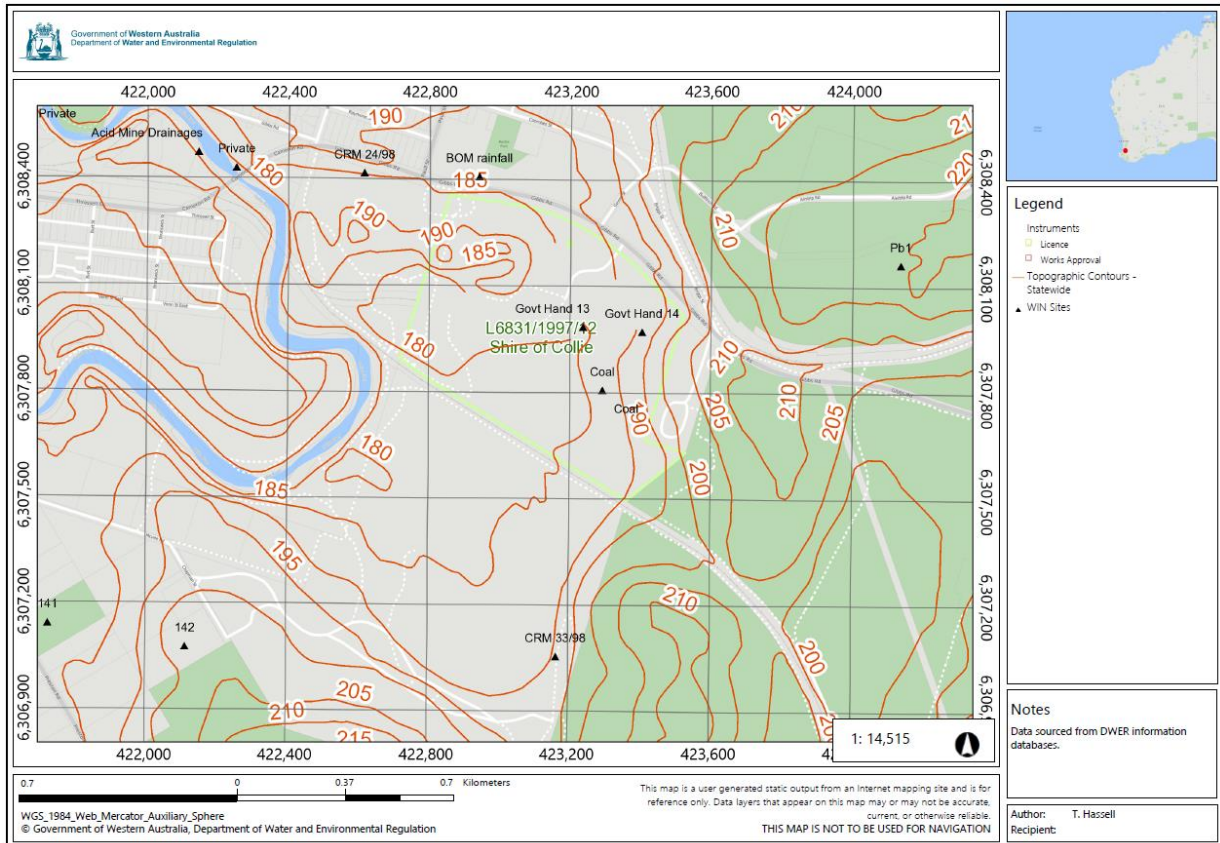


Figure 18: Off-site groundwater monitoring locations and topographic contours (March, 2017)

Based on the interpretation of the regional groundwater table data, and the topography of the area surrounding the site, local groundwater table levels may be influenced by the topographic highs to the south and east of the Premises (Figure 18). If topography influences groundwater flow then flow paths would extend from the north and south of the site to flow in a westerly direction towards the Collie River. Based on the local topography, and the depth to groundwater measured in bores located on the Premises, it is also likely that groundwater recharge and discharge occurs seasonally with water bodies (stormwater ponds and wetlands) located on and to the west of the Premises.

It is also possible that local groundwater flow properties are influenced by complexities introduced by the presence of historic mine workings and ground instability in the vicinity of the Premises. The interpretation of groundwater contours and groundwater flow paths presented for the Premises (360 Environmental, 2016) does not clearly identify groundwater flow paths or pathways for potential contaminant migration beyond the Premises boundary.

Key findings:

- (5) The Delegated Officer considers that the current local and site-specific hydrogeological interpretation for the Premises is unclear and this uncertainty should

be taken into consideration in the assessment of potential risk to off-site receptors. It is inferred that shallow groundwater beneath the Premises is in hydraulic connection with on-site wetlands and stormwater collection ponds, and off-site wetlands and the Collie River to the west of the Premises.

- (6) Based on the hydrogeological interpretation, the Delegated Officer considers that the current groundwater monitoring network is inadequate for the monitoring of potential pathways between contaminant sources (putrescible landfill) and receptors (shallow and deep groundwater and surface water).

7.7.2 Groundwater quality

Groundwater quality data from wells MW1A, MW1B, MW2S and MW2D have been reported from September 2011 through to October 2020, with the exception that MW1A and MW1B were blocked in August and October 2020. Wells MW3, MW4S and MW4D were sampled in September 2011, and from September 2016 onward. A summary of groundwater monitoring activities conducted at the Premises from October 2012 to October 2020 is presented in Table 12.

Table 12: Summary of groundwater monitoring events completed from October 2012 to October 2020

Monitoring Event(s)	Sampling method	Reference
October 2012, October 2013, April 2014, March 2015, September 2015 and March 2016	Bailing with a dedicated bailer for each site and a minimum 10 L purge prior to sampling.	360 Environmental, 2016
September 2016	Report not available in DWER records	
March 2017	Low flow sampling	360 Environmental, 2017
March 2018 and October 2018	Low flow sampling with a submersible bladder pump and decontamination procedures between bores.	Cardno, 2018
May 2019 and October 2019	Low flow sampling with decontamination procedures between bores.	ESS, 2019
August 2020 (replacement for April/May event which was missed) and October 2020	Low flow sampling with decontamination procedures between bores.	360 Environmental, 2021
April/March 2013, Sep/Oct 2014 and Sep/Oct 2017	No monitoring undertaken	

The 2016 groundwater monitoring programme review (360 Environmental, 2016) identified changes to groundwater monitoring which would provide alignment with current regulatory guidelines for contaminated sites assessment. This included a recommendation to change the sampling method from bailing to low flow sampling; 2017-2020 groundwater monitoring was undertaken in accordance with this recommendation. Following the 2016 review, sample collection, field quality assurance and quality control (QAQC) and handling was undertaken in general accordance with the National Environment Protection (Assessment of Site Contamination) Measure (as amended 2013) (NEPM). Samples were analysed by NATA accredited laboratories, with laboratory QAQC techniques provided in accordance with NEPM

requirements.

From 2016 to 2019, groundwater analytical results were compared to assessment criteria, as listed below, based on the identified environmental value of the site and receptors in the vicinity (360 Environmental, 2016; Cardno, 2018; ESS, 2019):

- Australian and New Zealand Guidelines for Fresh and Marine Water Quality – slightly to moderately disturbed fresh water ecosystems (Australian and New Zealand Governments [ANZG], 2018);
- Long-term irrigation (ANZECC/ARMCANZ, 2000);
- Livestock drinking water (ANZECC/ARMCANZ, 2000); and
- Non-potable groundwater use (Department of Health [DoH], 2014).

Other nominated assessment criteria were used prior to 2016; however, the groundwater monitoring programme review undertaken in 2016 is considered to be most representative of the receptors that are considered to be relevant for the site.

Based on the groundwater monitoring data presented in the 2016 review, contaminants of potential concern include nutrients (total nitrogen and ammonia) and metals (copper, lead, nickel and zinc). Concentrations of nutrients, copper, lead, nickel and zinc were generally greater in shallow groundwater sampled from bores located downgradient of the landfill (MW2S, MW3 and MW4S), compared to groundwater sampled from bores interpreted as upgradient of the landfill. Concentrations of some nutrients and metals exceeded the guidelines for freshwater ecosystems, suggesting that concentrations of some parameters in groundwater have the potential to impact downstream freshwater ecosystems including the Collie River (360 Environmental, 2016). Reports from subsequent biannual monitoring events undertaken from 2017 to 2020 generally showed consistent spatial trends to previous results (360 Environmental, 2017; Cardno, 2018; ESS, 2019; 360 Environmental, 2021). Recent groundwater monitoring events have recorded concentrations of cadmium above the guideline for freshwater ecosystems and this may be an additional contaminant of potential concern.

The September 2011 monitoring event included analysis of polycyclic aromatic hydrocarbons (PAH), organochlorine/organophosphorus pesticides (OCP), triazine herbicides, total organic carbon, polychlorinated biphenyls (PCB), benzene, toluene, ethylbenzene, xylenes (BTEX), total recoverable hydrocarbons (TRH), trichloroethene (TCE) and perchloroethene (PCE) in addition to the monitoring requirements of the licence. The sample results were all reported as below laboratory detection limit (360 Environmental, 2016). These analytes have not been included in any groundwater monitoring events reported to DWER since 2011.

Groundwater monitoring results show exceedances and increasing concentrations of some chemical parameters (major ions, nutrients and metals) that may indicate migration of leachate from the landfill into shallow groundwater down hydraulic gradient of operations at the Premises. The current suite of chemical parameters regularly monitored is limited, such that the identification and characterisation of hydrochemical properties of both groundwater and leachate is incomplete and uncertain. Furthermore, the absence of regular monitoring of surface water (wetlands), leachate and monitoring wells located upgradient and at a distance from operations (indicative of baseline groundwater quality) mean that full interpretation of groundwater quality results, and potential for impact is unable to be completed at this time.

Key findings:

- (7) Groundwater monitoring indicated that leachate migration may be impacting shallow groundwater down hydraulic gradient of leachate contaminant sources (putrescible landfill). The extent of potential impacts to groundwater and surface water due to other potential contaminant sources (scrap metal storage and vehicle washdown discharges) is unknown. The Delegated Officer considers that the current monitoring network (groundwater and surface water) and suite of parameters required by the groundwater monitoring conditions in the Existing Licence are insufficient to determine the nature and extent of leachate impacts in shallow groundwater and surface water receptors at the Premises and beyond the site boundary.

7.8 Landfill closure and rehabilitation

The Licence Holder has not formally proposed a final landform design or capping and rehabilitation plan (conceptual or detailed) for the Premises.

The WMP recommended that the Licence Holder produce a Landfill Closure Management Plan (ASK, 2019). The WMP also suggested that the Licence Holder liaise with DWER during preparation of the plan to discuss legacy issues including the stability of steep waste slopes and the proximity of landfilled waste to surface water as well as proposed plans for the final landform and intended capping design (ASK, 2019). At the time of this Review, the Licence Holder has not contacted DWER to discuss landfill closure plans for the Premises.

8. Risk assessment

8.1 Determination of emission, pathway and receptor

In undertaking a 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. It is noted that the risk assessment conducted as part of this Review is not considered to be a complete risk assessment of all operational aspects licensed to be undertaken at the Premises.

Sources and activities that are not assessed as part of this Review are:

- Dust, noise and odour emissions from operations on the Premises (with the exception of risks associated with asbestos receipt and burial);
- Management of small scale incidents (e.g. minor spills and contamination of waste streams);
- Hazardous Waste acceptance and storage (with the exception of risks associated with contaminated stormwater runoff);
- Windblown waste;
- Vermin/pests and weed control (operational); and
- Fire/smoke (with the exception of water use for fire control).

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 regulatory mechanisms such as Part IV of the EP Act, that emission will not be risk assessed further and will be screened out through Table 13.

The identification of the sources, pathways and receptors to determine Risk Events are set out in Table 13 below.

Table 13: Identification of emissions, pathway and receptors

Risk Events					Continue to detailed risk assessment	Reasoning	
Sources/Activities	Potential emissions	Potential receptors	Potential pathway	Potential adverse impacts			
Class II unlined landfill (active and inactive)	Storage of putrescible waste (inactive cells) and placement and storage of putrescible waste (active cells)	Potentially contaminated stormwater (to land)	Aquatic ecosystems (surface water on-site – ponds and wetlands)	Overland flow of runoff from operational and non-operational areas to retention areas on-site	Degradation of surface water quality on-site – impact to aquatic ecosystems and fauna Erosion/instability of landfill edges	Yes	The Delegated Officer considers it unlikely that surface water on-site supports significant ecosystems; however, the sources and emissions are linked to other Risk Events identified below (including infiltration of contained surface water and overland flow of contaminated stormwater). Refer to Section 8.5
		Leachate (to land)	Aquatic ecosystems (surface water on-site – ponds and wetlands) Terrestrial fauna (birds)	Overland flow of leachate from edge of landfill	Degradation of surface water quality on-site – impact to aquatic ecosystems and fauna	Yes	The Delegated Officer considers it unlikely that surface water on-site supports significant ecosystems; however, direct impact to terrestrial fauna (native birds) is considered to be possible and the sources and emissions are linked to other Risk Events identified below (contained surface water). Refer to Section 8.6
			On-site workers	Passive direct exposure to airborne contaminants and vapours Indirect ingestion via contact with contaminants	Health impact to on-site workers	No No	The Delegated Officer considers that risks to employees, visitors or contractors of the Licence Holder are managed as part of exposure risk assessments and prevention strategies required under other State legislation.
		Leachate (to groundwater)	Aquatic ecosystems (surface water on-site and off-site – ponds and wetlands)	Shallow groundwater discharge into wetlands and stormwater ponds	Degradation of surface water quality on-site and off-site – impact to aquatic ecosystems and fauna	Yes	The Delegated Officer considers it unlikely that surface water on-site supports significant ecosystems; however, impact to off-site ecosystems is considered to be possible and the sources and emissions are linked to other Risk Events identified below (contained surface water). Refer to Section 8.7
			Collie River: Aquatic and riparian ecosystems Public (recreation)	Shallow groundwater discharge to Collie River	Degradation of surface water quality off-site – impact to aquatic and riparian ecosystems and fauna Health impact to public Impact to amenity and environmental value	Yes	Refer to Section 8.7
			Beneficial users of groundwater (shallow aquifer)	Shallow groundwater flow from Premises toward Collie River Groundwater abstraction	Degradation of groundwater quality – impact to existing and future beneficial uses	No	There are no existing shallow groundwater users located down hydraulic gradient of the Premises. It is noted that the down-gradient hydraulic flow path (Section 8.7) is inferred. Based on the inferred groundwater flow paths from the Premises, hydrogeological conditions in shallow aquifer, potential land use considerations, and the presence of old mine workings; siting of groundwater bores between the Premises and Collie River is unlikely to produce a viable resource for domestic or industrial use. Therefore, the Delegated Officer considers that impacts to potential future groundwater users are unlikely and restrictions for use can manage risk.
			Beneficial users of groundwater (deep aquifer)	Groundwater flow from shallow aquifer to deep aquifer (dense contaminants) Groundwater abstraction	Degradation of groundwater quality – impact to future beneficial uses Impact to existing beneficial use (groundwater abstraction licence)	Yes	Refer to Section 8.7
			Landfill gas	Public/Workers on-site	Lateral migration through landfill	Property damage and health impact - Fire/explosion	No
		Public (residential dwellings and recreational facilities)		Passive venting to air	Health impact - asphyxiation Amenity impact - odour	Yes	Refer to Section 8.8.
		Asbestos disposal area	Asbestos unloading and burial	Asbestos fibres	Public/Workers on-site	Air/wind dispersion	Health impact to on-site workers and public on-site
Public (residential dwellings and recreational facilities)	Direct inhalation				Health impact to public off-site	Yes	Refer to Section 8.9.

Risk Events					Continue to detailed risk assessment	Reasoning	
Sources/Activities	Potential emissions	Potential receptors	Potential pathway	Potential adverse impacts			
Other operations	Storage and chipping of Green Waste Operation of transfer station area (unloading and storage of putrescible wastes, tyres, plastic, inert fill and Green Waste by general public) Hazardous Waste (inc. waste oil) storage Storage of scrap metal and refuse Vehicle washdown	Contaminated stormwater (to land)	Aquatic ecosystems (surface water on-site and off-site – ponds and wetlands) Collie River: Aquatic and riparian ecosystems Public (recreation) Terrestrial ecosystems Public (direct and indirect contact)	Overland flow of runoff from operational areas to surface water bodies (on-site and off-site) and vegetated areas (off-site) Direct inhalation or indirect ingestion via contact	Degradation of surface water quality on-site and off-site – impact to aquatic and riparian ecosystems and fauna Health impact to public Impact to amenity and environmental value Impact to terrestrial ecosystem function (weeds)	Yes	The Delegated Officer considers it unlikely that surface water on-site supports significant ecosystems, however, impact to off-site ecosystems and receptors is considered to be possible and the sources and emissions are linked to other Risk Events identified below (contained surface water). Refer to Section 8.5
		Contaminated stormwater (to groundwater)	Aquatic ecosystems (surface water on-site and off-site – ponds and wetlands) Collie River: Aquatic and riparian ecosystems Public (recreation)	Shallow groundwater discharge into wetlands and stormwater ponds Shallow groundwater discharge to Collie River	Degradation of surface water quality on-site and off-site – impact to aquatic and riparian ecosystems and fauna Impact to amenity and environmental value Health impact to public	Yes	The Delegated Officer considers it unlikely that surface water on-site supports significant ecosystems, however, impact to off-site ecosystems and receptors is considered to be possible and the sources and emissions are linked to other Risk Events identified below (contained surface water). Refer to Section 8.5
			Beneficial users of groundwater (shallow aquifer)	Shallow groundwater flow from Premises towards Collie River Groundwater abstraction	Degradation of groundwater quality – impact to existing and future beneficial uses	No	There are no existing shallow groundwater users located down hydraulic gradient of the Premises. It is noted that the down-gradient hydraulic flow path (Section 8.7) is inferred. Based on the inferred groundwater flow paths from the Premises, hydrogeological conditions in shallow aquifer, potential land use considerations, and the presence of old mine workings; siting of groundwater bores between the Premises and Collie River is unlikely to produce a viable resource for domestic or industrial use. Therefore, the Delegated Officer considers that impacts to potential future groundwater users is unlikely and restrictions for use can manage risk.
Deep excavation area (east of putrescible landfill) and onsite wetlands (west of putrescible landfill)	Retention of surface water (which may include potentially contaminated stormwater) in unlined ponds/wetlands and containment areas	Contained surface water (which may include potentially contaminated stormwater) (to land)	Aquatic ecosystems (surface water on-site – ponds and wetlands) Terrestrial ecosystems On-site workers	Direct contact	Degradation of surface water quality on-site – impact to aquatic ecosystems and fauna Impact to terrestrial ecosystem function (weeds) Health impact to on-site workers	No	The Delegated Officer considers it unlikely that surface water on-site supports significant ecosystems at this stage; however further understanding is likely to be required in the future for closure and rehabilitation of the Premises. The Delegated Officer considers that risks to employees, visitors or contractors of the Licence Holder are managed as part of exposure risk assessments and prevention strategies required under other State legislation.
		Contained surface water (which may include potentially contaminated stormwater) (to land)	Aquatic ecosystems (surface water on-site and off-site – ponds and wetlands) Collie River: Aquatic and riparian ecosystems Public (recreation) Terrestrial ecosystems	Overtopping of ponds and overland flow off-site	Degradation of surface water quality on-site and off-site – impact to aquatic and riparian ecosystems and fauna Health impact to public Impact to amenity and environmental value Impact to terrestrial ecosystem function (weed invasion)	Yes	The Delegated Officer considers it unlikely that surface water on-site supports significant ecosystems; however, impact to off-site ecosystems and receptors is considered to be possible. Refer to Section 8.10.
		Contained surface water (which may include potentially contaminated stormwater) (to groundwater)	Aquatic ecosystems (surface water on-site and off-site – ponds and wetlands) Collie River: Aquatic and riparian ecosystems Public (recreation)	Shallow groundwater discharge into wetlands and stormwater ponds Shallow groundwater discharge to Collie River	Degradation of surface water quality on-site and off-site – impact to aquatic and riparian ecosystems Health impact to public Impact to amenity and environmental value	Yes	The Delegated Officer considers it unlikely that surface water on-site supports significant ecosystems; however, impact to off-site ecosystems and receptors is considered to be possible. Refer to Section 8.10
			Beneficial users of groundwater (shallow aquifer)	Shallow groundwater flow from Premises toward Collie River Groundwater abstraction	Degradation of groundwater quality – impact to existing and future beneficial uses	No	There are no existing shallow groundwater users located down hydraulic gradient of the Premises. It is noted that the down-gradient hydraulic flow path (Section 8.7) is inferred. Based on the inferred groundwater flow paths from the Premises, hydrogeological conditions in shallow aquifer, potential land use considerations, and the presence of old mine workings; siting of groundwater bores between the Premises and Collie River is unlikely to produce a viable resource for domestic or industrial use. Therefore, the Delegated Officer considers that impacts to potential future groundwater users is unlikely and restrictions for use manage risk.

8.2 Consideration of Licence Holder controls

The detailed assessment of risk described in the following sections will consider Existing Licence conditions and historical application of those controls on the Premises based on the information provided in Section 3.2, Section 5.1.2 and Section 7.

For the purposes of assessing risk, it has been assumed that the temporary leachate management system proposed by the Licence Holder as part of their response to the EPN issued in 2009 (IWP, 2012) was implemented on the Premises, but the permanent leachate management system was not implemented. DWER has also not considered the content of the WMP (ASK, 2019) in the risk assessment as per earlier comments on this plan (refer to section 2.1.1).

Development of the landfill in accordance with the final landform design and filling plan in the WMP would change the risk profile for the Premises, and therefore require separate assessment under a works approval or licence amendment process.

8.3 Consequence and likelihood of risk events

A risk rating will be determined for risk events in accordance with the risk rating matrix set out in Table 14 below.

Table 14: Risk rating matrix

Likelihood	Consequence				
	Slight	Minor	Moderate	Major	Severe
Almost certain	Medium	High	High	Extreme	Extreme
Likely	Medium	Medium	High	High	Extreme
Possible	Low	Medium	Medium	High	Extreme
Unlikely	Low	Medium	Medium	Medium	High
Rare	Low	Low	Medium	Medium	High

DWER will undertake an assessment of the consequence and likelihood of the Risk Event in accordance with Table 15 below.

Table 15: Risk criteria table

Likelihood		Consequence		
The following criteria has been used to determine the likelihood of the Risk Event occurring.		The following criteria has been used to determine the consequences of a Risk Event occurring:		
		Environment	Public health* and amenity (such as air and water quality, noise, and odour)	
Almost Certain	The risk event is expected to occur in most circumstances	Severe	<ul style="list-style-type: none"> on-site impacts: catastrophic off-site impacts local scale: high level or above off-site impacts wider scale: mid-level or above Mid to long-term or permanent impact to an area of high conservation value or special significance[^] Specific Consequence Criteria (for environment) are significantly exceeded 	<ul style="list-style-type: none"> Loss of life Adverse health effects: high level or ongoing medical treatment Specific Consequence Criteria (for public health) are significantly exceeded Local scale impacts: permanent loss of amenity

Likelihood		Consequence		
The following criteria has been used to determine the likelihood of the Risk Event occurring.		The following criteria has been used to determine the consequences of a Risk Event occurring:		
		Environment	Public health* and amenity (such as air and water quality, noise, and odour)	
Likely	The risk event will probably occur in most circumstances	Major	<ul style="list-style-type: none"> • on-site impacts: high level • off-site impacts local scale: mid-level • off-site impacts wider scale: low level • Short-term impact to an area of high conservation value or special significance[^] • Specific Consequence Criteria (for environment) are exceeded 	<ul style="list-style-type: none"> • Adverse health effects: mid-level or frequent medical treatment • Specific Consequence Criteria (for public health) are exceeded • Local scale impacts: high level impact to amenity
Possible	The risk event could occur at some time	Moderate	<ul style="list-style-type: none"> • on-site impacts: mid-level • off-site impacts local scale: low level • off-site impacts wider scale: minimal • Specific Consequence Criteria (for environment) are at risk of not being met 	<ul style="list-style-type: none"> • Adverse health effects: low level or occasional medical treatment • Specific Consequence Criteria (for public health) are at risk of not being met • Local scale impacts: mid-level impact to amenity
Unlikely	The risk event will probably not occur in most circumstances	Minor	<ul style="list-style-type: none"> • on-site impacts: low level • off-site impacts local scale: minimal • off-site impacts wider scale: not detectable • Specific Consequence Criteria (for environment) likely to be met 	<ul style="list-style-type: none"> • Specific Consequence Criteria (for public health) are likely to be met • Local scale impacts: low level impact to amenity
Rare	The risk event may only occur in exceptional circumstances	Slight	<ul style="list-style-type: none"> • on-site impact: minimal • Specific Consequence Criteria (for environment) met 	<ul style="list-style-type: none"> • Local scale: minimal to amenity • Specific Consequence Criteria (for public health) met

[^] Determination of areas of high conservation value or special significance should be informed by the *Guidance Statement: Environmental Siting*.

* In applying public health criteria, DWER may have regard to the Department of Health's *Health Risk Assessment (Scoping) Guidelines* (2010).

"on-site" means within the Prescribed Premises boundary.

8.4 Acceptability and treatment of Risk Event

DWER will determine the acceptability and treatment of Risk Events in accordance with the Risk treatment Table 16 below.

Table 16: Risk treatment table

Rating of Risk Event	Acceptability	Treatment
Extreme	Unacceptable.	Risk Event will not be tolerated. DWER may refuse application.
High	May be acceptable. Subject to multiple regulatory controls.	Risk Event may be tolerated and may be subject to multiple regulatory controls. This may include both outcome-based and management conditions.
Medium	Acceptable, generally subject to regulatory controls.	Risk Event is tolerable and is likely to be subject to some regulatory controls. A preference for outcome-based conditions where practical and appropriate will be applied.
Low	Acceptable, generally not controlled.	Risk Event is acceptable and will generally not be subject to regulatory controls.

8.5 Risk Assessment – Potentially Contaminated Stormwater

8.5.1 Description of the emission

Rainfall or excess water generated from operations (e.g. fire suppression, vehicle washdown) may come into contact with waste and other contaminated materials, resulting in generation of runoff and overland flow of contaminated stormwater to surface water containment areas, on-site wetlands, off-site wetlands and the Collie River. The contaminants that are potentially contained in the stormwater can cause impact to aquatic and other associated ecosystems, public health, amenity and environmental value and native vegetation health and function.

Rainfall and surface water infiltrating into the active and inactive landfill areas is considered to be a leachate emission to land or groundwater and has been assessed separately in Sections 8.6 and 8.7. The infiltration of contained stormwater is considered as a separate risk event and is discussed in Section 8.10.

8.5.2 Identification and general characterisation of emission

Stormwater has the potential to become contaminated after coming into contact with operational areas and wastes stored on the Premises resulting in contaminated stormwater emissions. Wastes being accepted at the Premises include:

- Putrescible, inert (tyres) and clean fill;
- Asbestos;
- Green Waste (potentially containing non-vegetation material);
- Hazardous Waste including waste oil, paints, aerosols, LPG bottles, fire extinguishers, fluorescent lights and e-waste;
- Dirty and clean agricultural chemical containers (Drum Muster); and
- Scrap metal.

Based on the age of the landfill, wastes other than those listed above may also be contained on the Premises and may be exposed in areas that have the potential to come into contact with stormwater. The green waste and scrap metal storage areas are unsealed and may not be sufficient to contain stormwater within the operational area. The vehicle washdown bay has the potential to contaminate rainfall and runoff, and to generate runoff from wash water resulting in contaminated stormwater emissions.

In the Collie area, average annual rainfall exceeds evapotranspiration, and with the majority of rainfall falling in winter months, it can be expected that runoff volumes and frequency will be greatest from May to August (Section 6.2).

Based on the types and characteristics of waste accepted on the Premises, potential contaminants include but are not limited to; nutrients, hydrocarbons, metals and metalloids, pesticides, organic and biological contaminants, organic acids, asbestos and other miscellaneous contaminants (e.g. PFAS). It is noted that contamination resulting from rainfall interacting with exposed waste on the surface of the putrescible landfill is not likely to be significantly contaminated, compared to leachate resulting from infiltration of rainfall into the putrescible landfill.

8.5.3 Description of potential adverse impact from the emission

The putrescible landfill cells (active and inactive) receive rainfall to surface and slopes of the cells. While a daily cover is placed on the active cells, and cover is applied to inactive areas, the thickness and continuity of the soil layer is difficult to determine, and has at times been inconsistently applied. The majority of direct overland flow of stormwater from the cells flows down the sloped edges and into the deep excavation area (eastern side) or on-site wetland (western side) or into low areas at the edges of the landfill (surrounded by limited bunding).

On other operational areas of the Premises (transfer station, scrap metal storage, green waste

storage area, vehicle washdown bay), ground is unsealed/partially unsealed or unbunded, allowing stormwater to either flow off-site or be retained in low-lying areas for infiltration to ground. Overland flow of stormwater off-site is likely to be to the west, where uncontrolled, ephemeral drainage lines flow through native vegetation communities, to natural wetlands and to Collie River. Off-site areas to the west of the Premises are accessible to the public.

In general, surface water flow paths on-site and off-site are poorly understood and no stormwater management plan or stormwater management operational strategy exists for the Premises. Based on the information reviewed as part of this risk assessment, the Delegated Officer considers that surface water runoff from the putrescible landfill is contained on-site and infiltrates into the landfill, or to ground.

The Delegated Officer considers it unlikely that surface water on-site supports significant aquatic ecosystems, and as such, contaminated stormwater runoff to surface water containment on-site is unlikely to result in adverse impact to flora or fauna during operations. However, the retention of contaminated stormwater on-site has the potential to result in adverse impact to other receptors (discussed in Section 8.10). It is noted that suitability of on-site surface water to sustain natural ecosystems at closure has not been determined.

Contaminated stormwater flow off-site has the potential to cause adverse impact to aquatic and riparian ecosystems through degradation of surface water quality. Native fauna (birds and other species) may also be impacted via direct contact with contaminated stormwater. Typical contaminants resulting from stormwater contact with putrescible landfill includes nutrients (e.g. nitrogen and phosphorus). The flow of stormwater rich in nutrients has the potential to promote the establishment of non-native weed species resulting in impact to biodiversity and ecosystem function within riparian and native vegetation habitats off-site and post-closure.

Areas beyond the site boundary to the west, including wetlands and Collie River are accessible by the general public, and have the potential to be used for recreation. Contaminated stormwater has the potential to impact on public health (via direct or indirect contact – inhalation, ingestion and/or absorption) and is likely to impact on amenity and environmental values.

Infiltration of contaminated stormwater runoff from operational areas to shallow groundwater has the potential to degrade groundwater and soil quality, resulting in impacts to surface water quality in groundwater discharge areas, and degradation of soil through the accumulation and adsorption of contaminants in the unsaturated zone. The shallow aquifer (Nakina Formation) and underlying deep aquifer (Ewington Coal Measures) may be in hydraulic connection in the vicinity of, and down hydraulic gradient of the Premises. Groundwater flow paths are not well defined on-site or beyond the site boundary, and have been inferred to be towards the west and north.

It is noted that while some management of stormwater is required under the Existing Licence, monitoring is not required.

8.5.4 Criteria for assessment

Relevant land and water assessment criteria include the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG, 2018), Non-Potable Use Guidelines (Department of Health, 2014), Guidelines for Managing Risk in Recreational Water (NHMRC, 2008), DWER Assessment and Management of Contaminated Sites, and the Assessment of Site Contamination NEPM 1999 (as amended in 2013) for soils and groundwater.

The Delegated Officer considers that storage ponds and other drainage structures should be designed to contain and control rainfall runoff for a 1 in 20 (5%) AEP storm event. Storm events up to 1 in 100 (1%) AEP, and 1 in 100 (1%) AEP flood fringe mapping should also be considered to ensure that infrastructure is adequate and does not result in any catastrophic failures such as flooding of the landfill or failure of water containment structures and

stormwater control structures.

8.5.5 Licence Holder controls

This assessment has reviewed the controls set out in Table 17 below.

Table 17: Licence Holder's proposed controls for contaminated stormwater emissions

Site infrastructure	Description	Operation details	Reference to Revised Licence plan
Existing infrastructure for diversion and control of stormwater emissions			
Class II putrescible landfill	Active tipping trenches bordered by temporary earthen bunds. Inactive areas compacted and capped (>1 m soil cover).	<ul style="list-style-type: none"> Waste acceptance criteria limits set for the Premises (mass and type of waste). Waste placed/exposed only in active trenches enclosed by earthen or other bunds. Waste is placed within a defined trench of restricted length (30 m) in layers not exceeding 500 mm. Daily cover of waste with 150 mm cover material. Inactive trenches covered with > 1 m soil cover. 	Figure 2
Transfer station area	Publicly accessible waste transfer station. Concrete hardstand for waste tipping only, bitumen hardstand in waste storage area and remaining areas are compacted, unsealed ground.	<ul style="list-style-type: none"> Waste for putrescible landfill is placed on internally draining concrete apron. Waste is removed from apron on a daily basis or as needed to ensure sufficient capacity so that the hardstand pad can receive waste. Waste hydrocarbons stored in self-bunded tank designed to contain 110% of the volume of stored containers/vessels. Paints, vehicle batteries and aerosols stored on self-bunded pallets on bitumen hardstand. E-waste, tyres, LPG bottles, fire extinguishers and dirty/clean agricultural chemical containers stored on bitumen hardstand. No stormwater diversion infrastructure. 	Figure 2
Green waste storage and chipping area	Designated area separated from other operational areas to allow for	<ul style="list-style-type: none"> Bund constructed of vegetation debris is present along the southern edge of the area. 	Figure 2

Site infrastructure	Description	Operation details	Reference to Revised Licence plan
	burning. Cleared, unsealed ground surrounded by dense native vegetation.	<ul style="list-style-type: none"> • Long term storage of Green Waste only occurs in the designated green waste storage area. • Only uncontaminated Green Waste is burnt. 	
Scrap metal waste storage area	Compacted, unsealed ground surrounded by dense native vegetation.	<ul style="list-style-type: none"> • Waste is placed and stored on unsealed ground. • Waste is removed from site periodically by scrap metal recyclers. 	Figure 2
Vehicle washdown bay	Hardstand area designated for vehicle washing. Previously used by Licence Holder, public and third-parties using landfill area but not currently in use (Section 7.3.4).	<ul style="list-style-type: none"> • Bunding and grading insufficient to capture wash water. • Sump present beneath hardstand to store wash water but currently no on-site treatment or off-site disposal arrangements to manage/dispose of sump water. 	Figure 2
Stormwater infrastructure	Non-engineered excavation and wetland areas to the east and west of the landfill capture and store some stormwater. Limited non-engineered drains and diversion bunds to direct stormwater flow.	<ul style="list-style-type: none"> • Limited earthen bunding constructed along roadways/tracks to contain stormwater. • Stormwater is directed away from the active landfill. • Drains are maintained to allow for drainage. • On-site wetlands receive some stormwater from the western side of the landfill. • Deep excavation area receives some stormwater from the eastern side of the landfill. 	Figure 2
Proposed controls for management of contaminated stormwater			
Leachate Prevention and Management Plan (IWP, 2012)	<ul style="list-style-type: none"> • Waste profiling to ensure surface water runs in predetermined directions, directing contaminated surface water back into the landfill. • Cover and capping protocols to shed uncontaminated stormwater away from the landfill to prevent percolation of stormwater through waste mass. 		

Site infrastructure	Description	Operation details	Reference to Revised Licence plan
Existing Licence controls for prevention of contamination of stormwater			
Stormwater management	<ul style="list-style-type: none"> Stormwater is directed away from the tipping area. Stormwater drains are kept clear to allow for drainage. Water that has come into contact with waste is retained on the Premises. 		
Landfill Management	<ul style="list-style-type: none"> Waste acceptance criteria limits set for the Premises (mass and type of waste). Distance of at least 100 m is maintained between the tipping area and surface water bodies. Waste is not disposed within 35 m of the Premises boundary. Waste disposal occurs within a limited tipping area, in a defined trench or an area enclosed by earthen bunds. Daily cover of 150 mm cover material. 		
Monitoring	<ul style="list-style-type: none"> Biannual monitoring of shallow groundwater (seven monitoring wells). No stormwater monitoring conducted. 		
Closure and Rehabilitation	<ul style="list-style-type: none"> Final waste profile is covered with a soil cover of at least one (1) m. Inactive cells are progressively covered with at least one (1) m cover soil to form a cap. 		

8.5.6 Key findings

Key findings:

(8) The Delegated Officer has reviewed the information regarding contaminated stormwater emissions and has found:

- Stormwater coming into contact with wastes accepted and stored on the Premises has the potential to become contaminated to levels that can cause adverse impacts to receptors.
- The contained surface water on the Premises is not likely to sustain significant ecosystem function (aquatic or terrestrial) during operations; however surface water quality for closure of the Premises needs to be considered.
- Activities and contaminant sources are generally undertaken on compacted, unsealed/partially unsealed areas with incomplete or no stormwater drainage or control.
- The controls implemented on the active and inactive putrescible landfill cells are not constructed to an engineered design and are considered to be inadequate to control stormwater contamination from the surface of the putrescible landfill.
- There is a high likelihood of uncontrolled flow of stormwater beyond the boundary of the Premises to the north, south and west; however, surface water

flow paths on-site and off-site are poorly understood.

6. The hydrogeological characteristics of the shallow aquifer are poorly understood, groundwater flow pathways within and beyond the site boundary are poorly understood and the current groundwater monitoring network is considered to be inadequate for the monitoring of potential impacts to groundwater resulting from operations.
7. Current operational controls for stormwater (bundling and containment ponds) are not informed by an operational strategy or operational stormwater management plan (or similar).

8.5.7 Consequence

If stormwater becomes contaminated, then the Delegated Officer has determined that the impact of uncontrolled discharge via overland flow, or seepage into shallow groundwater will be low level to a local scale environment or minimal to a wider scale environment, and impacts to amenity will be low-level and local scale. Adverse health impacts are considered to be low level. Therefore, the Delegated Officer considers the consequence of contaminated stormwater to be **moderate**.

8.5.8 Likelihood of Risk Event

It is noted that stormwater and standing surface water is not sampled as part of the current monitoring required by the Existing Licence, so stormwater quality information is not available.

Several instances of standing water and uncontrolled discharge of stormwater off-site have been observed during site inspections and compliance inspections undertaken since 2009. Occurrences have noted the presence of surface water drainage, with visible oily sheen, or discolouration indicating the likelihood for contamination. Another instance noted waste water from vehicle wash down of a third-party waste transfer vehicle pooling and flowing off-site to a vegetated area. There is anecdotal record of contamination within Green Waste and scrap metal stockpiles which could impact the quality of stormwater from waste storage areas and runoff generated from fire suppression. The majority of operations with a likelihood to cause impact to stormwater take place on compacted, unsealed/partially unsealed ground, with earthen bunding constructed in only some areas within the Premises.

Based on the current infrastructure and historical implementation of licence conditions, the Delegated Officer has determined that the occurrence of stormwater emissions that contain contaminants that can cause moderate impacts to receptors could occur at some time. Therefore, the Delegated Officer considers the likelihood to be **possible**.

8.5.9 Overall rating of contaminated stormwater emission

The Delegated Officer has compared the consequence and likelihood ratings described above with the risk rating matrix and determined that the overall rating for the risk of contaminated stormwater impacts is **medium**.

8.5.10 Regulatory controls for contaminated stormwater risk

The Licence Holder will be required to implement the following controls to manage the potential impacts from overland flow of contaminated stormwater:

- Limits on waste acceptance for storage and disposal (type and volume).
- Operational controls including:
 - Stormwater that has come into contact with waste is retained on the Premises.
 - Immediate clean-up of spills inside or outside an engineered containment

system.

- Cover, earthen bunding and grading requirements for the Class II putrescible landfill to promote runoff away from the active tipping face.
- Maintenance of at least 100 m between the tipping area and any surface water body outside of the Premises boundary.
- Infrastructure controls including:
 - Putrescible waste and green waste drop off areas are required to be located on the existing concrete hardstand, maintained to prevent leakage.
 - The hardstand in the vehicle washdown bay is required to be maintained to prevent leakage and capture stormwater run-off.
 - Stormwater from the putrescible waste drop off area, green waste drop off area, green waste storage area, Drum Muster compound, vehicle washdown bay and scrap metal storage area is required to be captured and retained on the Premises.
 - Active landfilling/tipping areas to be enclosed by earthen bunds and situated at least 35 m from the Premises boundary.
 - Storage requirements for Hazardous Waste such as weather proofing and bunding to prevent contamination of stormwater.
- Specified Actions of preparing and submitting i) a Groundwater Monitoring Plan, ii) a Hydrogeological Assessment, iii) Operational Stormwater and Leachate Management Plan and iv) Landfill Closure Management Plan.

The Operational Stormwater and Leachate Management Plan must outline a water balance, stormwater management protocols and infrastructure. Stormwater management measures are to be designed for a 1 in 20 (5%) AEP storm event, with additional consideration given to a 1 in 100 (1%) AEP storm event and the 1 in 100 (1%) AEP flood fringe area.

The Landfill Closure Management Plan must outline post-closure stormwater management measures.

The Licence Holder will also be required to monitor groundwater and surface water quality. Overland flow of potentially contaminated stormwater across the Premises boundary is not an authorised Discharge and the Revised Licence requires the Licence Holder to notify DWER if any stormwater containment area overtops.

8.6 Risk Assessment – Leachate emissions to land

8.6.1 Description of the emission

The decomposition of Class II Putrescible Waste in active and inactive cells within the landfill has the potential to generate leachate with high concentrations of organic and inorganic contaminants. Leachate emissions from the edges and slopes of the landfill may result in contamination of soil, surface water and/or groundwater which can result in impact to aquatic and other associated ecosystems, public health, amenity and environmental value and native vegetation health and function.

8.6.2 Identification and general characterisation of emission

Landfill leachate is formed from the infiltration of water (rainfall or dust suppression water) through the landfill cells, and also from the moisture content of the buried waste. 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. A surface leachate sample collected in 2009 contained elevated concentrations of metals and metalloids, and hydrocarbons. It is noted that a detailed analysis of all potential contaminants was not undertaken on that sample and that leachate composition is likely to change over time depending on the volumes and types of waste accepted.

The sources of leachate emissions to land are primarily the active and inactive landfill cells. The presence of clayey soils and shallow groundwater indicate that infiltration through the unsaturated zone is likely to be slow. Past inspections of the Premises found several instances of expression of landfill leachate at the ground surface near the base of the landfill.

It is inferred that there is a phreatic surface of leachate within the landfill leading to seepage from the sides and base of sloped edges, resulting in emission of leachate to the ground surface surrounding the landfill landform. The leachate generation rates, and presence of a leachate phreatic surface within the waste mass are unknown. Some leachate is likely to flow to surface water containment areas and mix with stormwater. Emissions resulting from these areas is considered as a separate risk event in Section 8.10. Assessment of leachate emissions to groundwater, including infiltration of ponded leachate to the groundwater surface are considered in Section 8.7.

8.6.3 Description of potential adverse impact from the emission

The putrescible landfill cells (active and inactive) are covered with a soil cover; however, thickness and continuity of the cover is not known. Rainfall and dust suppression water infiltrating through the cover and uncapped areas of the active cells mixes with moisture and contaminants within the waste mass to generate landfill leachate which can emit to land at the edges of the landfill. Leachate emissions from the landfill flow into the deep excavation area (eastern side) or wetland (western side) or into low points at the edges of the landfill to mix with stormwater and surface water. Leachate may also flow directly off-site (to the south west) or can infiltrate through unsealed ground to shallow groundwater. The existence of overland flow paths for direct discharge of leachate off-site is uncertain.

The concentrations of contaminants in leachate is likely to be higher than concentrations of contaminants in stormwater flowing from the putrescible landfill. Waters contaminated with leachate have the potential to cause adverse impact to aquatic and riparian ecosystems through degradation of surface water quality. The Delegated Officer considers it unlikely that surface water on-site supports significant aquatic ecosystems, and as such, leachate flow to surface water containment on-site is unlikely to result in adverse impact to aquatic fauna during operations. It is noted that suitability of surface water to sustain natural ecosystems at closure has not been determined. The containment of contaminated stormwater on-site has the potential to result in adverse impact to other receptors. This is discussed in Section 8.10.

Native fauna (birds and other species) may be impacted via direct contact with leachate on the ground surface. Concentrations of nutrients present in leachate (e.g. nitrogen and phosphorus) have the potential to promote the establishment of non-native weed species resulting in impact to biodiversity and ecosystem function within riparian and native vegetation habitats both on-site and off-site.

Direct flow of leachate off-site has the potential to impact on public health (via direct or indirect contact – inhalation, ingestion and/or absorption) and is likely to impact on amenity and environmental values. The potential for off-site flow of leachate emissions is poorly understood.

8.6.4 Criteria for assessment

Relevant land and water assessment criteria include the Australian and New Zealand

Guidelines for Fresh and Marine Water Quality (ANZG, 2018), Non-Potable Use Guidelines (Department of Health, 2014), Guidelines for Managing Risk in Recreational Water (NHMRC, 2008), DWER Assessment and Management of Contaminated Sites, and the Assessment of Site Contamination NEPM 1999 (as amended in 2013) for soils and groundwater.

The Delegated Officer considers that leachate storage and containment infrastructure should be designed to contain and control rainfall runoff for a 1 in 20 (5%) AEP storm event. Storm events up to 1 in 100 (1%) AEP and 1 in 100 (1%) AEP flood fringe mapping should also be considered to ensure that infrastructure is adequate and does not result in any catastrophic failure during operation and post-closure.

8.6.5 Licence Holder controls

This assessment has reviewed the controls set out in Table 18 below.

Table 18: Licence Holder’s proposed controls for leachate emissions to land

Site infrastructure	Description	Operation details	Reference to Revised Licence plan
Existing infrastructure for control of leachate emissions to land			
Class II putrescible landfill	<p>Unlined waste mass. Active tipping trenches bordered by temporary earthen bunds.</p> <p>Inactive areas compacted and capped (>1 m soil cover).</p>	<ul style="list-style-type: none"> Waste acceptance criteria limits set for the Premises (mass and type of waste). Waste is placed within a defined trench of restricted length (30 m) in layers not exceeding 500 mm. Daily cover of waste with 150 mm cover material. Inactive trenches covered with > 1 m soil cover. Earthen bunding (non-continuous) constructed at base of landfill to contain ponded discharges. 	Figure 2
Stormwater infrastructure	<p>Non-engineered excavation and wetland areas to the east and west of the landfill capture and store some stormwater, including leachate discharges to land.</p> <p>Limited non-engineered drains and diversion bunds to direct stormwater flow.</p>	<ul style="list-style-type: none"> Limited earthen bunding constructed along roadways/tracks to contain stormwater. Stormwater is directed away from the active landfill. On-site wetlands receive some stormwater from the western side of the landfill. Deep excavation area receives some stormwater from the eastern side of the landfill. 	Figure 2

Site infrastructure	Description	Operation details	Reference to Revised Licence plan
Proposed controls for management of leachate emissions to land			
Leachate Prevention and Management Plan (IWP, 2012)	<p>Temporary leachate management system</p> <ul style="list-style-type: none"> • Construction of a temporary leachate collection system incorporating an earthen bund constructed around the downgradient area where leachate flowed out from the landfill. • Construction of a temporary small surface water diversion bund on top of the landfill to prevent uncontaminated surface water entering the storage area. • Contaminated stormwater/leachate is pumped back onto the active landfill. <p>Permanent leachate management system (not fully implemented)</p> <ul style="list-style-type: none"> • Waste profiling to ensure surface water runs in predetermined directions diverting uncontaminated surface water away from the landfill. • Temporary and permanent capping on the western side of the landfill to reduce the percolation of stormwater through the waste mass and reduce the quantity of leachate being generated • Localised leachate collection system including sub-soil drain and storage tank, installed as needed in case discharges continue to occur in the short term. • General landfill management including concept design, filling plan, intermediate cover and permanent capping protocol. 		
Existing Licence controls for prevention of leachate emissions to land			
Stormwater management	<ul style="list-style-type: none"> • Stormwater is directed away from the tipping area. • Water that has come into contact with waste is retained on the Premises. 		
Landfill Management	<ul style="list-style-type: none"> • Waste acceptance criteria limits set for the Premises (mass and type of waste). • Distance of at least 100 m is maintained between operational areas and surface water bodies. • Waste is not disposed within 35 m of the Premises boundary. • Waste disposal occurs within a limited tipping area, in a defined trench or an area enclosed by earthen bunds. • Daily cover of 150 mm cover material. 		
Monitoring	<ul style="list-style-type: none"> • Biannual monitoring of shallow groundwater (seven monitoring wells) of pH, conductivity, nutrients, ions and metals and metalloids. • No leachate monitoring conducted. 		
Closure and Rehabilitation	<ul style="list-style-type: none"> • Final waste profile is covered with a soil cover of at least one (1) metre. • Inactive cells are progressively covered with at least one (1) m cover soil to form a cap. 		

8.6.6 Key findings

(9) The Delegated Officer has reviewed the information regarding leachate emissions to land and has found:

1. Leachate emissions from the edges of the landfill are poorly controlled and quality and flow pathways are poorly understood; however the Delegated Officer considers leachate emissions have the potential to cause adverse impact to receptors.
2. It is uncertain if leachate emanating from the landfill flows directly off-site.
3. The contained surface water on the Premises is not likely to sustain significant ecosystem function (aquatic or terrestrial) during operations; however surface water quality for closure of the Premises needs to be considered.
4. Locations and parameters currently monitored as part of Existing Licence requirements are not considered to be adequate to understand the potential for leachate emissions to impact ambient surface water and groundwater on and off-site.
5. The Licence Holder has not implemented all elements of the controls required by the EPN. Leachate management controls proposed by the Licence Holder including the temporary and permanent leachate management systems in the LPMP, have not been implemented, or those that have (e.g. temporary bunding) have not been assessed for effectiveness.
6. Subsequent assessment of the LPMP by the Delegated Officer finds that measures proposed in the document are not likely to be effective in mitigating potential leachate impacts to ground and surface waters.

8.6.7 Consequence

If emission of leachate to land occurs, the Delegated Officer has determined that the impact of landfill leachate on fauna on-site during operations will be minimal to low level. If off-site flow of leachate occurs to the south, impacts are considered likely to be low level on a local scale. Mixing of leachate with on-site surface water may lead to a risk of environmental criteria not being met. Therefore, the Delegated Officer considers the consequence of leachate emissions to land to be **moderate**.

It is noted that risks to employees, visitors or contractors of the Licence Holder are managed as part of exposure risk assessments and prevention strategies required under other State legislation.

8.6.8 Likelihood of Risk Event

The EPN issued to the Licence Holder in 2009 related to an occurrence of leachate flowing from the edges of the active landfill to the wetland situated adjacent to the western edge of the landfill. The leachate was observed to be present on several site visit occurrences over a three month timeframe. Samples of leachate collected by a DWER officer found the leachate contained metals and metalloids, and hydrocarbons at concentrations that had the potential to cause impact to health and the environment. Compliance inspections and other site inspections occurring between 2009 and 2017 also identified surface expression of leachate from the edges of the landfill landform.

Based on the topography, the siting of access roads and tracks and the presence of earthen bunding and unsealed ground around the landfill, it is unlikely that direct leachate emissions to the land surface would regularly reach beyond the boundary of the Premises. The likelihood of subsequent flow of ponded leachate via stormwater discharge, overtopping of water

containment or infiltration to shallow groundwater has been considered as part of other risk events discussed in other sections.

The Delegated Officer has determined that the likelihood of leachate emissions to land occurring with the potential to cause impact to receptors will probably not occur in most circumstances. Therefore, the Delegated Officer considers the likelihood of impact to be **unlikely**.

8.6.9 Overall rating of leachate emissions to land

The Delegated Officer has compared the consequence and likelihood ratings described above with the risk rating matrix and determined that the overall rating for the risk of leachate impacts from emission to land is **medium**.

8.6.10 Regulatory controls for leachate emissions to land

The Licence Holder will be required to implement the following controls to manage the potential impacts from leachate emissions to land:

- Limits on waste acceptance for disposal (type and volume).
- Infrastructure control requiring the active areas of the Class II putrescible landfill to be sited at least 35 m from the Premises boundary.
- Operational controls including:
 - Bunding, grading and temporary cover requirements for the Class II putrescible landfill to promote runoff away from the active tipping face.
 - Disposal, compaction and temporary/final cover requirements for the Class II putrescible landfill.
 - Maintenance of at least 100 m between the tipping area and any surface water body outside of the Premises boundary.
- Specified Actions of preparing and submitting i) a Groundwater Monitoring Plan, ii) a Hydrogeological Assessment, iii) Operational Stormwater and Leachate Management Plan and iv) Landfill Closure Management Plan.

The Operational Stormwater and Leachate Management Plan must outline leachate management protocols and infrastructure during premises operations.

The Landfill Closure Management Plan must outline post-closure leachate management measures.

The Licence Holder will also be required to monitor groundwater and surface water quality. Overland flow of leachate across the Premises boundary is not an authorised Discharge in the Revised Licence.

8.7 Risk Assessment – Leachate emission to groundwater

8.7.1 Description of the emission

The decomposition of Class II putrescible waste into active and inactive cells within the landfill has the potential to generate leachate with high concentrations of organic and inorganic contaminants. Leachate emissions from the base of the landfill and infiltration from areas of ponded leachate may result in contamination of soil, surface water and/or groundwater which can result in impact to aquatic and other associated ecosystems, public health, amenity and environmental value and native vegetation health and ecosystem function.

8.7.2 Identification and general characterisation of emission

Landfill leachate is formed from the infiltration of water (rainfall or dust suppression water) through the landfill cells, and also from the moisture content of the buried waste. 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. Leachate composition is not currently monitored at the Premises. Leachate seeping from the base of the landfill has the potential to be more concentrated in contaminants compared to leachate emissions to land as the liquid has the potential to be in contact with waste for a longer period of time.

The sources of leachate emissions to groundwater are primarily the active and inactive landfill cells. The landfill base is unlined and sited on weathered clayey sands. Leachate generation rates, and the potential for a leachate phreatic surface to be present within the waste mass are unknown.

8.7.3 Description of potential adverse impact from the emission

The putrescible landfill cells (active and inactive) are covered with a soil cover (thin daily cover or a thicker inactive landfill cell cover); however, thickness and continuity of the cover is not known. Rainfall and dust suppression water infiltrating through the cover, and uncapped areas of the active cells mixes with moisture and contaminants within the waste mass to generate landfill leachate from the base of the unlined landfill and at the edges and sides of the landfill.

The ultimate fate of leachate emissions to land that pond on the ground surface is likely to be infiltration through unsealed ground to shallow groundwater. Leachate generated within the landfill can seep from the base directly to shallow groundwater. The depth to groundwater directly beneath the base of the landfill is not well understood. Two monitoring locations (MW3 and MW4) are sited at an elevation which may be similar to the base of waste deposition (Figure 16). Historical (MW3) and recent (MW4) measurements of standing water level (SWL) at these locations indicates that depth to the watertable is approximately two metres below the land surface (estimated from elevation of SWL and top of groundwater well casing) (360 Environmental, 2017).

It is inferred that shallow groundwater beneath the Premises flows towards and discharges into Collie River (Section 7.7.1). There is a high likelihood of connection (discharge and recharge) between shallow groundwater and natural wetlands and stormwater containment areas both on and off-site. It is noted that groundwater flow paths on-site and beyond the Premises boundary are not well defined and for the purposes of this risk assessment have been inferred from DWER assessment of groundwater conditions.

Infiltration of leachate to shallow groundwater from the land surface or from the base of the putrescible landfill has the potential to degrade groundwater and soil quality, resulting in impacts to surface water quality and aquatic and riparian ecosystems in groundwater discharge areas, and degradation of soil through the accumulation and adsorption of contaminants in the unsaturated zone. The shallow aquifer (Nakina Formation) and underlying deep aquifer (Ewington Coal Measures) may be in hydraulic connection in the vicinity of, and down hydraulic gradient of the Premises.

The Delegated Officer considers it unlikely that surface water on-site supports significant aquatic ecosystems, and as such, leachate flow to surface water containment on-site is unlikely to result in adverse impact to flora or aquatic fauna during operations. It is noted that suitability of surface water to sustain natural ecosystems at closure has not been determined.

Areas beyond the site boundary to the west, including off-site wetlands and Collie River are accessible by general public, and have the potential to be used for recreation. Surface water impacted by contaminated groundwater has the potential to impact on public health (via direct

or indirect contact – inhalation, ingestion and/or absorption) and is likely to impact on amenity and environmental values.

There are no currently registered shallow groundwater users down inferred hydraulic gradient of the Premises, however, both groundwater and surface water allocation licenses exist directly west of the Premises for abstraction and use of water for industrial purposes. A groundwater licence also exists directly south of the Premises at the Collie Race Club for abstraction and use of water for irrigation and animal care. The groundwater licences to the west and south of the Premises are for the Lower Collie Group aquifer, not the shallow Nakina aquifer. Based on the inferred groundwater flow paths from the Premises, hydrogeological conditions in the shallow aquifer, potential land use considerations, and the presence of old mine workings; siting of groundwater bores between the Premises and Collie River is unlikely to produce a viable resource for domestic or industrial use. Therefore, the Delegated Officer considers that impacts to potential future groundwater users is unlikely and restrictions for use (based on groundwater quality) can manage risks.

8.7.4 Criteria for assessment

Relevant assessment criteria include the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG, 2018), Non-Potable Use Guidelines (Department of Health, 2014), Guidelines for Managing Risk in Recreational Water (NHMRC, 2008), DWER Assessment and Management of Contaminated Sites, and the Assessment of Site Contamination NEPM 1999 (as amended in 2013) for soils and groundwater.

8.7.5 Licence Holder controls

This assessment has reviewed the controls set out in Table 19 below.

Table 19: Licence Holder’s proposed controls for leachate emissions to groundwater

Site infrastructure	Description	Operation details	Reference to Revised Licence plan
Existing infrastructure for control of leachate emissions to groundwater			
Class II putrescible landfill	Unlined waste mass. Active tipping trenches bordered by temporary earthen bunds Inactive areas compacted and capped (>1 m soil cover)	<ul style="list-style-type: none"> Waste acceptance criteria limits set for the Premises (mass and type of waste) Waste is placed within a defined trench of restricted length (30 m) in layers not exceeding 500 mm. Daily cover of waste with 150 mm cover material. Inactive trenches covered with > 1 m soil cover. 	Figure 2

Site infrastructure	Description	Operation details	Reference to Revised Licence plan
Proposed controls for management of leachate emissions to groundwater			
Leachate Prevention and Management Plan (IWP, 2012)	Permanent leachate management system (not fully implemented) <ul style="list-style-type: none"> Waste profiling to ensure surface water runs in predetermined directions diverting uncontaminated surface water away from the landfill. Temporary and permanent capping protocol on the western side of the landfill to reduce the percolation of stormwater through the waste mass and reduce the quantity of leachate being generated Localised leachate collection system including sub-soil drain and storage tank, installed as needed in case discharges continue to occur in the short term. General landfill management including concept design, filling plan, intermediate cover and permanent capping protocol. 		
Existing Licence controls for prevention of leachate emissions to groundwater			
Stormwater management	<ul style="list-style-type: none"> Stormwater is directed away from the tipping area. Water that has come into contact with waste is retained on the Premises. 		
Landfill Management	<ul style="list-style-type: none"> Waste acceptance criteria limits set for the Premises (mass and type of waste). Distance of at least 100 m is maintained between operational areas and surface water bodies. Waste is not disposed within 35 m of the Premises boundary. Waste disposal occurs within a limited tipping area, in a defined trench or an area enclosed by earthen bunds. Daily cover of 150 mm cover material. A separation distance of at least 3 m is maintained between the base of the current waste disposal and highest known level of the water table aquifer. 		
Monitoring	<ul style="list-style-type: none"> Biannual monitoring of shallow groundwater (seven monitoring wells) of pH, conductivity, nutrients, ions and metals and metalloids. No leachate monitoring conducted. 		
Closure and Rehabilitation	<ul style="list-style-type: none"> Final waste profile is covered with a soil cover of at least one (1) metre. Inactive cells are progressively covered with at least one (1) m cover soil to form a cap. 		

8.7.6 Key findings

Key findings:

(10) The Delegated Officer has reviewed the information regarding leachate emissions to groundwater and has found:

1. Current controls for limiting generation of leachate include activities to limit ingress of stormwater only.
2. The contained surface water on the Premises is not likely to sustain significant ecosystem function (aquatic or terrestrial) during operations; however surface water quality for closure needs to be considered.
3. The hydrogeological characteristics of the shallow aquifer are poorly understood. Groundwater flow pathways beyond the site boundary are poorly understood and the current groundwater monitoring network is considered to be inadequate for the monitoring of potential impacts to groundwater resulting from leachate emissions to groundwater.
4. There is uncertainty regarding the potential connectivity between shallow and deep groundwater aquifers in the vicinity of and down hydraulic gradient of the Premises.
5. Parameters currently monitored in bi-annual groundwater monitoring do not capture the range of contaminants potentially contained in landfill leachate generated on the Premises.
6. The Licence Holder has not implemented all elements of the controls required by the EPN. Leachate management controls proposed by the Licence Holder including the temporary and permanent leachate management systems in the LPMP, have not been implemented, or those that have (e.g. temporary bunding) have not been assessed for effectiveness.
7. Subsequent assessment of the LPMP by the Delegated Officer finds that measures proposed in the document are not likely to be effective in mitigating potential leachate impacts to ground and surface waters.

8.7.7 Consequence

If leachate emissions to groundwater occur, the Delegated Officer has determined that the impact to aquatic and riparian ecosystems at a local scale (Collie River and off-site wetlands) is likely to be low to mid-level, with exceedance of specific environmental criteria off-site. Local, mid-level impacts to amenity may occur and there is a potential for specific criteria related to public health to be exceeded. Therefore, the Delegated Officer considers the consequence of leachate emissions to groundwater to be **major**.

8.7.8 Likelihood of Risk Event

The active and inactive landfill areas are sited on unsealed, permeable substrate. A groundwater monitoring network is currently monitored biannually to measure ambient groundwater quality at the Premises. Based on the flow path characteristics assessed in Section 7.7.1, the current monitoring locations are unlikely to allow assessment of groundwater characteristics down hydraulic gradient of the landfill. Furthermore, the current status of groundwater impacts to surface water is not understood as only groundwater is currently monitored under the Existing Licence conditions.

The suite of parameters required under the Existing Licence is not considered to be complete with respect to assessment of potential contaminants in leachate; however, current groundwater monitoring results indicate that groundwater down-gradient of the landfill contains concentrations of metals and metalloids that are elevated with respect to freshwater ecosystem criteria.

The hydrogeological characteristics assessed as part of this targeted review indicate that there is potential hydraulic connection between shallow groundwater impacted by the landfill and off-site surface water (Collie River and off-site wetlands), however significant uncertainty

remains about this potential pathway. The Delegated Officer has determined that the contamination of groundwater through leachate emissions to levels that have the potential to cause major impacts could occur at some time. Therefore, the Delegated Officer considers the likelihood of impact due to leachate emissions to groundwater to be **possible**.

8.7.9 Overall rating of leachate emissions to groundwater

The Delegated Officer has compared the consequence and likelihood ratings described above with the risk rating matrix and determined that the overall rating for the risk of leachate emissions to groundwater is **high**.

8.7.10 Regulatory controls for leachate emissions to groundwater

The Licence Holder will be required to implement the following controls to manage the potential impacts from leachate emissions to groundwater:

- Limits on waste acceptance for disposal (type and volume).
- Operational controls including:
 - Bunding, grading and temporary cover requirements for the Class II putrescible landfill to promote runoff away from the active tipping face.
 - Disposal, compaction and temporary/final cover requirements for the Class II putrescible landfill.
 - Maintenance of a separation distance of at least 3 m between the base of waste stored or disposed after the Revised Licence is issued and the highest known level of the water table aquifer.
 - Maintenance of at least 100 m between the tipping area and any surface water body outside of the Premises boundary.
- Specified Actions of preparing and submitting i) a Groundwater Monitoring Plan, ii) a Hydrogeological Assessment, iii) Operational Stormwater and Leachate Management Plan and iv) Landfill Closure Management Plan.

The Groundwater Monitoring Plan and Hydrogeological Assessment should be prepared in parallel as of each scope of work will inform the outcome of the other. For example, the current interpretation of groundwater flow directions should be used to inform the proposed siting of new groundwater monitoring bores in the Groundwater Monitoring Plan. Following installation of new monitoring bores, the hydrogeological interpretation in the Hydrogeological Assessment should be revised to reflect additional groundwater level data collected from the new bores.

The Operational Stormwater and Leachate Management Plan must outline leachate management protocols during premises operations.

The Landfill Closure Management Plan must outline post-closure leachate management measures.

The Licence Holder will also be required to monitor groundwater and surface water quality.

8.8 Risk Assessment – Landfill gas

8.8.1 Description of the emission

Landfill gas in the form of methane and carbon dioxide can be generated from the degradation of putrescible and biodegradable waste and can migrate vertically or laterally from the landfill waste landform and cause health impacts from inhalation and asphyxiation, ecotoxicity, fire/explosion, and amenity impacts.

8.8.2 Identification and general characterisation of emission

Landfill gas generation is usually limited in the early stages of landfill development, but generation rates generally increase in proportion to the amount of waste decomposing under anaerobic conditions. The generation of landfill gas within a landfill the size of the putrescible landfill on the Premises is usually considered to be relatively minor; however, landfill gas generation rates have not been estimated by the Licence Holder and are unknown. Following capping and closure of a landfill, on-going generation of gas presents a risk to receptors, unless gas release from the landfill is controlled at levels to manage potential impacts.

Landfill gas is produced in an anaerobic environment within the landfill and production and composition of the gas will vary depending on:

- Waste composition and age;
- Depth of waste;
- Density of waste;
- Moisture content and distribution of waste;
- Landfill temperature;
- The presence of chemical inhibitors;
- The design of the landfill cell; and
- Hydraulic characteristics of the site.

Landfill gas is primarily comprised of methane and carbon dioxide with trace amounts of oxygen, sulfur and hydrocarbon gases.

8.8.3 Description of potential adverse impact from the emission

If not appropriately managed, landfill gas can be emitted from a landfill via a number of pathways including:

- Through the landfill surface (lateral or vertical migration through a compromised or non-existent capping);
- Through subsurface voids (man-made or natural); or
- With leachate migration.

Landfill gas can cause health, safety, amenity and environmental impacts due to the methane and carbon dioxide content. Under certain conditions, trace components of hydrogen sulphide may also pose a risk.

Potential impacts associated with the release of landfill gas include toxicity from inhalation, toxicity to ecosystems, asphyxiation, fire and explosion and amenity impacts, such as odour. The risk of asphyxiation, fire and explosion is likely to be localised to the Premises and immediate surrounds.

Prevailing wind direction for the majority of the year is from the south east in the morning, and from the north west in the afternoon. Land to the west of the Premises is accessible to the public and supports terrestrial ecosystems. The closest residential receptors are approximately 420 m to the north and 520 m to the north west from the active and inactive landfill, other residences are located at greater distances (> 800 m) generally to the north, south and west of the Premises. Uncontrolled venting of gas has the potential to impact on health, ecosystems and amenity to receptors downwind of the Premises.

Once the capping system is in place, there is the potential for landfill gas to be trapped beneath the capping layer. If allowed to build up, pockets of pressurised gas may escape in an

uncontrolled manner (e.g. explosion), presenting a safety risk to personnel/public on-site and damaging the integrity of the capping system and landfill stability.

The risk assessment has been completed based on the current land use of the Premises and does not consider potential future land use changes following closure. Only off-site receptors have been considered because the Delegated Officer considers that on-site risks to employees, visitors or contractors of the Licence Holder while the Premises is operating are managed as part of exposure risk assessments and prevention strategies required under other State legislation.

8.8.4 Criteria for assessment

There are no set threshold or concentration criteria for landfill gas emissions to air. Amenity impacts can be assessed against the general provisions of the EP Act, specifically where odour unreasonably interferes with the health, welfare, convenience, or comfort of any person.

8.8.5 Licence Holder controls

This assessment has reviewed the controls set out in Table 20 below.

Table 20: Licence Holder’s proposed controls for landfill gas emissions

Site infrastructure	Description	Operation details	Reference to Revised Licence plan
Existing infrastructure for control of landfill gas emissions			
Class II putrescible landfill	Active tipping trenches bordered by temporary earthen bunds Inactive areas compacted and capped (>1 m soil cover)	<ul style="list-style-type: none"> Waste acceptance criteria limits set for the Premises (mass and type of waste). Waste is placed within a defined trench of restricted length (30 m) in layers not exceeding 500 mm. Active trenches are covered with at least 150 mm cover material every day the site is open. Inactive trenches covered with > 1 m soil cover. 	Figure 2
Proposed controls for management of landfill gas emissions			
None			
Existing Licence controls for prevention of landfill gas emissions			
Landfill Management	<ul style="list-style-type: none"> Waste acceptance criteria limits set for the Premises (mass and type of waste). Disposal of current waste at least 35 m from the Premises boundary. 		
Closure and Rehabilitation	<ul style="list-style-type: none"> Final waste profile is covered with a soil cover of at least one (1) metre. Inactive cells are progressively covered with at least one (1) m cover soil to form a cap. 		

8.8.6 Key findings

Key findings:

(11) The Delegated Officer has reviewed the information regarding emissions of landfill gas and has found:

1. Landfill gas generation has the potential to cause adverse impacts, especially in a post-closure setting.
2. Landfill gas generation rates during operations and post-closure have not been estimated for the Premises.
3. There is no current strategy for the estimation, management, control and/or monitoring of landfill gas generation during operations or post closure.

8.8.7 Consequence

If landfill gas generation occurs during operations the Delegated Officer has determined that the impact of gas emissions will be minimal off-site (amenity and potential health impacts). In a post-closure setting, when landfill gas has a greater potential to build up and cause more serious impact, impacts have the potential to be high level with potentially high level impacts to amenity and mid level impacts to health. Therefore, the Delegated Officer considers the worst-case scenario consequence of landfill gas emissions post-closure to be **major**.

8.8.8 Likelihood of Risk Event

The Delegated Officer has determined that landfill gas emissions causing major impacts will probably not occur in most circumstances and the likelihood of impact to be **unlikely**.

8.8.9 Overall rating of landfill gas emissions

The Delegated Officer has compared the consequence and likelihood ratings described above with the risk rating matrix and determined that the overall rating for the risk of landfill gas emissions is **medium**.

8.8.10 Regulatory controls for landfill gas risk

The Licence Holder will be required to implement the following controls to manage potential impacts from landfill gas emissions:

- Limits on waste acceptance for disposal (type and volume).
- Infrastructure control requiring a minimum separation distance of 35 m between the putrescible landfill and the Premises boundary.
- Operational controls including disposal, compaction and temporary/final cover requirements for the Class II putrescible landfill.
- Specified Action of preparing and submitting a Landfill Closure Management Plan which includes measures to control landfill gas post-capping and closure, assessment of landfill gas production and determination of infrastructure required to mitigate impacts to receptors.

8.9 Risk Assessment – Asbestos

8.9.1 Description of the emission

Asbestos fibres can be released from asbestos waste material being disposed at the Premises. Release of fibres may occur during handling (unloading) and burial and air

movement can carry fibres causing an adverse impact to workers, or public outside the Premises.

8.9.2 Identification and general characterisation of emission

Asbestos is a hazardous material, which was used extensively in Australian buildings and structures from the 1950s through to 1990. The Premises is licensed to accept asbestos wastes including asbestos containing material (ACM) and asbestos fibre and dust waste. The material is buried in a designated area of the Premises and is generally unloaded directly by the public. The current volume of asbestos waste buried in the designated area is not known as records have not been consistently kept during operations. Asbestos fibres can be released into the atmosphere during unloading, mechanical breakdown during burial, or disturbance of previously buried waste during digging and burial earthworks.

Based on the age of the landfill, asbestos waste also has the potential to be buried within the putrescible landfill. Emissions of asbestos fibres to the atmosphere may occur as a result of erosion to landfill edges or catastrophic failure of the landfill landform.

8.9.3 Description of potential adverse impact from the emission

Asbestos is a hazardous material. Inhalation of asbestos fibres can impact human health through the slow-rate development of lung diseases including asbestosis and mesothelioma (a form of lung cancer). The risk of developing a serious condition is usually dependent on the number of fibres inhaled and the number and duration of exposures, and in most cases, risks from exposure are very low.

Asbestos fibres have the potential to become airborne during unloading and disturbance on burial. Working machinery may break down ACM to release fibres. The digging of disposal trenches and earthwork to backfill existing trenches has the potential to disturb previously buried asbestos waste material. Once airborne, fibres may be transmitted off-site and can be inhaled by workers or public off-site. The Delegated Officer considers that on-site risks to employees, visitors or contractors of the Licence Holder are managed as part of exposure risk assessments and prevention strategies required under other State legislation.

Prevailing wind direction for the majority of the year is from the south east in the morning, and north west in the afternoon. Residences are located approximately 460 m to the north and 600 m to the north west and over one kilometre to the west and south west of the current asbestos disposal area. There are no residential properties within 1.5 km to the east of the asbestos disposal area. A vegetation buffer is situated around the perimeter of the operations. This vegetated area is accessible to the public and is zoned for parks and recreation or State Forest. A sports and recreation area is located immediately north of the Premises, on the opposite side of Gibbs Road, about 200 m north of the asbestos disposal area.

The potential impacts from inhalation of asbestos fibres are health impacts to public or on-site workers.

8.9.4 Criteria for assessment

The Guidelines for the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia (DoH, 2009) specify criteria for assessment of dust and asbestos emissions.

8.9.5 Licence Holder controls

This assessment has reviewed the controls set out in Table 21 below.

Table 21: Licence Holder's proposed controls for asbestos emissions

Site infrastructure	Description	Operation details	Reference to Revised Licence plan
Existing infrastructure for control of asbestos emissions			
Asbestos disposal area	Active disposal trenches	<ul style="list-style-type: none"> Specified area for acceptance and burial of asbestos waste as indicated on a maintained plan and located separate to the active putrescible landfill. Disposed asbestos waste is covered within 24 hours of disposal. 	Figure 2
Vegetation buffer	Native vegetation	<ul style="list-style-type: none"> Wide vegetation buffer separating residential receptors from airborne emissions. 	Figure 2
Proposed controls for management of asbestos emissions			
None			
Existing Licence controls for prevention of asbestos emissions			
Landfill Management	<ul style="list-style-type: none"> Material containing asbestos shall be covered within 24 hours after disposal, with minimum depth of one (1) metre of cover material. Material containing asbestos waste shall be buried under personal supervision of the Licence Holder. An accurate and up to date register shall be kept (and updated within two hours of burial) of material containing asbestos waste disposed of at the Premises and will include: the date, the person's name that disposed of the waste, and confirmation that the waste has been covered in accordance with the licence. A plan shall be maintained showing the current position of material containing asbestos waste disposed of at the Premises. No visible dust shall be allowed to cross the Premises. 		
Monitoring	<ul style="list-style-type: none"> None 		
Closure and Rehabilitation	<ul style="list-style-type: none"> None 		

8.9.6 Key findings

Key findings:

(12) The Delegated Officer has reviewed the information regarding asbestos emissions and has found:

1. The release of asbestos fibres from the Premises has the potential to cause impact to residential receptors and recreational receptors to the north and

north west.

2. While licence controls are considered to limit the potential for impact, controls are not consistently applied during operation of the Premises.
3. Additional regulatory controls will be required to ensure that asbestos waste is appropriately managed at the Premises.

8.9.7 Consequence

If disturbance and release of asbestos fibres occurs, the Delegated Officer has determined that the impact of an exposure to receptors would be a high level ongoing medical treatment. Therefore, the Delegated Officer considers the consequence of impact due to exposure to asbestos fibres to be **severe**.

8.9.8 Likelihood of Risk Event

The Delegated Officer has determined that asbestos impacts will probably not occur in most circumstances. Therefore, the Delegated Officer considers the likelihood of asbestos impacts occurring to be **unlikely**.

8.9.9 Overall rating of asbestos emissions

The Delegated Officer has compared the consequence and likelihood ratings described above with the risk rating matrix and determined that the overall rating for the risk of asbestos is **high**.

8.9.10 Regulatory controls for asbestos risk

The Licence Holder will be required to implement the following controls to manage potential impacts from asbestos emission:

- Waste acceptance specifications requiring i) Special Waste Type 1 to be appropriately wrapped or contained on acceptance and ii) preventing waste containing visible asbestos or ACM from being accepted as Inert Waste Type 1.
- Infrastructure control requiring the Special Waste Type 1 burial area to be designated on a site map.
- Operational controls including:
 - Storage of Special Waste Type 1 is not allowed, direct disposal under supervision of the Licence Holder must occur.
 - Interim and final cover of Special Waste Type 1 with a dense, inert and incombustible material.
 - Premises operated in a manner which prevents buried asbestos from being disturbed.
 - Prevention of visible dust crossing the boundary of the Premises.
- Administrative requirements for records to be kept showing compliance with disposal and cover controls and the location of buried waste.
- Specified Action of preparing and submitting an Asbestos Management Plan.

8.10 Risk Assessment – Contained surface water

8.10.1 Description of the emission

Surface water contained on-site results from the collection of runoff (including contaminated stormwater), leachate and discharge of shallow groundwater to the surface. The surface water is contained in non-engineered areas including a deep excavation area and natural wetlands. The contained water has the potential to overtop during rainfall events, and infiltrate to shallow groundwater resulting in contamination of soil, shallow groundwater downgradient of the Premises and connected surface water bodies.

8.10.2 Identification and general characterisation of emission

The contained surface water at the Premises is not currently monitored. The source of water within the contained surface water features is inferred from an assessment of site hydrogeological and hydrological conditions. The two main areas of surface water containment include the deep excavation area (to the east) and a natural wetland (to the west) situated either side of the putrescible landfill (Figure 2). Both features are non-engineered and comprise natural sediment bases and non-bunded sides and edges. The topography of the site is such that the water contained in the deep excavation area is unlikely to overtop and discharge to surface water off-site. Several other non-permanent surface water retention areas exist around the base of the putrescible landfill, mainly to the west of the waste landform.

The surface water containment features are likely to receive both contaminated and uncontaminated runoff from operational areas of the Premises, including the putrescible landfill, transfer station, green waste storage area, scrap metal storage area and vehicle washdown bay. Landfill leachate emissions to ground may also discharge from the base of the landfill to surface water containment features (Section 7.6.2). Inferred groundwater depth and flow paths indicate that there is the potential for periodic discharge of shallow groundwater (which may be impacted by leachate seepage) into surface water containment features.

Leachate and runoff generated from the Premises 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. The quality of sources of surface water and contained surface water is not currently monitored on the Premises.

8.10.3 Description of potential adverse impact from the emission

The surface water containment features are non-engineered, not lined and have no control structures for prevention of overtopping or seepage to ground. There is evidence to suggest that during and following heavy rainfall, features may fill and overtop, discharging surface water to ground. In the western parts of the Premises, there is indication that preferential flow paths drain to the west, where ephemeral drainage lines flow through native vegetation to natural wetlands and to Collie River. Off-site areas to the west of the Premises are accessible to the public.

The lack of liner or base compaction within the ponds may also lead to infiltration of surface water to shallow groundwater. Inferred groundwater flow paths indicate that shallow groundwater discharges to natural wetlands and Collie River to the west of the Premises.

In general, surface water flow paths on-site and off-site are poorly understood and no stormwater management plan or stormwater management operational strategy exists for the Premises. The Delegated Officer considers that surface water contained in the deep excavation area to the east of putrescible landfill is unlikely to overtop and flow off-site, but may infiltrate to ground.

The Delegated Officer considers it unlikely that surface water on-site supports significant aquatic ecosystems, and as such, containment of contaminated surface water on-site is unlikely to result in adverse impact to flora or fauna during operations. It is noted that suitability of on-site surface water to sustain natural ecosystems at closure has not been

determined.

The overtopping of contained surface water and subsequent flow off-site (to the west of the putrescible landfill) has the potential to cause adverse impact to aquatic and riparian ecosystems through degradation of surface water quality. Native fauna (birds and other species) may also be impacted via direct contact with contaminated surface water. Typical contaminants resulting from stormwater contact with putrescible landfills includes nutrients (e.g. nitrogen and phosphorus). The flow of water rich in nutrients has the potential to promote the establishment of non-native weed species resulting in impact to biodiversity and ecosystem function within riparian and native vegetation habitats off-site and post-closure.

Areas beyond the site boundary to the west, including wetlands and Collie River are accessible by the general public, and have the potential to be used for recreation. Contaminated surface water has the potential to impact on public health (via direct or indirect contact – inhalation, ingestion and/or absorption) and is likely to impact on amenity and environmental values.

Infiltration of contaminated surface water from containment features to shallow groundwater has the potential to degrade groundwater and soil quality, resulting in impacts to surface water quality in groundwater discharge areas, and degradation of soil through the accumulation and adsorption of contaminants in the unsaturated zone. Groundwater flow paths are not well defined on-site or beyond the site boundary, and have been inferred to be towards the west and north.

Monitoring of surface water (natural or contained) is not required under the Existing Licence.

8.10.4 Criteria for assessment

Relevant land and water assessment criteria include the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG, 2018), Non-Potable Use Guidelines (Department of Health, 2014), Guidelines for Managing Risk in Recreational Water (NHMRC, 2008), DWER Assessment and Management of Contaminated Sites, and the Assessment of Site Contamination NEPM 1999 (as amended in 2013) for soils and groundwater.

The Delegated Officer considers that storage ponds and other drainage structures should be designed to contain and control rainfall runoff for a 1 in 20 (5%) AEP storm event. Storm events up to 1 in 100 (1%) AEP and 1 in 100 (1%) AEP flood fringe area mapping should also be considered to ensure that infrastructure is adequate and does not result in any catastrophic failures such as flooding of the landfill or failure of water storage dams and stormwater control structures.

8.10.5 Licence Holder controls

This assessment has reviewed the controls set out in Table 22 below.

Table 22: Licence Holder’s proposed controls for containment of surface water

Site infrastructure	Description	Operation details	Reference to Revised Licence plan
Existing infrastructure for diversion and control of contained surface water			
Stormwater infrastructure	Non-engineered excavation and wetland areas to the east and west of the landfill capture and store	<ul style="list-style-type: none"> On-site wetlands receive some stormwater from the western side of the landfill. Deep excavation area receives some stormwater from the eastern side of 	Figure 2

Site infrastructure	Description	Operation details	Reference to Revised Licence plan
	some stormwater. Limited non-engineered drains and diversion bunds to direct stormwater flow.	the landfill.	
Proposed controls for management of contained surface water			
None			
Existing Licence controls for prevention of emissions from contained surface water			
Stormwater management	<ul style="list-style-type: none"> Water that has come into contact with waste is retained on the Premises. 		
Landfill Management	<ul style="list-style-type: none"> Distance of at least 100 m is maintained between operational areas and surface water bodies. 		
Monitoring	<ul style="list-style-type: none"> Biannual monitoring of shallow groundwater (seven monitoring wells). No stormwater monitoring conducted. 		
Closure and Rehabilitation	None		

8.10.6 Key findings

Key findings:

(13) The Delegated Officer has reviewed the information regarding emissions from contained surface water and has found:

1. Surface water contained on-site has the potential to become contaminated to levels that can cause adverse impacts to receptors.
2. The contained surface water on the Premises is not likely to sustain significant ecosystem function (aquatic or terrestrial) during operations; however surface water quality for closure of the Premises needs to be considered.
3. Surface water containment features are not engineered and are not currently maintained or managed in a way to prevent adverse impacts or emissions.
4. There is a high likelihood of overtopping and uncontrolled flow of surface water beyond the boundary of the Premises to the west; however, surface water flow paths are poorly understood.
5. The hydrogeological characteristics of the shallow aquifer are poorly understood, flow pathways beyond the site boundary are poorly understood and the current groundwater monitoring network is considered to be inadequate for the monitoring of potential impacts to groundwater resulting from operations.
6. Current operational controls for control of stormwater (bunding and

containment ponds) appear to be ad-hoc and are not informed by an operational strategy or an operational stormwater management plan.

8.10.7 Consequence

If emissions of surface water from containment features occurs, the Delegated Officer has determined that the impact to off-site receptors will be low at a local scale, with potential for specific criteria for protection of terrestrial and aquatic ecosystems off-site to be exceeded. Therefore, the Delegated Officer considers the consequence of emission of contained surface water to be **moderate**.

8.10.8 Likelihood of Risk Event

The Delegated Officer has determined that the likelihood of moderate impacts resulting from emission of contained surface water off-site could occur at some time. Therefore, the Delegated Officer considers the likelihood to be **possible**.

8.10.9 Overall rating of emission of contained surface water

The Delegated Officer has compared the consequence and likelihood ratings described above with the risk rating matrix and determined that the overall rating for the risk of emission of contained surface water is **medium**.

8.10.10 Regulatory controls for contained surface water risk

The Licence Holder will be required to implement the following controls to manage the potential impacts from contained surface water:

- Limits on waste acceptance for storage and disposal (type and volume).
- Specified Actions of preparing and submitting i) a Groundwater Monitoring Plan, ii) a Hydrogeological Assessment, iii) Operational Stormwater and Leachate Management Plan and iv) Landfill Closure Management Plan.

The Operational Stormwater and Leachate Management Plan must outline a water balance, stormwater management protocols and infrastructure. Stormwater management measures are to be designed for a 1 in 20 (5%) AEP storm event, with additional consideration given to a 1 in 100 (1%) AEP storm event and the 1 in 100 (1%) AEP flood fringe area.

The Landfill Closure Management Plan must outline post-closure stormwater management measures.

Surface water containment features are likely to receive both contaminated and uncontaminated run off from operational areas of the Premises, therefore the regulatory controls outlined for contaminated stormwater in Section 8.5.10 are likely to have an indirect impact on the risks from contained surface water. Surface water containment features may also receive landfill leachate emissions to land (via overland flow) and groundwater (via subsurface discharge into surface water). The controls outlined in Sections 8.6.10 and 8.7.10 will therefore indirectly contribute to mitigating the risks from contained surface water.

The Licence Holder will also be required to monitor groundwater and surface water quality. Overland flow of stormwater across the Premises boundary is not an authorised Discharge in the Revised Licence. The Revised Licence requires the Licence Holder to notify DWER if any stormwater containment area overtops.

8.11 Summary of acceptability and treatment of Risk Events

A summary of the risk assessment and the acceptability or unacceptability of the Risk Events

set out above, with the appropriate treatment and control, are set out in Table 23 below.

A summary of regulatory controls determined to be appropriate for each Risk Event is set out in Table 24. The risks and related controls are set out in the assessment in Section 8. DWER will determine controls having regard to the adequacy of controls proposed by the Licence Holder. The conditions of the Licence will be set to give effect to the determined regulatory controls.

Table 23: Risk assessment summary

	Description of Risk Event			Risk rating	Acceptability with controls (conditions on instrument)
	Emission	Source	Pathway/ Receptor (Impact)		
1.	Contaminated stormwater	Putrescible landfill and other operational areas of the Premises	Overland flow or infiltration to shallow groundwater and migration to on-site stormwater containment ponds or off-site to surface water bodies, terrestrial ecosystems and recreational areas.	Moderate consequence Possible likelihood Medium Risk	Acceptable subject to regulatory controls
2.	Leachate to land	Putrescible landfill	Seepage from edge of landfill with subsequent overland flow to on-site stormwater containment ponds or off-site to surface water bodies.	Moderate consequence Unlikely likelihood Medium Risk	Acceptable subject to regulatory controls
3.	Leachate to groundwater	Putrescible landfill	Seepage from the base of the landfill to shallow groundwater or infiltration of surface leachate to shallow groundwater. Migration off-site to surface water bodies and groundwater.	Major consequence Possible likelihood High Risk	Acceptable subject to regulatory controls
4.	Landfill gas	Putrescible landfill	Vertical or lateral migration to atmosphere or ground. Potential impacts to off-site residential or recreational receptors.	Major consequence Unlikely likelihood Medium Risk	Acceptable subject to regulatory controls

	Description of Risk Event			Risk rating	Acceptability with controls (conditions on instrument)
	Emission	Source	Pathway/ Receptor (Impact)		
5.	Asbestos	Asbestos disposal area	Wind-borne distribution of hazardous materials off-site to residential and recreational receptors.	Severe consequence Unlikely likelihood High Risk	Acceptable subject to regulatory controls
6.	Contaminated surface water	Surface water containment ponds	Overland flow of surface water following overtopping or infiltration from unlined storage areas. Discharge or infiltration to shallow groundwater. Potential impacts to surface water bodies, terrestrial ecosystems and recreational areas.	Moderate consequence Possible likelihood Medium Risk	Acceptable subject to regulatory controls

Table 24: Summary of regulatory controls to be applied

		Licence condition reference														
		1, 2 and 3 Waste acceptance	4 Infrastructure and equipment	5 Storage and process controls	6 Landfill disposal requirements	7 Asbestos disposal requirements	12 Dust generation	14 and 15 Spills	16 Stormwater containment	17 Waste separation from groundwater	18 Tipping area separation from surface water	19 Stormwater overtopping notification	21, 23, 24 and Schedule 2 Groundwater monitoring	22, 23, 24 and Schedule 2 Surface water monitoring	25 and 26 Specified actions	27 Asbestos records
Risk Items (see risk analysis in Section 8)	1. Contaminated stormwater	●	●	●	●			●	●	●	●	●	●	●		
	2. Leachate emission to land	●	●	●	●				●		●	●	●	●	●	
	3. Leachate emission to groundwater	●	●	●	●				●	●		●	●	●	●	
	4. Landfill gas	●	●	●	●						●				●	
	5. Asbestos	●	●	●		●	●								●	●
	6. Contaminated surface water	●	●	●	●			●	●	●	●	●	●	●	●	

9. Determination of Revised Licence conditions

The conditions in the Revised Licence have been determined in accordance with the *Guidance Statement: Setting Conditions*. Table 25 provides a summary of changes made to existing conditions and new conditions to be applied in the Revised Licence.

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

Table 25: Licence conversion table

Existing licence condition	Condition summary	New condition reference	Conversion notes
Existing conditions			
Definitions	Definitions	Table 8	Updated to current terminology and include additional terms and references.
All relevant	licensee	Licence Holder	Updated to current terminology.
G1	Waste acceptance and management	1, 2 and 3	<p>Reformatted into current licence structure and waste acceptance specification added or edited for:</p> <ul style="list-style-type: none"> • Inert Waste Type 1; • Inert Waste Type 2; • Special Waste Type 1; and • Contaminated solid waste. <p>Special Waste Type 2 removed from the waste acceptance table.</p> <p>New separate waste types and acceptance specifications listed to reflect current terminology and updated Premises operations:</p> <ul style="list-style-type: none"> • Uncontaminated Fill; • Scrap metal; • Used agricultural chemical containers (only clean containers permitted in accordance with Drum Muster guidance); and • Hazardous wastes. <p>Additional recordkeeping and storage protocols for waste which does not meet acceptance specification also added.</p>
G2(a) and (c)	Asbestos disposal requirements	7	<p>Additional cover specifications and requirement to prevent buried asbestos waste from being disturbed.</p> <p>Removal of reference to biomedical waste as the Premises does not accept Special Waste Type 2 for landfilling.</p>

Existing licence condition	Condition summary	New condition reference	Conversion notes
G2(b)	Biomedical waste	Condition removed	The Premises does not accept Special Waste Type 2 for landfilling.
G2(d) and G2(e)	Asbestos and biomedical waste	27	Removal of reference to biomedical waste as the Premises does not accept Special Waste Type 2 for landfilling. Minor rewording of conditions relating to asbestos.
G3	Management of waste depot and landfill activities	4, 5 and 6	New controls on landfilling activities including: <ul style="list-style-type: none"> • clear specification of which wastes are authorised to be disposed within the Class II putrescible landfill; • which part of the Premises is authorised to be used for landfilling; and • additional cover and grading requirements.
G4	Fencing and security	11	Requirement for additional security measures to align with current licensing approach. Fencing requirements changed to be more flexible and outcome-based in response to Licence Holder's feedback on draft Revised Licence.
G5(a)	Containment of windblown waste	Condition removed	Removed as Conditions 4 and 13 provide adequate controls for windblown waste.
G5(b)	Collection of waste washed or blown from tipping area	13	Reference change only.
G6	Signage	4	Additional requirement to display hours of operation to align with current licensing approach.

Existing licence condition	Condition summary	New condition reference	Conversion notes
G7(a)	Annual Environment Report	32	<p>Additional reporting requirements to align with current licensing approach including:</p> <ul style="list-style-type: none"> • updated site map; • waste input and output data; • provision of additional information relating to groundwater and surface water monitoring including: methodologies, quality assurance and quality control procedures and results, groundwater contour diagram, interpretive assessment of monitoring results and trend graphs; and • summary of environmental incidents and responses. <p>Removal of certain reporting requirements including:</p> <ul style="list-style-type: none"> • measures taken to suppress dust and control windblown waste.
G7(b)	Annual Audit Compliance Report	31	Updated to current reporting requirements.
G8	Containment of chemical/ hydrocarbon containers	4 and 5	Reworded to specify that waste oil and containers must be stored in the waste oil recycling shed only. This must be weatherproof and suitably constructed, bunded and maintained to prevent leakage.
G9(a)	Tyre storage	5	<p>Additional controls to align with current licensing approach including:</p> <ul style="list-style-type: none"> • reduction of maximum number of stockpiled tyres from 100 to 99 (storage of 100 or more tyres is threshold for Category 57); • requirement to store tyres in stockpiles in the transfer station, including maximum dimensions, minimum separation distances and storage configurations; and • reference to <i>Environmental Protection Regulations 1987</i> for further tyre storage guidance.
G9(b)	Tyre burial	Condition removed	Condition removed based on Licence Holder's feedback on the draft Revised Licence that they do not intend to landfill any tyres. The Licence Holder will need to implement other management controls to ensure the number of tyres stored on-site does not exceed 99.
A1	Visible dust	12	Reworded for clarity.

Existing licence condition	Condition summary	New condition reference	Conversion notes
A2(a) and A2(b)	Burning of Green Waste	4 and 8	<p>Additional requirements to align with current licensing approach. These include:</p> <ul style="list-style-type: none"> • Green Waste to be burnt is free from any non-Green Waste contaminants. • The designated burning area is sited at least 50 m from Premises boundary and separated from live vegetation by at least 30 m of clear ground. <p>The requirements for timing of burning and supervision updated to more accurately reflect the Licence Holder's current practices and impose appropriate controls to ensure fires remain under control or are extinguished.</p> <p>Removal of requirements to:</p> <ul style="list-style-type: none"> • provide an adequate water supply and distribution system - the requirement for an appropriate fire fighting vehicle is considered to be a sufficient control; and • burn Green Waste in a manner that minimises the generation of smoke – this is not an enforceable condition and has been removed to align with the current licensing approach.
A2(c)	Extinguishing unauthorised fires	9	Reference change only.
A2(d)	Reporting on unauthorised fires	10	Rewording and removal of comment regarding reporting to DPAW and LGA to align with current licensing approach.
W1(a)	Direction of stormwater away from tipping area	6	Additional requirement that earthen bunding and surface grading are maintained to direct stormwater away from the tipping area.
W1(b)	Clearing stormwater drains	Condition removed	Removed as Condition 16 provides sufficient stormwater control measures.
W1(c)	Retention of stormwater	4 and 16	Condition wording retained. Additional stormwater controls added to Condition 4 to require that stormwater related to specific infrastructure is captured and retained on the Premises.

Existing licence condition	Condition summary	New condition reference	Conversion notes
W2(a)	Separation distance of waste to groundwater	17	Updated to also apply separation distance to stored waste material, e.g. Green Waste, scrap metal and Hazardous Waste, and clarify that this condition applies from the issue date of the Revised Licence.
W2(b)	Separation distance of filled and tipping areas to surface water bodies	18	<p>Reworded to clarify that the separation distance applies between the tipping area and surface water bodies outside of the Premises boundary only.</p> <p>Applying the separation distance to previously filled areas is not enforceable because this landfilling has already occurred.</p> <p>The Delegated Officer considers it unlikely that surface water on-site supports significant aquatic ecosystems. These water bodies are currently used to store contaminated and uncontaminated stormwater from operational areas. Based on these considerations, applying the separation distance to surface water bodies inside the Premises is not considered a beneficial regulatory control.</p>
W3	Groundwater monitoring bores	4	Reference change only.
W4(a) W4(b) W4(c)	Groundwater monitoring requirements	21 and Schedule 2	<p>Restructuring of groundwater monitoring table including new groundwater monitoring requirements as follows:</p> <ul style="list-style-type: none"> • increased sampling frequency from six-monthly to quarterly for most analytes; • inclusion of additional parameters; • inclusion of organic parameters on a six-monthly frequency; and • inclusion of reference to AS/NZS 5667.11.
W4(d)	NATA accreditation	23	Minor rewording only
New Conditions			

Existing licence condition	Condition summary	New condition reference	Conversion notes
N/A	Infrastructure and equipment	4	Additional requirements for maintenance and operation of site infrastructure and equipment including designation on a site map. New infrastructure controls are focused on maintenance of infrastructure, improving stormwater capture, waste containment and mitigating fire risk.
N/A	Waste storage and processing	5	Provision of storage and process controls for each waste type. Includes new controls for Clean Fill, Uncontaminated Fill, Inert Waste Type 1, Inert Waste Type 2, Putrescible Waste, Contaminated Solid Waste, Green Waste, Special Waste Type 1, Hazardous Wastes (waste oil, vehicle batteries, e-waste, paint, LPG bottles, fire extinguishers and fluorescent lights), used agricultural chemical containers and scrap metal waste.
N/A	Spills management	14 and 15	Requirement to clean up spills outside of an engineered containment system and dispose of environmentally hazardous materials to a suitably licensed premises.
N/A	Notification requirements	19	Requirement to notify the CEO if any stormwater containment areas overtop.
N/A	Waste input/output monitoring	20	Requirement to record waste types and amounts in each load arriving, leaving or rejected from the Premises to align with current licensing approach.
N/A	Surface water monitoring	22 and Schedule 2	New surface water monitoring requirements outlined including: <ul style="list-style-type: none"> • monitoring locations; • sampling frequency; • parameters and units; and • reference to AS/NZS 5667.1, 5667.4 and 5667.6.
N/A	Timing of quarterly and six-monthly monitoring	24	Specification of timing for quarterly and six-monthly monitoring.

N/A	Specified actions	25	<p>Requirement for specified actions to be completed including preparation and submission of the following:</p> <ul style="list-style-type: none"> • Groundwater Monitoring Plan – The scope is to review the current groundwater monitoring network and propose new monitoring bores. The objective is to improve the groundwater monitoring program by addressing uncertainties about the current bore network and investigating data gaps in groundwater flow and quality. • Hydrogeological Assessment – The scope is to provide a hydrogeological conceptual site model focussed on understanding potential impacts from activities of the Premises. This will be informed by a desktop review of currently available hydrogeological information and the findings of intrusive investigations (bore installation). The objective is to investigate data gaps in the current understanding of source-pathway-receptor linkages at the Premises. • Asbestos Management Plan (AMP) – The scope is to prepare an AMP in accordance with the <i>Guideline: Managing asbestos at construction and demolition waste recycling facilities</i> (DWER, 2021). The objective is to develop and document operational procedures, roles and responsibilities which the Licence Holder will implement to manage asbestos risks at the Premises. • Operational Stormwater and Leachate Management Plan – The scope is to assess the required stormwater storage capacity and propose improvements to stormwater and leachate infrastructure at the Premises. The objective is to set out the plan for infrastructure and operational improvements to achieve compliance with Condition 16 during landfill operations. • Landfill Closure Management Plan – The scope addresses various aspects of landfill closure planning such as emissions, geotechnical stability and proposed future land use. The objective is to set out the control measures which will be implemented at the Premises in the short and long-term to ensure ongoing protection of the environment, human health and amenity.
N/A	Specified actions reporting	26	Requirement to report on compliance with specified actions

Existing licence condition	Condition summary	New condition reference	Conversion notes
N/A	Maintaining Books	28 and 29	These requirements are consistent with the current licensing approach for landfills.
N/A	Recording of complaints	30	
Schedules and attachments			
Attachment 1, 2 and 3	Waste types and definitions, contaminated threshold table and leachable concentration table	Attachments removed	This information is available in the Landfill Definitions.
Attachment 4	Maps	Schedule 1	<p>Premises map updated with more recent aerial imagery, to show location of Lot 501 (excluded from Premises boundary) and groundwater monitoring locations removed.</p> <p>Operations and Infrastructure Map added to show the location of infrastructure and equipment.</p> <p>Addition of monitoring locations map which shows the location of groundwater and surface water monitoring locations.</p>
Attachment 5	Annual Audit Compliance Report	Attachment removed	The current approved Annual Audit Compliance Report form is available online at www.dwer.wa.gov.au .
N/A	Monitoring requirements	Schedule 2	<p>Addition of a schedule outlining the groundwater and surface water monitoring program requirements including field quality assurance and quality control procedures in accordance with Assessment of Site Contamination NEPM.</p> <p>Requirement to record specific details relating to groundwater and surface water monitoring.</p>

10. Applicant's comments

The Licence Holder was provided with the draft Decision Report and draft Revised Licence on 3 December 2020. The Licence Holder responded on 22 April and 20 May 2021. The Licence Holder's comments and DWER's responses are summarised in Appendix 2.

11. 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 (summarised in Appendix 1). 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.

DWER understands that the Licence Holder's future plans for the development of the Premises remain uncertain. This Review was based on existing Premises operations and did not undertake a risk assessment for future development of the landfill in accordance with the landfill design presented in the WMP (ASK, 2019). The Delegated Officer considers that these changes would change the risk profile for the Premises and therefore require assessment under a works approval or licence amendment.

Based on the site context and environmental setting of the Premises, DWER considers that future development of the landfill in accordance with the final landfill design in the WMP would require a greater degree of engineering controls compared to the existing unlined landfill. However, based on the Delegated Officer's determination that the existing Premises operations and legacy issues present a medium to high risk to receptors, it is possible that the potential risk from future development of the landfill may not be acceptable, even with consideration of viable engineering controls.

If the Licence Holder decides to close the Class II putrescible landfill within a short-term timeframe and operate the Premises as a Category 62 solid waste depot only, the Premises will still be subject to regulatory requirements under the EP Act and the CS Act. While these regulatory requirements would be different from those specified as a result of this Review, some may still be applicable such as landfill closure and management planning and environmental investigations and monitoring.

Ruth Dowd

**SENIOR MANAGER WASTE INDUSTRIES
REGULATORY SERVICES**

an officer delegated under section 20 of the *Environmental Protection Act 1986*

Appendix 1: Key documents

	Document title	In text ref	Availability
1.	Existing Licence L6831/1997/12 – Gibbs Road Putrescible Landfill Site issued 21 May 2015	Existing Licence	accessed at www.der.wa.gov.au
2.	DEC, 2009. <i>DEC13419 Note to File: Collie landfill – sampling results</i> . Department of Environment and Conservation, South-west Region.	DEC, 2009	DWER records (A1114854)
3.	DoW, 2007. <i>Managing water in the Upper Collie</i> . Department of Water, Perth.	DoW, 2007	accessed at www.dwer.wa.gov.au
4.	DoW, 2009. <i>Analysis of water flowing from an abandoned mine shaft in Collie, Western Australia – draft report</i> . Department of Water, South-west Region.	DoW, 2009	
5.	DER, December 2014. <i>Assessment and management of contaminated sites</i> .	DER, 2014	
6.	DER, July 2015. <i>Guidance Statement: Regulatory principles</i> . Department of Environment Regulation, Perth.	DER, 2015a	
7.	DER, October 2015. <i>Guidance Statement: Setting conditions</i> . Department of Environment Regulation, Perth.	DER, 2015b	
8.	DER, November 2016. <i>Guidance Statement: Environmental Siting</i> . Department of Environment Regulation, Perth.	DER, 2016	
9.	DER, February 2017. <i>Guidance Statement: Risk Assessments</i> . Department of Environment Regulation, Perth.	DER, 2017a	

	Document title	In text ref	Availability
10.	DWER, June 2019. <i>Guideline: Decision Making</i> . Department of Water and Environmental Regulation, Perth.	DWER, 2019a	
11.	DWER, June 2019. <i>Guideline: Industry Regulation Guide to Licensing</i> . Department of Water and Environmental Regulation, Perth.	DWER, 2019b	
12.	DWER, December 2019. <i>Landfill Waste Classification and Waste Definitions 1996 (as amended 2019)</i>	DWER, 2019c	
13.	DWER, 2021. <i>Guideline: Managing asbestos at construction and demolition waste recycling facilities</i> . Department of Water and Environmental Regulation, Perth.	DWER, 2021	
14.	360 Environmental, 2016. <i>Groundwater Monitoring Programme Review, Gibbs Road Landfill Site, Collie</i> . Report prepared for Shire of Collie. Ref. 1003 EA. 22 August 2016	360 Environmental, 2016	DWER records (A1514784)
15.	360 Environmental, 2017. March 2017 <i>Biannual Groundwater Monitoring Event, Gibbs Road Landfill Site</i> . Report prepared for Shire of Collie. Ref. 1003 GA. 5 April 2017	360 Environmental, 2017	DWER records (A1514774)
16.	360 Environmental, 2021. <i>2020 Groundwater Monitoring Report</i> . Report prepared for Shire of Collie. Ref 4007AA 7 April 2021.	360 Environmental, 2021	DWER records (A1994905)
17.	ANZECC and ARMCANZ, 2000. <i>Australian and New Zealand Guidelines for Fresh and marine Water Quality</i> .	ANZECC and ARMCANZ, 2000	accessed at http://www.waterquality.gov.au
18.	ANZG, 2018. <i>Australian and New Zealand Guidelines for Fresh and Marine Water Quality</i> .	ANZG 2018	accessed at https://www.waterquality.gov.au/anz-guidelines

	Document title	In text ref	Availability
19.	ASK Waste Management, 2019. <i>Waste Management Plan, Gibbs Road Waste Management Facility.</i>	ASK, 2019	DWER records (A1865708)
20.	Bureau of Meteorology (BOM), 2019. <i>Climate Data Online.</i> Accessed 21 May 2019. www.bom.gov.au	BOM, 2019	accessed at www.bom.gov.au
21.	Cardno, 2018. <i>Groundwater monitoring – Gibbs Road landfill.</i> Report prepared for Shire of Collie. Ref CW1032100. 4 December 2018.	Cardno, 2018	DWER records (A1775876)
22.	CSIRO, 2014. <i>Australian Soil Resource Information System.</i>	CSIRO, 2014	accessed at www.asris.csiro.au/
23.	DoH, 2009. <i>Guidelines for the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia.</i> Department of Health, Perth.	DoH, 2009	accessed at www.health.wa.gov.au
24.	DoH, 2010. <i>Health Risk Assessment (Scoping) Guidelines.</i> Department of Health, Perth.	DoH, 2010	
25.	DoH, 2014. <i>Contaminated Sites Ground and Surface Water Chemical Screening Guidelines.</i> Department of Health, Perth.	DoH, 2014	
26.	Environmental Site Services, 2019. <i>Shire of Collie – Gibbs Road Landfill Groundwater Monitoring Annual Report.</i>	ESS, 2019	DWER records (DWERDT290118)
27.	Goldsmith, CRD., Brice, SJ. and Evans, AW. (1995). <i>An Investigation of the Controls on Shallow Subsidence in the Collie Basin.</i> Minerals and energy Research Institute of Western Australia.	Goldsmith, Brice and Evans, 1995	
28.	IW Projects, 2009. <i>Temporary Leachate Collection System.</i> DWG 020 Rev 0. Drawing prepared for Shire of Collie. 24 December 2009	IWP, 2009	DWER records (A1113832)

	Document title	In text ref	Availability
29.	IW Projects, 2012. <i>Leachate Prevention and Management Plan</i> . Rev 2. Report prepared for Shire of Collie. August 2012.	IWP, 2012	DWER records (A1338922)
30.	Le Blanc Smith, G. (1993). <i>Geology and Permian Coal Resources of the Collie Basin, Western Australia</i> . Western Australia Geological Survey, Report 38.	Le Blanc Smith, 1993	accessed at http://www.dmp.wa.gov.au/
31.	NEPC, 2013. <i>National Environmental Protection (Assessment of Site Contamination) Measure</i> .	NEPM 2013	accessed at http://www.nepc.gov.au
32.	NHMRC, 2008. <i>Guidelines for managing risks in recreational water</i> .	NHMRC, 2008	accessed at www.nhmrc.gov.au
33.	Stass Environmental, 2010. <i>Monitoring bore installation at Collie Landfill</i> .	Stass 2010	
34.	Stass Environmental, 2011. <i>Ground Water Hydraulics Assessment Gibbs Road Landfill Site, Collie, WA</i> .	Stass, 2011	DWER records (A1338924)
35.	Varma, S. (2002). <i>Hydrogeology and Groundwater Resources of the Collie Basin, Western Australia</i> . Water and Rivers Commission Resource Science Division.	Varma, 2002	
36.	Zhang, Q., Varma, S., Bradley, J., and Schaeffer, J. (2007). <i>Groundwater Model of the Collie Basin, Western Australia</i> . Department of Water. Hydrogeological Record Series. Report No. HG. 15. January 2007.	Zhang et. al., 2007	accessed at www.dwer.wa.gov.au

Appendix 2: Summary of applicant’s comments on risk assessment and draft conditions

Condition	Summary of Licence Holder comment	DWER response
Correspondence from the Licence Holder dated 22 April 2021		
N/A	<p>The Shire of Collie have reviewed the proposed licence amendments, along with meeting with your staff via Microsoft Teams to discuss various issues in further detail. As part of these discussions, we have notified your staff of a proposal by Renergi Pty Ltd to process most of the municipal waste received at the Gibbs Road Putrescible Landfill Site into bio-char and bio-oil product(s) that will be then offered to various markets. This pilot project has received significant funding from both State and Federal Governments. If successful, this approach to waste diversion could revolutionise the waste industry in Australia and possibly other parts of the world. The project has a 2-year timeframe from initiation to commissioning and is expected to be in operation by January 2023. In light of this proposal, I believe that the proposed license amendments should be postponed until the outcome of this project is better understood. If the license amendment is issued in its current format then I believe that most of the plans required as part of the update would be essentially outdated within 2 years.</p>	<p>The Delegated Officer acknowledges that the proposed addition of the Renergi plant will affect how the Premises functions and operates. However, the scope of the licence review was limited to assessing the existing activities at the Premises, in particular the aspects relating to the EPN issued to the Premises in 2009.</p> <p>The risk assessment outlined in Section 8 of this Decision Report indicates that the existing activities considered within the scope of the Review present a medium to high risk. The Delegated Officer determined that these risks would only be acceptable subject to regulatory controls on the licence. As these risks relate to the current Premises operations, they exist regardless of whether the Renergi plant is built or not.</p> <p>The Delegated Officer determined not to postpone the licence amendment. The timelines allowed for the specified actions in Condition 25 of the Revised Licence are still reasonable when the proposed timeline for the Renergi plant project is taken into account.</p> <p>Changes to the premises proposed as part of the Renergi plant project will require a separate assessment and approval process under Part V of the EP Act.</p>

Condition	Summary of Licence Holder comment	DWER response
N/A	In the meantime, I would encourage continued dialogue between the Shire of Collie and DWER to address any specific risks associated with current landfill operations, including the matters raised in your most recent inspection (Feb 2020) until a new license is issued. It is my understanding that most issues raised in the report have been addressed and reported to your staff via email on 30 March 2021 and 8 April 2021. The only outstanding matter is the removal of Western Power poles which are scheduled for removal to an appropriate landfill site in the next 4 weeks by Western Power.	The Delegated Officer acknowledges the steps taken by the Licence Holder to address compliance matters raised following a compliance inspection at the Premises on 10 February 2020. However, the scope of the Review covers a broader range of matters than were raised as part of the compliance inspection.
25	Since the Renergi plant will not process Asbestos, I can confirm that the Shire of Collie is preparing a draft Asbestos Management Plan in accordance with the DWER Asbestos Guidelines, which we will forward to your staff for comment within the next 4 weeks.	The Revised Licence specifies a due date for the Asbestos Management Plan which is about 6 months from the date of the licence amendment.
Correspondence from the Licence Holder dated 21 May 2021		
N/A	The Shire of Collie has reviewed the proposed licence amendment's and recognises the changes are required to address the risks identified in your Decision Report, however we maintain our position that the proposed Renergi plant will have a significant impact on the premises function with a significant reduction in the amount of waste disposed to landfill.	The Delegated Officer determined to proceed with issuing the Revised Licence for the reasons outlined in the responses to the Licence Holder's initial comments, as above. Changes to the Premises proposed as part of the Renergi plant project will require a separate assessment and approval process under Part V of the EP Act.

Condition	Summary of Licence Holder comment	DWER response
N/A	Items that were of concern during the initial site visit have been discussed and reported to your office over the past twelve months with no further issues raised to date.	DWER sent a letter to the Licence Holder outlining the outcome of the February 2020 compliance inspection on 17 April 2020. The Delegated Officer acknowledges that the Licence Holder has since undertaken some actions to address the matters raised in this letter and has reported on these actions to DWER. These matters are separate to the Review process but have been considered in the outcome of this assessment where relevant.
1 and 5 – Waste acceptance and processing	Special Waste Type 2 Biomedical – Please remove from licence as we do not accept any medical including sharps.	Edits implemented on the basis that the Licence Holder does not intend to accept Special Waste Type 2.
4 – Infrastructure and equipment	Drum muster area – The current area is currently fenced, however there is not a stormwater capture system in place. This requirement is seen as excessive as the drums have been inspected.	The Delegated Officer determined that it is not necessary to require the Drum Muster compound to comprise a hardstand surface that is maintained to prevent leakage and capture stormwater and retain it on the Premises. This decision was made on the basis that Condition 1 in the Revised Licence requires the used agricultural chemical containers accepted at the Premises to be empty and triple rinsed to remove residues. The wastes stored in the Drum Muster compound should therefore be at a relatively low risk of generating contaminated stormwater runoff.
4 – Infrastructure and equipment	Vehicles permanent – remove water cart and replace with truck.	Edits implemented. The truck is required to be maintained in good working order, consistent with other vehicles kept permanently on the premises.
4 – Infrastructure and equipment	Vehicles temporary – add water cart	Edits implemented.

Condition	Summary of Licence Holder comment	DWER response
<p>4 – Infrastructure and equipment</p> <p>Figure 2 – premises layout and infrastructure</p>	<p>Updated map of groundwater monitoring locations provided.</p>	<p>The Monitoring Locations Map (Figure 3 in the Revised Licence) was updated to show the groundwater monitoring locations as depicted in the map provided by the Licence Holder.</p>
<p>5 – Waste processing</p>	<p>Uncontaminated Fill and Inert Waste Type 2 – updated map shows updated area</p>	<p>The draft Revised Licence specified that tyres (Inert Waste Type 2) are stored on hardstand within the transfer station. The map provided by the Licence Holder shows the part of the transfer station where tyres are stored, however the Delegated Officer considers that this specific location is not required to be defined in the Revised Licence.</p> <p>The draft Revised Licence does not specify any limitations on where uncontaminated fill is stored or reused on the premises.</p>
<p>5 – Waste processing</p>	<p>Table 3, Inert Waste Type 2, part (b) – Remove from licence as Shire of Collie does not support the burying of tyres under any circumstances. Shire of Collie supports tyre stewardships and promotes recycling of tyres.</p>	<p>Part (b) of this condition which allowed for excess tyres to be buried by landfilling was removed in accordance with the Licence Holder's request. The Licence Holder will need to implement other management controls to ensure the number of tyres stored on-site does not exceed 99.</p> <p>'Disposal by landfilling' was also removed from the processes permitted for Inert Waste Type 2. This waste type is permitted to be received, handled and stored prior to removal from the Premises only.</p> <p>Condition 1 was also edited to reflect that Inert Waste Type 2 is not permitted to be accepted at the Premises under prescribed premises Category 64.</p>

Condition	Summary of Licence Holder comment	DWER response
<p>4 – Infrastructure and equipment</p> <p>11 - Security</p>	<p>Comment – Active areas are fenced where this is a risk to the public, entire fencing of the facility is not feasible or warranted.</p>	<p>The Delegated Officer understands that the Licence Holder has had difficulty maintaining fencing around the Premises boundary in the past due to vandalism. Condition 11 part (b) was edited to require maintenance of suitable fencing or an alternative barrier to prevent unauthorised access to areas used for the storage, processing and disposal of waste as far as is practicable. The perimeter fencing requirements in Condition 4, Table 2 were removed.</p> <p>These edits provide increased flexibility for the Licence Holder to determine the type of structure used to prevent public access and identify the key areas which the public should be prevented from accessing. The Delegated Officer considers it reasonable that these controls are implemented as far as is practicable.</p>
<p>21 – Groundwater monitoring</p>	<p>Moving from 6 monthly to quarterly testing is not warranted at this stage. We would prefer to keep testing at 6 months and ONLY carry out additional tests if results indicate any unusual readings.</p>	<p>The Delegated Officer considers that quarterly groundwater sampling is required to improve the understanding of groundwater quality and flow in the vicinity of the premises and identify potential seasonal trends. The risk assessment in Section 8.7 of this Decision Report determined that leachate emissions to groundwater pose a high risk to receptors, including the Collie River and off-site wetlands. The Delegated Officer considers that a quarterly groundwater sampling frequency is a proportionate regulatory control to address and further investigate this risk.</p>

Condition	Summary of Licence Holder comment	DWER response
25 – Specified actions	<p>Amendments to the timeframe to develop plans as follows:</p> <ul style="list-style-type: none"> • Groundwater Monitoring Plan – change from 6 to 12 months • Hydrogeological Assessment – retain as 12 months • Asbestos Management Plan – retain as 6 months • Stormwater and Leachate Plan – retain as 24 months • Closure Plan – change from 24 months to 36 months 	<p>The Delegated Officer considers that the proposed timeframe change for the Groundwater Monitoring Plan is acceptable. A consistent timeframe with the Hydrogeological Assessment will allow these documents to be prepared in parallel and the findings of each to feed into one another. This edit was implemented in the Revised Licence.</p> <p>The Licence Holder did not provide any justification for requiring an additional year to complete the Landfill Closure Management Plan. The Delegated Officer considers that a 24 month timeframe to complete this plan is reasonable and determined not to allow an extension within the Revised Licence.</p> <p>The timeframes for Specified Actions in the Revised Licence were edited to specify a calendar date rather than referring to the number of months since the date of the licence amendment.</p>
Figure 2 – Operations and Infrastructure Map	<p>The Licence Holder provided an updated map showing the operations and infrastructure layout, including an updated Special Waste Type 1 burial area.</p>	<p>Figure 2 in the Revised Licence was updated to better reflect the Licence Holder's current operational areas. The following changes were made:</p> <ul style="list-style-type: none"> • Slight expansion of the green waste storage area to the west of the area shown in the draft Revised Licence. • Expansion of the Special Waste Type 1 disposal area to the east and south of the area shown in the draft Revised Licence. • The waste oil recycling shed was moved from the centre of the transfer station to the western side of the transfer station. • The newly constructed reuse shop was added. <p>The Delegated Officer considers that the above changes do not</p>

Condition	Summary of Licence Holder comment	DWER response
		<p>affect the outcome of the risk assessment in Section 8.</p> <p>The Licence Holder's map showed areas labelled as 'Concrete Waste' and 'Animal Waste' which were both outside the approved active Class II putrescible landfill cell in the draft Revised Licence. The Licence Holder did not provide any clarification about how these areas are used, and whether they are used for waste storage or landfilling. The Review therefore did not consider the activities undertaken in these areas.</p> <p>The Licence Holder's map also showed the area labelled as 'Land Fill General Waste' to be larger than the approved active Class II putrescible landfill cell defined in the draft Revised Licence.</p> <p>The areas labelled as 'Concrete Waste', 'Animal Waste' and 'Land Fill General Waste' in the Licence Holder's map are not authorised to be used for landfilling of waste. The area defined as the active Class II putrescible landfill cell in the Operations and Infrastructure Map (Figure 2) of the Revised Licence is the only area within the Premises boundary which is authorised to be used for landfilling of Inert Waste Type 1, Putrescible Waste or Contaminated Solid Waste (excluding Special Waste Type 1).</p> <p>If the Licence Holder would like to seek approval to expand the landfilling areas on the Premises or handle wastes in a manner which is not authorised under the Revised Licence, they will need to apply to amend their licence to provide DWER with an opportunity to assess and regulate these activities. Condition 32, Table 7 was edited to remove the requirement to report on changes to the Special Waste Type 1 burial area or active Class II putrescible landfill area within the AER as any such changes would require formal assessment by DWER.</p>

Appendix 3: Environmental Protection Notice

Environmental Protection Act 1986

Section 65

ENVIRONMENTAL PROTECTION NOTICE

PERSON TO WHOM THIS NOTICE IS GIVEN:

(Being the occupier of the Premises described below)

Shire of Collie
87 Throssell Street
COLLIE in the State of Western Australia

PREMISES TO WHICH THIS NOTICE RELATES:

Collie Landfill and Waste Depot, Gibbs Road, COLLIE and being more particularly described as:

The whole of Crown Reserve 36457, vested to the Shire of Collie for the purpose of "Use and requirements of the Shire of Collie"

("the Premises")

REASON FOR WHICH THIS NOTICE IS SERVED:

This Notice is issued because I suspect on reasonable grounds that there is, and is likely to be, an emission from the Premises in the form of a discharge of leachate and the leachate:

- (a) has caused and is likely to cause pollution, namely a direct alteration of the environment at Collie to its detriment or degradation by the contamination of:
 - (i) the atmosphere with odorous gas and vapours;
 - (ii) soil on the Premises;
 - (iii) surface water on, and adjacent to, the Premises; and
- (b) is likely to cause pollution, namely a direct alteration of the environment at Collie:
 - (i) to its detriment or degradation by the contamination of groundwater underlying the Premises and adjacent to the Premises;
 - (ii) to its detriment or degradation by the contamination of the Collie River; and

- (iii) to the detriment of an environmental value, being the beneficial use of the Premises, land adjacent to the Premises, and the Collie River.

("the Pollution").

REQUIREMENTS OF THIS NOTICE:

The occupier of the Premises who is bound by this Notice is required to do the following:

- 1 Take the following measures which I consider necessary to control and abate the discharge of leachate and the Pollution:
 - 1.1 Prepare a Leachate Collection Plan for the construction of a leachate collection system which will contain the spread of the leachate both beyond and within the boundary of the Premises.
 - 1.1.1 The Leachate Collection Plan is to contain engineering design specifications for the leachate collection system and a proposed timeframe for its construction.
 - 1.1.2 The leachate collection system is to comprise of a diversion drain and collection sumps which meet the following requirements:
 - (a) the diversion drain and collection sumps shall be constructed in accordance with the document entitled "Water Quality Protection Note 27 – Liners for containing pollutants, using engineered soils (Department of Water, February 2006); and
 - (b) the collection sumps shall be designed with a capacity to allow for
 - (i) a one in 20 year storm event;
 - (ii) a minimum of 10 days retention, including a one in 20 year storm event; and
 - (iii) a minimum of 300mm freeboard at all times.
 - 1.2 Submit the Leachate Collection Plan required by clause 1.1 to the Regional Manager, South West Region of the Department of Environment and Conservation ("the Regional Manager") for approval within seven days of the date of service of this Notice.
 - 1.3 Implement the Leachate Collection Plan after it has been approved by the Regional Manager in accordance with the timeframe set out in the Plan and approved by the Regional Manager.
 - 1.4 Once the leachate collection system required by clause 1.1 has been constructed, remove and dispose of collected leachate on a weekly basis in accordance with the Environmental Protection (Controlled Waste) Regulations 2004.

- 1.5 Within one month after the date of service of this Notice, remove and dispose of any soil or other solid material on or adjacent to the Premises that has been contaminated by the leachate in accordance with the Environmental Protection (Controlled Waste) Regulations 2004.
- 2 Conduct an investigation into the cause, nature and extent of the leachate and its consequences, which is to include:
 - 2.1 weekly monitoring of surface water for the following parameters at the locations designated as MP1, MP2, MP3, MP4, MP5 and MP6 in Attachment 1:
 - (a) heavy metals;
 - (b) BTEX;
 - (c) hydrocarbons;
 - (d) pH;
 - (e) total phosphorus;
 - (f) total nitrogen;
 - (g) sodium to chloride ratio; and
 - (h) estimation of flow (volume and speed) at each sampling point.
 - 2.2 investigation into the appropriate location, and installation, of groundwater monitoring bores in accordance with the Department of Water "Water Quality Protection Note WQPN 30, Groundwater monitoring bores", February 2006 for the purposes of assessing the impacts of the leachate on groundwater.
 - 2.3 investigation into whether or not the source or cause of the discharged leachate may reasonably be removed or eliminated and, if so, the methods that could be used to do so;
 - 2.4 investigation into whether any systems, measures, or apparatus could be employed on or at the Premises in addition to and/or instead of the leachate collection system required by clause 1.1 to manage discharges of leachate;
 - 2.5 investigation into modifications that could be made to the capping or covering procedures for finished landfill cells used at the Premises to reduce the discharge of leachate; and
 - 2.6 investigation into procedures that could be applied at the Premises to test solid wastes for liquids before they are accepted for burial on the Premises.

- 3 Prepare a Leachate Prevention and Management Plan which is to report on the investigation required under clause 2 and set out recommendations regarding:
 - 3.1 actions to be taken for the removal or elimination of the source or cause of the leachate;
 - 3.2 actions to be taken for the future prevention and management of any leachate being discharged from the Premises;
 - 3.3 whether, in light of the results of the monitoring required by clause 2.1, actions should be taken to contain, treat or decontaminate surface water on and adjacent to the Premises;
 - 3.4 the installation of groundwater monitoring bores, the conduct of a groundwater monitoring program and the reporting of results from the program to the Regional Manager; and
 - 3.5 proposed timeframes for the actions referred to in clauses 3.1 to 3.4.
- 4 Submit the Leachate Prevention and Management Plan required by clause 3 to the Regional Manager for approval within two months of the date of service of this Notice.
- 5 Implement the recommendations set out in the Leachate Prevention and Management Plan after it has been approved by the Regional Manager in accordance with the timeframes set out in the Plan and approved by the Regional Manager.
- 6 Submit a written report outlining the progress made in implementing the requirements of this Notice to the Regional Manager by 4pm of the last Friday of every week after the date of service of the Notice, until all the requirements of this Notice have been fulfilled.



R Atkins
DEPUTY DIRECTOR GENERAL ENVIRONMENT
DEPARTMENT OF ENVIRONMENT AND CONSERVATION
As delegate of the CEO

30 October 2009

IMPORTANT NOTE: A PERSON WHO IS BOUND BY THIS NOTICE AND WHO DOES NOT COMPLY WITH THIS NOTICE COMMITS AN OFFENCE.

lodge with the Minister for Environment an appeal in writing setting out the grounds of that appeal.

Any other person who disagrees with a requirement contained in this Notice may within 21 days of the making of that requirement lodge with the Minister for the Environment an appeal in writing setting out the grounds of that appeal.

PENDING THE DETERMINATION OF AN APPEAL REFERRED TO ABOVE THE RELEVANT REQUIREMENTS CONTAINED IN THIS NOTICE CONTINUE TO HAVE EFFECT.

ATTACHMENT 1 – SAMPLING POINTS



LEGEND

- Topographic Contours, Statewide
- EP_instruments_091208*
- W4572*
- Towns
- A
- B
- C
- Coille 50cm Orthomosaic - Landgate 2006

* Project Data is denoted by asterisk.
This data has not been quality assured.
Please contact map author for details.



Scale 1:4983
(Approximate when reproduced at A4)
Geocentric Datum Australia 1994
Note: the data in this map have not been projected. This may result in geometric distortion or measurement inaccuracies.
Prepared by: cartelliar
Prepared for:
Date: 25/10/2009 3:25:02 PM

Information derived from this map should be considered with the same care as the data by the agency acronym in the legend.

