Application for Works Approval

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

Works Approval Number	W6814/2023/1
Applicant	City of Armadale
File number	DER2023/000358
Premises	City of Armadale Landfill and Recycling Facility 145 – 147 Hopkinson Road HILBERT WA 6112 Legal description – Lot 600 on Deposited Plan 400460 Certificate of Title Volume 2828 Folio 800 As defined by the coordinates in Schedule 2 of the works approval and the premises maps attached to the issued works approval
Date of report	18 August 2023
Decision	Works approval granted

Jarrod Abrahams

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

Table of Contents

Tables and figures

1. Decision summary

This decision report documents the assessment of potential risks to the environment and public health from emissions and discharges during the construction and operation of the premises. As a result of this assessment, Works Approval W6814/2023/1 has been granted.

2. Scope of assessment

2.1 Regulatory framework

In completing the assessment documented in this decision report, the Department of Water and Environmental Regulation (the department; DWER) has considered and given due regard to its regulatory framework and relevant policy documents which are available at https://dwer.wa.gov.au/regulatory-documents.

In the absence of published guidance in Western Australia, the department has also given due regard to the EPA Victoria document titled *788.3: Siting, design, operation and rehabilitation of landfills* (EPAV 2015). This guideline has previously been used by the department as the benchmark for landfill development and closure.

2.2 Application summary and overview of premises

On 29 May 2023, the applicant submitted an application for a works approval to the department under section 54 of the *Environmental Protection Act 1986* (EP Act).

The application is to undertake construction works relating to the final capping and closure of the Class II putrescible landfill at the premises. The premises is approximately 4.4 km northwest of Byford.

The applicant submitted an additional request on 5 July 2023 to include temporary relocation of the current landfill gas flare in the scope of the application.

The premises relates to the category and assessed design capacity under Schedule 1 of the Environmental Protection Regulations 1987 (EP Regulations) which are defined in Licence L6964/1997/11, however the scope of this works approval application relates only to Category 64. The infrastructure and equipment relating to the premises category and any associated activities which the department has considered in line with the *Guideline: Risk Assessments* (DWER 2020) are outlined in Works Approval W6814/2023/1.

2.3 Proposed works

The scope of the proposed works includes:

- installation of landfill capping;
- construction of two leachate ponds;
- construction of a new vehicle wash facility and decommissioning of the existing washdown;
- temporary relocation of the landfill gas flare and associated infrastructure;
- permanent relocation of the landfill gas flare and associated infrastructure; and
- a new internal access road.

The landfill capping component of the application covers the complete closure of the landfill over multiple stages. Stage 1 covers capping of already completed areas and other stages are for capping of areas to be completed in the near future. The landfill is expected to stop accepting waste and reach final waste profile heights by 31 December 2024.

The new leachate ponds are both for ongoing landfill operations up to the end of 2024 and for post-closure leachate collection from the capped waste mass.

Temporary relocation of the landfill gas flare is proposed, so that the flare is located away from areas of the premises where construction works will be undertaken. This will allow both leachate ponds to be constructed simultaneously.

The proposed new leachate ponds, new vehicle wash facility and relocated landfill gas flare will require a time-limited operations period through Works Approval W6814/2023/1.

Landfill operations occur on the eastern portion of the landfill site, well away from the area of proposed capping works. However, the leachate ponds, vehicle wash facility and gas flare are in an area currently occupied by site operations for laydown, stockpiling and workshop infrastructure. The applicant has stated that all the necessary infrastructure will be removed from the construction areas prior to the commencement of works. The landfill waste placement activities will also be unaffected by these proposed construction works.

2.3.1 Landfill capping

Table 1 below shows the proposed stages of capping and closure at the premises. The capping stages and final design profiles of the landfill are shown in Figure 1. The applicant proposes to install a synthetically lined capping system over the landfill.

The applicant intends to rapidly fill the remaining airspace at the premises, targeting a completion of landfilling by the end of 2024 or early 2025. Waste receival is planned to cease at the end of December 2024 in order to prepare for closure of the landfill.

Table 1: Capping and closure activity timing

Closure activity	Timeframe
Capping Stage 1	Proposed to occur as soon as possible following the grant of the works approval.
Capping Stage 2 (southern)	These areas will either be progressively capped as they are completed or capped as a single construction activity once the landfill operations have ceased. The staging and timing of the landfill capping will be dependent on the rate at which the landfill fills and the availability of construction materials. These areas are expected to be filled by early 2025.
Capping Stage 3 (central)	
Capping Stage 4 (northern)	
Post closure monitoring and maintenance	2025 - 2055
End of landfill post-closure period	30 years after closure

Capping design

The proposed capping design is intended to provide a cap that is less permeable than the underlying in-situ clay base of the landfill. This will prevent gradual accumulation of leachate from rainfall ingress within the landfill. The landfill cap will contain the following layers in ascending order (Figure 2):

- A minimum 500 mm thick recycled glass and soil final cover layer above the waste mass;
- A gas collection trench located below the synthetic lining layer and at least 300 mm deep into the final cover that contains extraction pipework and is backfilled with highly permeable recycled glass or coarse sand (Figure 4);
- A low permeability linear low-density polyethylene (LLDPE) synthetic liner;

- A geocomposite drainage net with top and bottom geotextile, to provide drainage of infiltrating stormwater above soil field moisture capacity from the upper capping layers;
- A minimum 1.5 m thick layer of uncompacted growing medium to protect the synthetic liner and scarified at the surface provide suitable habitat for vegetation; and
- Surface vegetation comprised of sub-tropical cereal rye, native grass seeds and shallow rooted shrubs to provide erosion control and stabilisation of the soil capping layers.

The area covered by the capping will extend past the perimeter of the landfill waste mass so that rainfall and stormwater on top of the capping is conveyed beyond the waste footprint (Figure 3).

Pipework for landfill gas and leachate management infrastructure that penetrates through the LLDPE liner will be boot sealed (Figure 2, Figure 3 and Figure 4).

Capping installation

The applicant has not proposed any reshaping of the landfill waste mass as part of the proposed capping works. The existing soil cover layer over the waste mass will only be trimmed to required levels.

The works required to install the proposed landfill capping will consist of the following general sequence of events:

- Accumulation of suitable soil materials on the premises;
- Ordering and construction quality assurance (CQA) testing of synthetic liner materials;
- Clearing and grubbing of the works area where required;
- Surface trimming to achieve a uniform surface and remove excess soil cover for reuse on top of the synthetic liner;
- Installation of compacted fill where necessary to ensure a minimum soil cover over the waste surface;
- Surface preparation prior to liner installation;
- CQA approval of the liner material;
- Installation of the LLDPE liner material;
- Installation of the geocomposite drainage layer;
- Installation of the growing medium;
- Ripping of the final surface;
- CQA inspection during liner, sand drainage layer and growing medium installation;
- Submission of the CQA Validation Report and Compliance Report to DWER; and
- Surface vegetation establishment when the weather is suitable for rapid plant establishment (autumn/winter and early spring).

Waste profile and stability

The top of waste profile for the Stage 1 capping area is flat at a typical grade of 1 (V) in 50 (H). Stages 2, 3 and 4 have been designed at 1 (V) in 20 (H).

The applicant has not undertaken a site-specific stability assessment of the final capped landfill. This is due to a similar capping design being used by the applicant's consultant in the capping of other landfill projects (Henderson landfill Cell 6 capping and Dardanup landfill Cell 5 capping). These projects were determined through stability analysis as being stable and had final waste slopes of up to 1 (V) in 3.5 (H) and 1 (V) in 3 (H). The applicant's consultant concludes that the significantly flatter slopes at the premises are intrinsically more stable, and as the same capping design has demonstrated stability under more severe conditions, the final capped landfill would be stable and not require a site-specific analysis.

Both of the previous assessments considered worst-case slope scenarios and found that the design achieved all adopted factors of safety considered acceptable for non-hazardous waste. Key recommendations in both assessments were to extend the geocomposite drainage layer at least 5 m beyond the crest and 1 m beyond the toe of the slopes. This has been incorporated into the proposed design at the premises.

Site after use

Following closure of the landfill the premises will remain in operation as a waste transfer station and tip shop. The waste transfer station is already operational, as it is in the eastern portion of the premises which comprises a landfill area that was previously capped and closed in the late 1990's. This use is likely to continue after the 30-year post-closure period for the landfill.

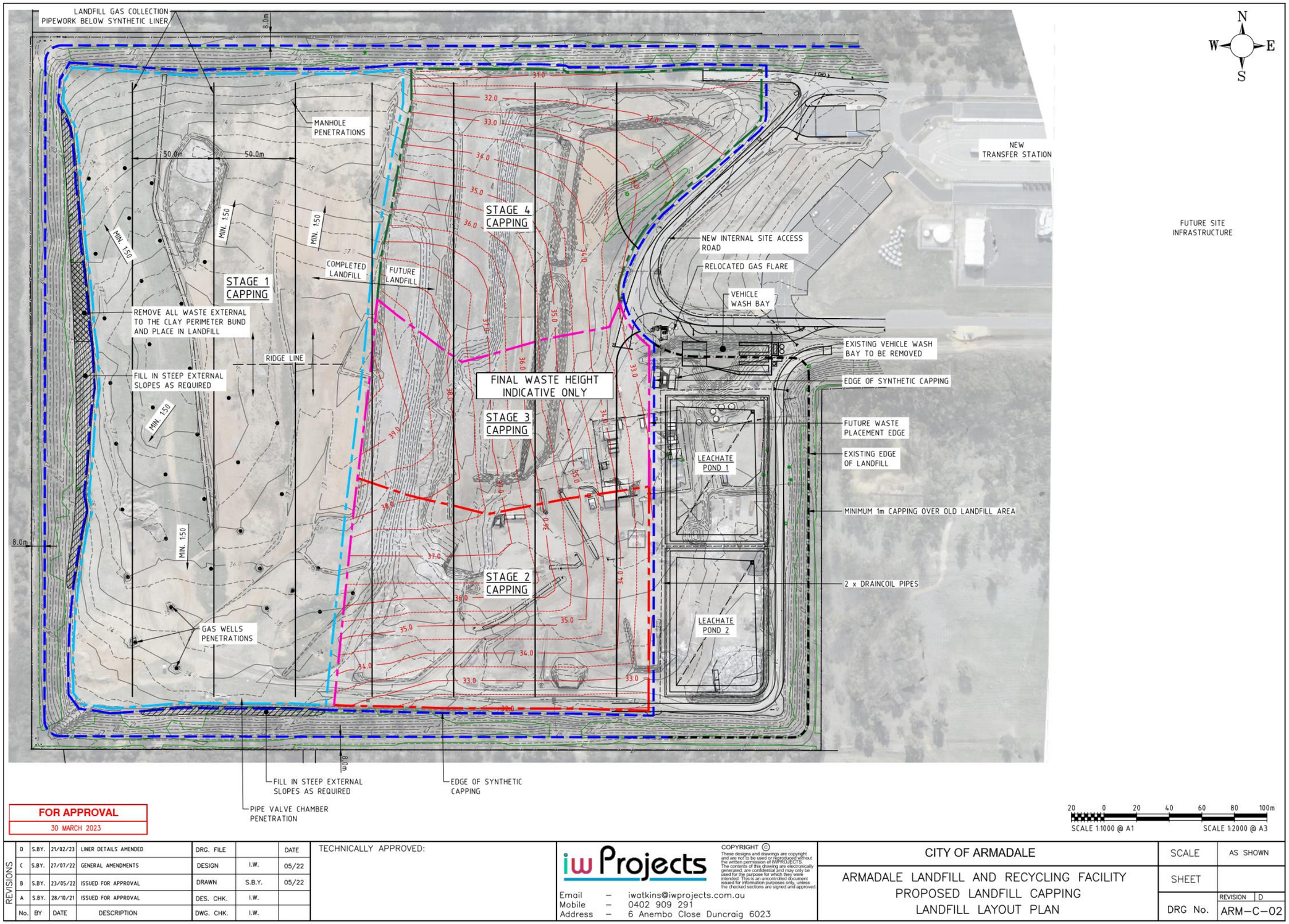
The applicant has not proposed any post-closure use of the landfill area to be capped as part of this application. The height and final design profile of this area along with waste settlement, would be difficult to accommodate most uses. The applicant is understood to be investigating whether solar power generation on this area would be a viable use.

Surface water management

The capping is designed so that rainfall on the capped surface will infiltrate through the soil growing medium and be intercepted by the geocomposite drainage layer. The intercepted stormwater will be conveyed to outside the perimeter of the landfill and discharged beyond the landfill footprint, into the existing perimeter drains surrounding the premises. Due to the impermeable LLDPE liner within the capping system, this water would not have come not contact with the waste mass and should be uncontaminated.

Rainfall will initially be absorbed and retained within the growing medium until the soil reaches field saturation levels, with rainfall then seeping through the soil and entering the drainage layer. Accordingly, there will be a substantial time delay between rainfall events and the emergence of water from the geocomposite drainage layer, with flow rates being extremely slow and distributed all around the landfill footprint.

During more intense storm events, any stormwater that is not able to percolate into the soil growing medium will flow off the capped surface and directly enter the perimeter drain network.



FOR APPROVAL
30 MARCH 2023

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	A	S.BY.	28/10/21	ISSUED FOR APPROVAL	DES. CHK.	I.W.	
	No.	BY	DATE	DESCRIPTION	DWG. CHK.	I.W.	

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CITY OF ARMADALE	
ARMADALE LANDFILL AND RECYCLING FACILITY PROPOSED LANDFILL CAPPING LANDFILL LAYOUT PLAN	
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Figure 1: Capping layout and staging

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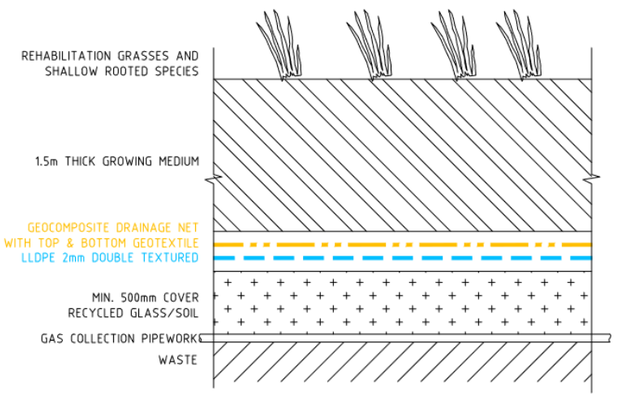

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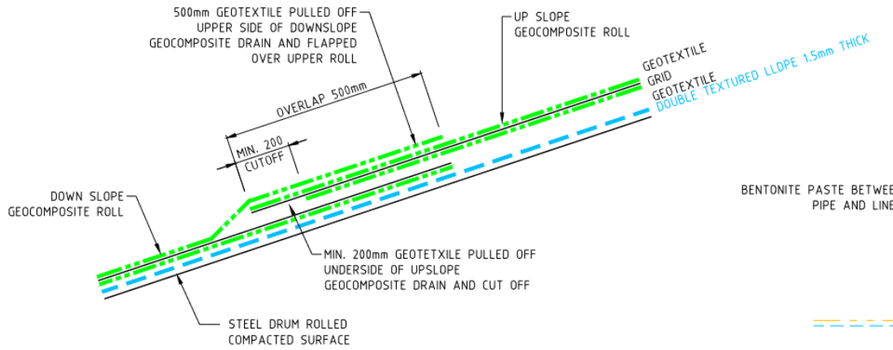

GEOCOMPOSITE DRAINAGE LAYER - ROLL END JOIN DETAIL
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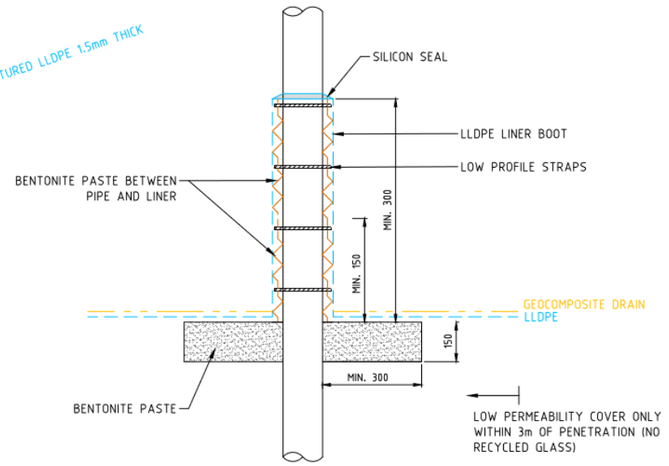

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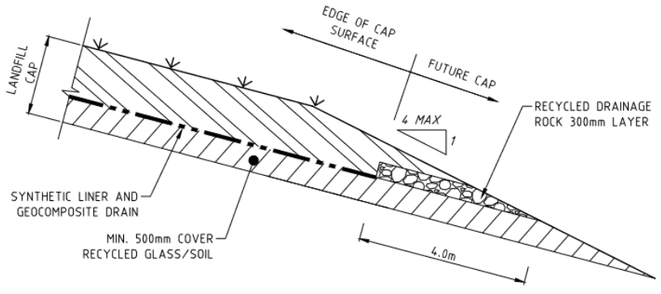

CAP TERMINATION DETAIL - DOWNHILL
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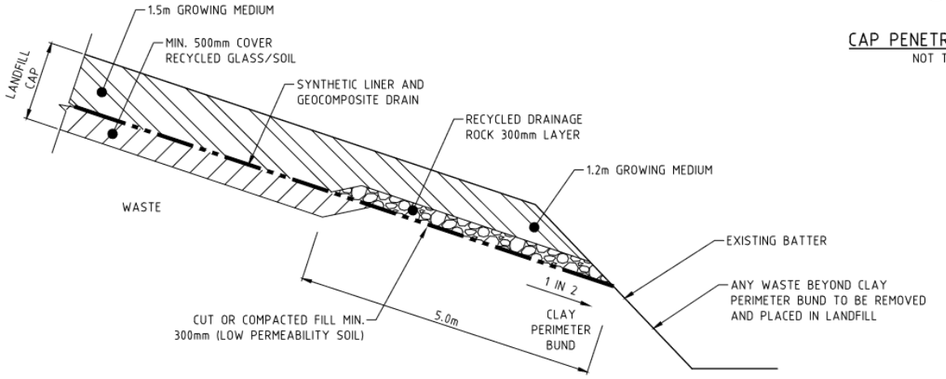

TYPICAL SECTION - CAP EDGE DETAIL
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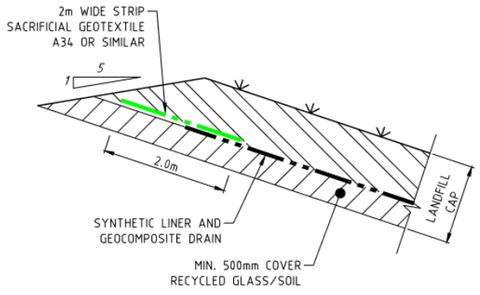

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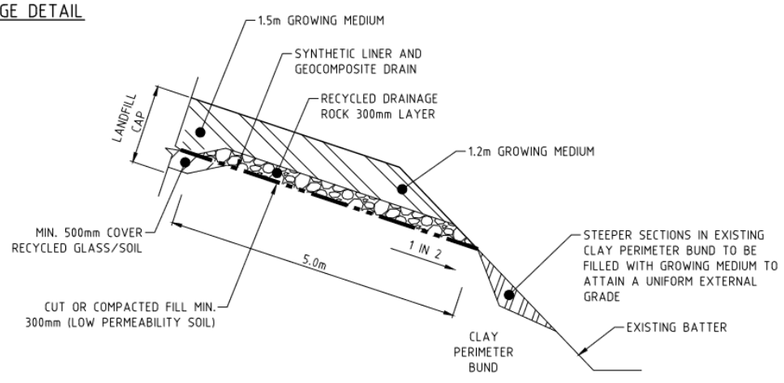

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ARMADALE LANDFILL AND RECYCLING FACILITY
PROPOSED LANDFILL CAPPING
CAPPING TYPICAL DETAILS – SHEET 1 OF 3

SCALE: AS SHOWN
SHEET:
DRG No.: ARM–C–05
REVISION: D

Figure 2: Capping typical details 1

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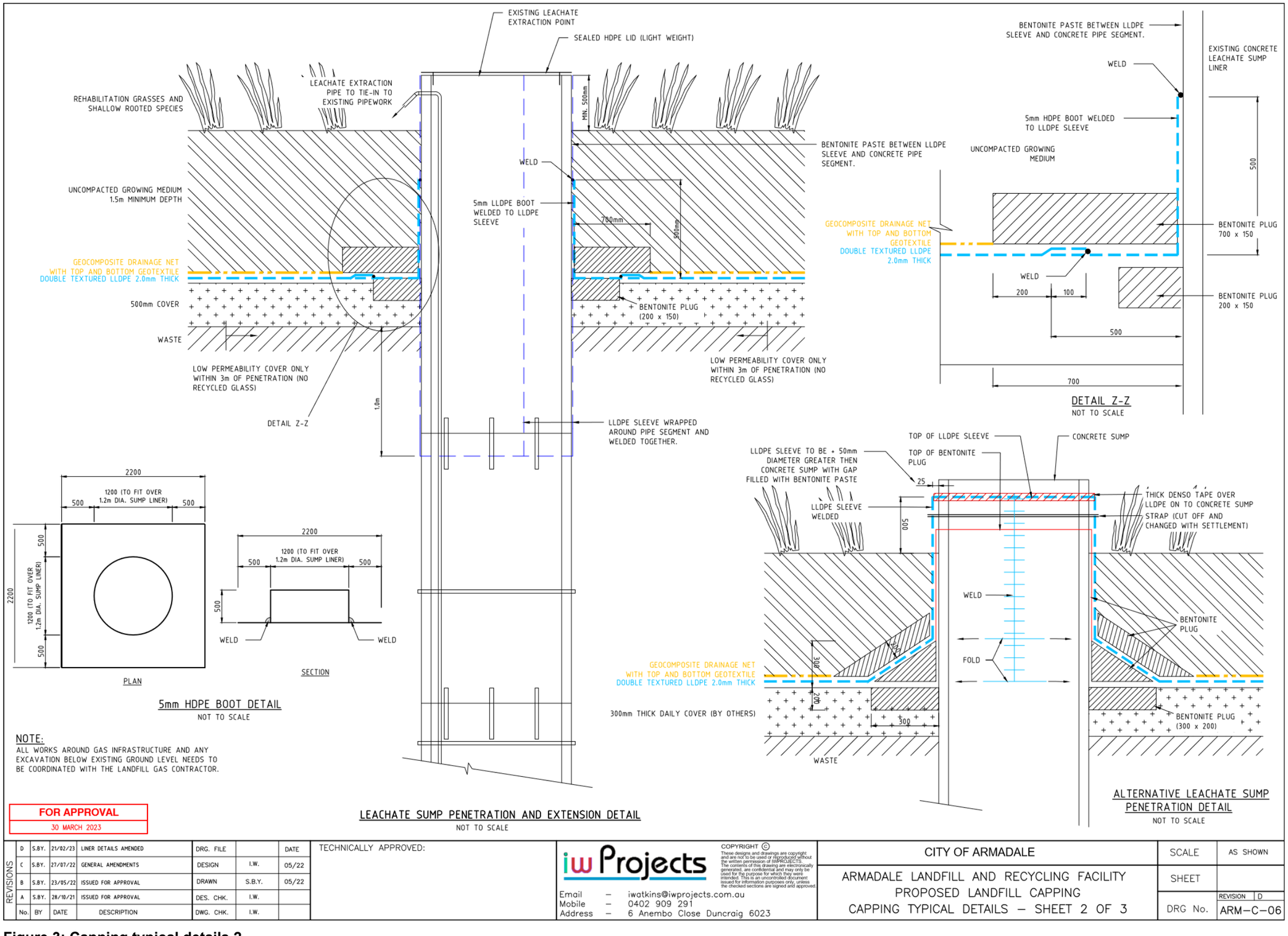

Figure 3: Capping typical details 2

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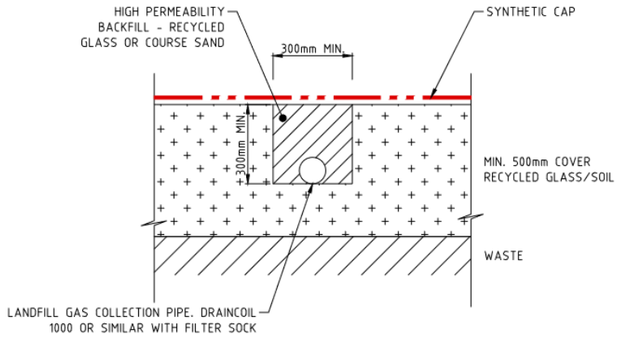

LANDFILL GAS COLLECTION PIPE TRENCH DETAIL

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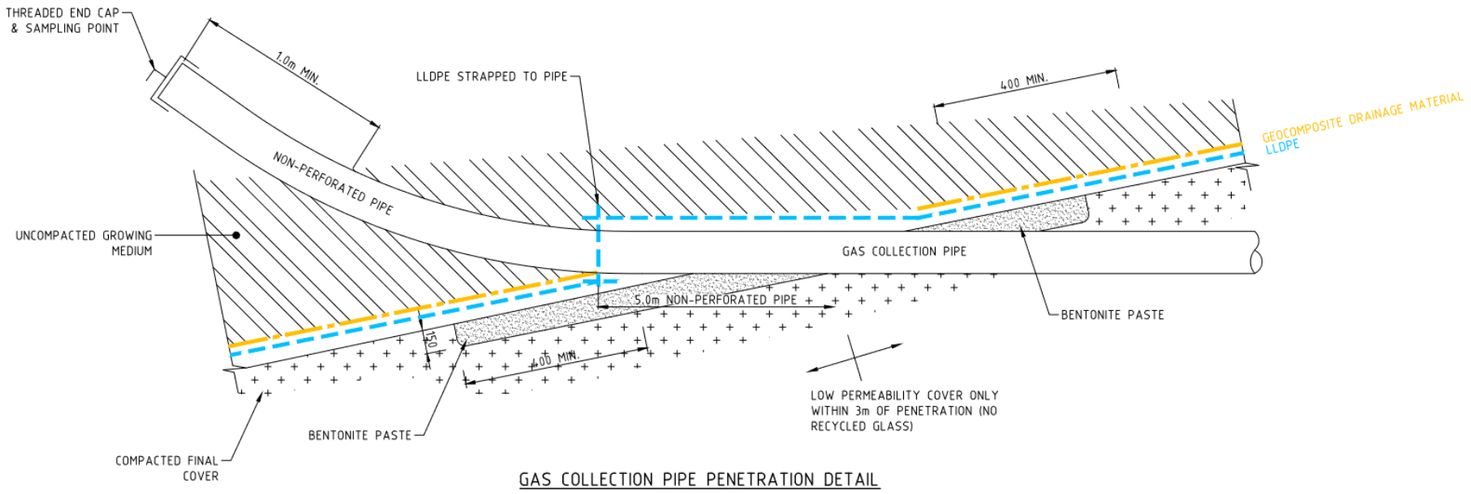

GAS COLLECTION PIPE PENETRATION DETAIL

NOT TO SCALE

NOTE:

ALL WORKS AROUND GAS INFRASTRUCTURE AND ANY EXCAVATION BELOW EXISTING GROUND LEVEL NEEDS TO BE COORDINATED WITH THE LANDFILL GAS CONTRACTOR.

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ARMADALE LANDFILL AND RECYCLING FACILITY
PROPOSED LANDFILL CAPPING
CAPPING TYPICAL DETAILS – SHEET 3 OF 3

SCALE	AS SHOWN
SHEET	
DRG No.	REVISION D ARM–C–07

Figure 4: Capping typical details 3

2.3.2 New leachate ponds

The applicant is proposing to install two permanent synthetically lined leachate ponds that are located on the south-eastern edge of the landfill area. The ponds will receive vehicle washdown water in addition to leachate from the landfill and will be part of the long-term leachate management system during the post closure period.

The leachate ponds will replace the current progressive leachate pond which is located at the low point adjacent to the active tipping face. Installation of the ponds will need to occur prior to closure, as there will be no space for the current progressive pond when the landfill is nearing the maximum waste footprint.

As closure of the landfill is expected to occur by 2025, there will only be up to one year of leachate generation from the active landfill that will be pumped into the new leachate ponds. After this period the completed landfill will be closed and capped. Leachate generation after closure will be from the slow draining of suspended leachate within the waste mass and the quantity of leachate is anticipated to decrease over time to low volumes.

Pond design

Both ponds have a sloping design and sump, resulting in a shallow and deep end on each pond. The shallow ends have an operational storage height of 1.5 m and minimum top of embankment height of 2 m. The deep ends have a 2.5 m operational storage height and minimum top of embankment height of 3 m. Each pond has an average overall operational storage depth of 2 m.

The pond dimensions provide a total operational storage capacity of 14,500 m^3 (7,250 m^3 each) and surface area of 7,250 m^2 (3,625 m^2 each). Pond embankments are raised at a minimum 1 m above surround ground level to prevent stormwater ingress.

The ponds will provide additional storage for a 1% annual exceedance probability (AEP) >168-hour duration storm event through the designed 0.5 m operational freeboard height. The shallow average design depth of the ponds is also to ensure leachate stays under aerobic conditions using passive means, which should reduce the potential for increased odour emissions that would occur under anaerobic conditions.

Both ponds will be lined with a 2 mm thick single-sided textured high-density polyethylene (HDPE) liner. A cushion geotextile will also be placed below the HDPE liner and above the soil subgrade to provide protection.

Water balance

For the first three to five years, the ponds are anticipated to be fully utilised to remove all leachate currently within the waste mass and allow the landfill to slowly drain off excess leachate. Beyond five years, the ponds will progressively manage less leachate as the landfill dries out. Towards the end of the 30-year post-closure period, there is anticipated to be minimal leachate being generated within the capped landfill.

The applicant has not undertaken modelling of leachate generation potential of the landfill due to the imminent closure date. The size of the new leachate ponds has been derived based on the previous sizes of the progressive leachate pond utilised at the premises. Exact volumes of leachate generated at the premises have not been measured, however the volume of leachate being generated has generally been able to be removed via evaporation each year.

The two proposed ponds will provide an effective evaporation area of approximately 7,250 m^2 (3,625 m^2 each). This provides approximately 10% more area than the average evaporation area of 6,670 m^2 that was available in the progressive leachate pond between 2015 - 2021. The ponds will also provide substantially more leachate storage volume than was previously available, as the progressive leachate pond was generally only 0.5 m to 1 m deep.

Using statistics from the Bureau of Meteorology's Perth Airport weather station (No. 009021), the applicant reports that annual evaporation from the ponds will be 1.3 m in a mean rainfall year and 1.1 m in a 90th percentile rainfall year. Based on the available evaporation surface area for the ponds, there is expected to be a net evaporation loss of 9,425 m^3 in a mean rainfall year and 7,875 m^3 in a 90th percentile year. The new ponds will also be fitted with surface sprays to increase the rate of evaporation that occurs from the ponds.

Contingency

If the two new leachate ponds reach maximum operating capacity, the applicant has proposed to undertake the following contingency measures:

- Increase recirculation of leachate onto the exposed waste surface where potential action is needed during the remaining period of landfill operations;
- Temporarily cease extracting leachate from the landfill and let excess volumes accumulate in the progressive leachate pond (if still present) or in the base of the landfill;
- Maximise surface evaporation from the lined leachate ponds by maximising utilisation of the sprays when the weather and wind direction is suitable;
- Remove excess leachate off-site, where accessible off-site disposal locations are available depending on PFAS concentrations within the leachate; and
- Where time permits, apply for approval to construct and operate alternative leachate removal systems, such as forced evaporation using air evaporators and/or waste heat from the landfill gas flare.

Leachate pond construction

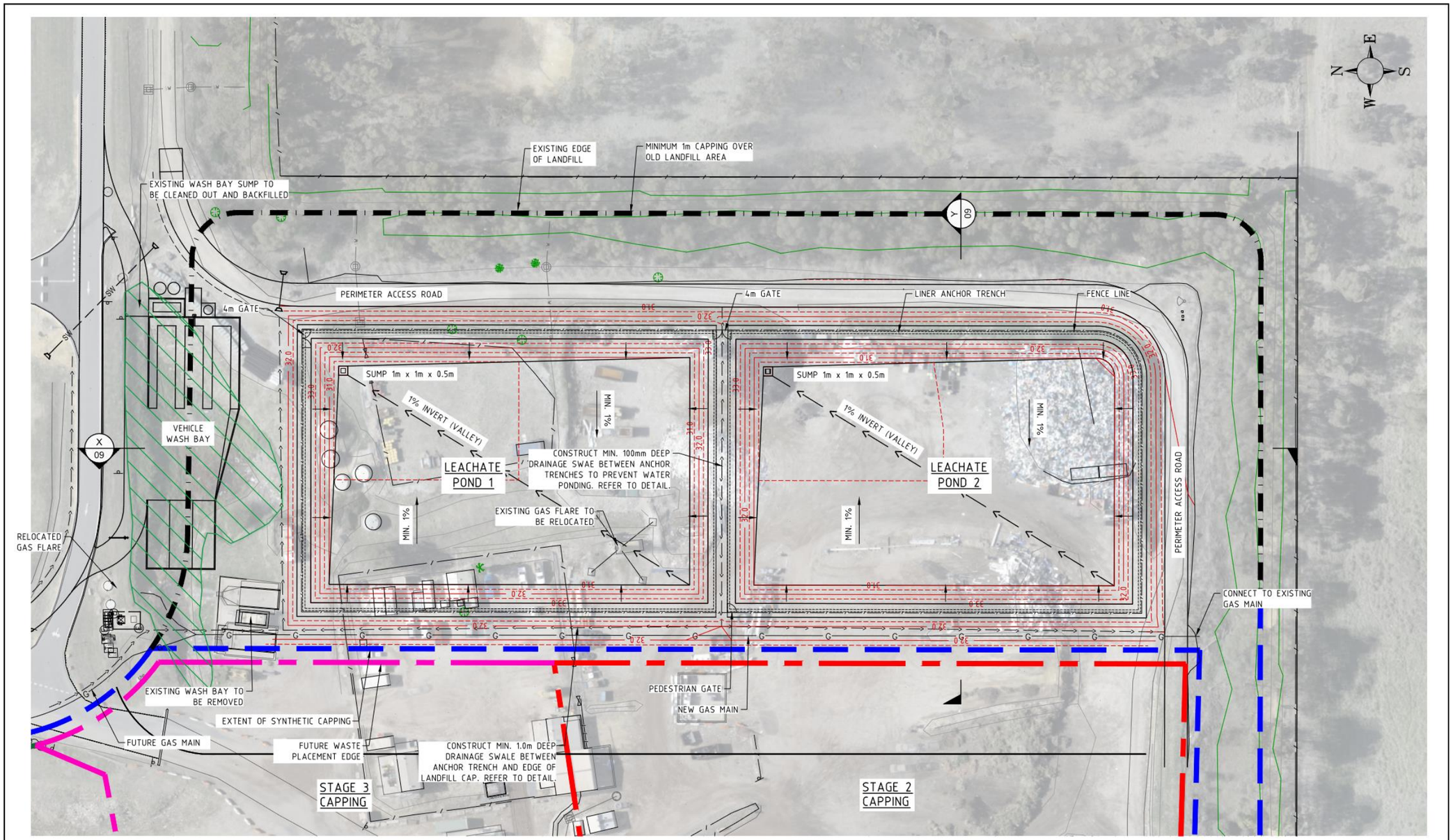
Construction of both leachate ponds will occur simultaneously. The works required to construct the leachate ponds will consist of the following general sequence of events:

- Accumulation of suitable soil material;
- Ordering and CQA testing of synthetic liner materials;
- Removal of any remaining operational infrastructure;
- Clearing and grubbing of the works area;
- Excavation and placement of compacted fill to design levels;
- Surface preparation prior to liner installation;
- CQA approval of liner material
- Installation of the HDPE liner (layout and joining/welding);
- Installation of miscellaneous items such as perimeter fencing, safety system and leachate distribution pipework;
- CQA inspection during fill placement and liner installation; and
- Submission of the CQA Validation Report and Compliance Report to DWER.

The applicant is proposing to commence construction of the leachate ponds during the 2023/24 financial year, with the installation being completed by autumn 2024.

Leachate extraction pipework

The applicant intends to continue the progressive expansion of the existing leachate extraction pipework below the waste mass until closure. However, the efficiency of the system will be improved by installing a 200 mm thick high permeability layer over the pipe network.



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30 MARCH 2023

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CITY OF ARMADALE	SCALE: AS SHOWN
ARMADALE LANDFILL AND RECYCLING FACILITY PROPOSED LANDFILL CAPPING LEACHATE PONDS LAYOUT PLAN	SHEET: DRG No.: ARM–C–08 REVISION: D

Figure 5: Leachate ponds layout

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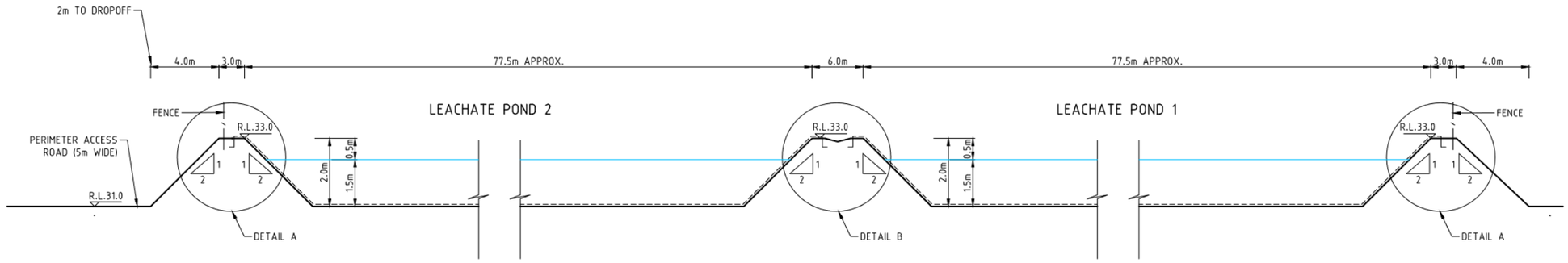

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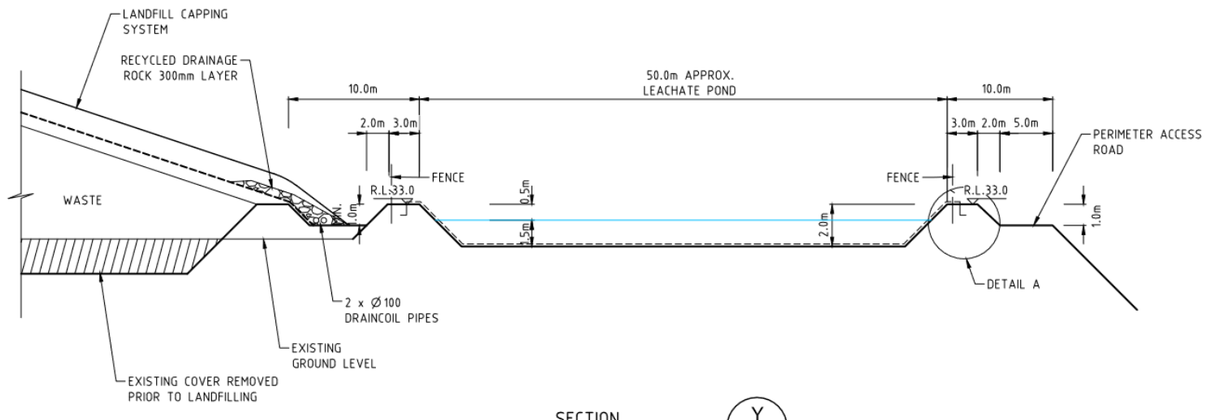

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NOTE:
SECTIONS ARE INDICATIVE ONLY AND SUBJECT TO DETAILED DESIGN OF INFRASTRUCTURE.

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CITY OF ARMADALE

ARMADALE LANDFILL AND RECYCLING FACILITY
PROPOSED LANDFILL CAPPING
LEACHATE PONDS SECTIONS

SCALE: AS SHOWN
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Figure 6: Leachate ponds typical sections

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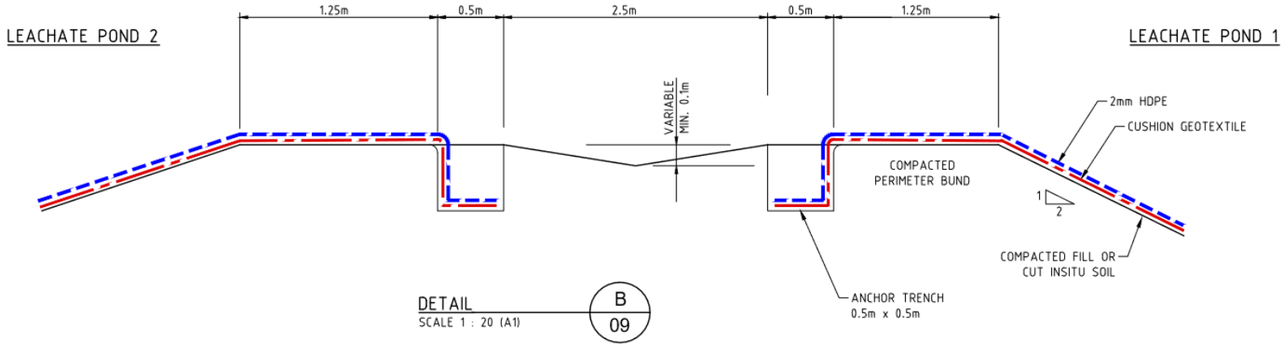
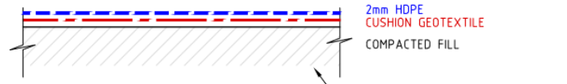
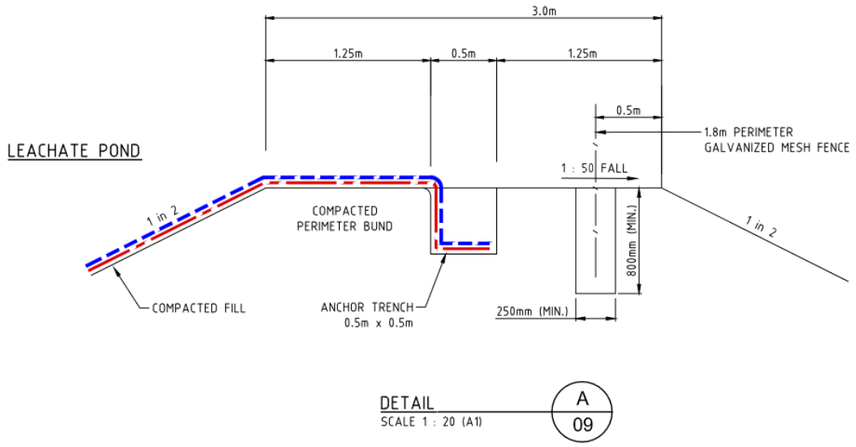


DETAIL B / 09
SCALE 1 : 20 (A1)



POND LINER DETAIL
NOT TO SCALE



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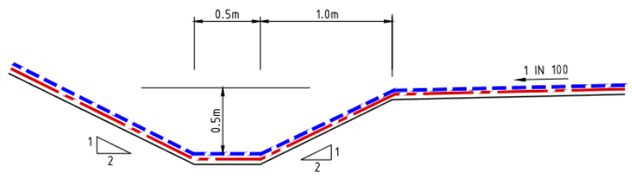
SCALE 1 : 20 (A1)



SUMP DETAIL
NOT TO SCALE

FOR APPROVAL
30 MARCH 2023

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	B	S.BY.	23/05/22	ISSUED FOR APPROVAL	DRAWN	S.B.Y.	05/22
	A	S.BY.	28/10/21	ISSUED FOR APPROVAL	DES. CHK.	I.W.	
	No.	BY	DATE	DESCRIPTION	DWG. CHK.	I.W.	

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CITY OF ARMADALE

ARMADALE LANDFILL AND RECYCLING FACILITY
PROPOSED LANDFILL CAPPING
LEACHATE POND DETAILS

SCALE: AS SHOWN
SHEET:
DRG No.: ARM-C-10
REVISION: D

Figure 7: Leachate ponds details

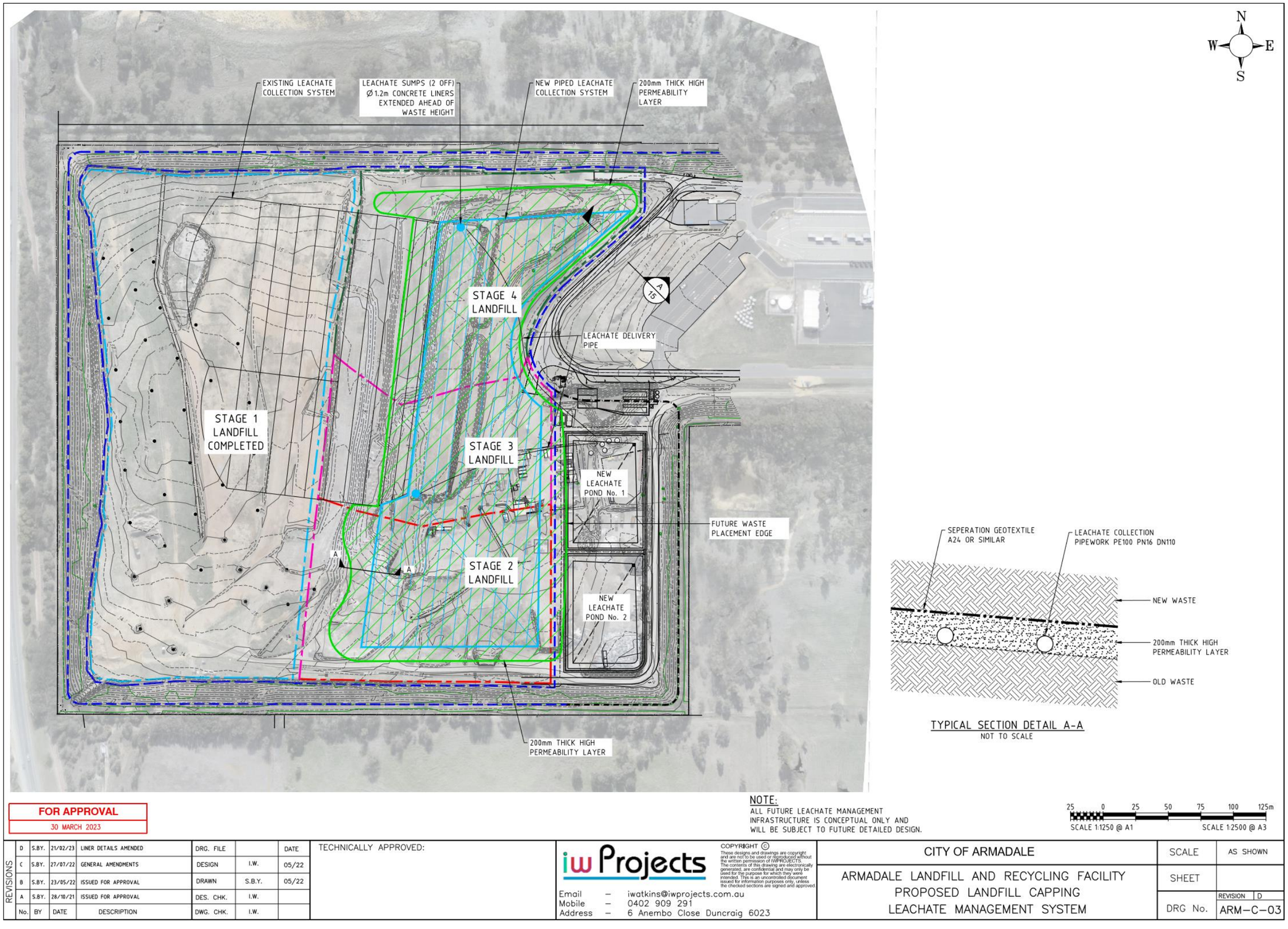


Figure 8: Existing and future layout of leachate system pipework

Works Approval: W6814/2023/1

2.3.3 Landfill gas flare relocation

A landfill gas extraction system is currently installed across the Stage 1 capping area. The gas extraction system has been progressively expanded as areas of the landfill are completed. Gas extracted from the landfill is combusted onsite using a landfill gas flare. The flare is located in the south-eastern portion of the landfill, in the area proposed to be used for the two new leachate ponds. Accordingly, the flare will require relocation.

As outlined in Section 2.3.1, the capping system design will incorporate a network of perforated pipes that are installed below the LLDPE liner. These gas extraction pipelines will prevent the build-up of gas pressure beneath the LLDPE liner as the liner will be preventing the vertical migration of gas from the landfill surface. Gas collected in the pipelines will be conveyed to the gas flare for combustion.

All works related to the landfill gas pipework and flare will be carried out or supervised by the applicant's specialist landfill gas contractor.

Temporary relocation

The existing landfill gas flare is constructed on a steel frame that is bolted to concrete strip footings and supported by four stay-wires. The flare will be disconnected from the gas pipework and unbolted from its current footings for later use.

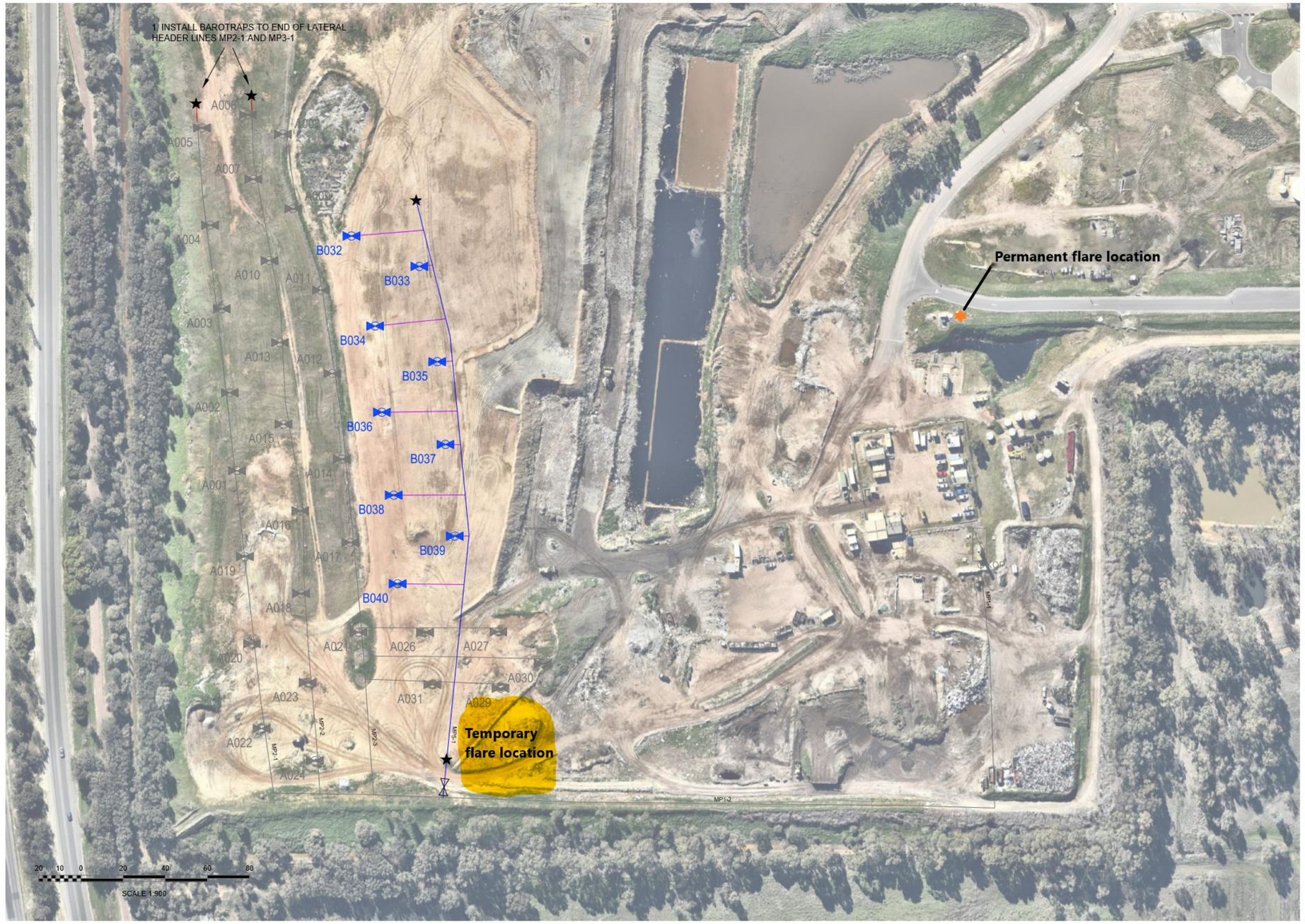
A temporary flare will be acquired and used for between six months and 2.5 years. The temporary flare will be located immediately adjacent to the existing gas extraction ring main. This will move the flare away from construction activities for both leachate ponds and the vehicle washdown bay, and not require any expansion of the existing gas ring main. Capping at this location will however be unable to complete until the flare is permanently relocated.

The duration that the temporary flare is used depends on whether the applicant will commence the permanent relocation of the flare after construction of the leachate ponds and new internal access roads are completed or wait until the landfill has been filled and the final gas wells and pipework installed.

Permanent relocation

Permanent relocation of the landfill gas flare will be to the north, away from the landfill and leachate ponds and to a more long-term accessible position adjacent the new internal access road.

New concrete strip footings will be constructed with the relocated flare re-bolted to the concrete and have stay wires attached for added stabilisation. Permanent conveyance pipework will also be constructed to the new location.



MAPPING INFORMATION	
Coordinate System:	Australian Map Grid
Coordinate Units:	Metres
Zone:	50
NEARMAP INFORMATION	
Date:	16/07/2019

FIELD SUMMARY				
	PIPE SIZE	LENGTH	ITEM	TOTAL
HORIZ WELL	63mm	0	⊗	0
	90mm	0	⊕	0
	110mm	0	■	0
	125mm	0	●	0
	160mm	0	★	0
	200mm	0	⋈	0
FLOW	63mm	0	✳	0
	90mm	150	◉	0
	110mm	0	⋈	0
	125mm	0	OKOP	0
LATERAL	50mm	0	◎	0
	125mm	20	▱	0
	160mm	290		
	200mm	0		
AIR	32mm	0		
	63mm	0		
LEACHATE	63mm	0		
	90mm	0		
	125mm	0		
	160mm	0		
MAIN HEADER	90mm	0		
	110mm	0		
	125mm	0		
	160mm	0		
	200mm	0		
	225mm	0		
	250mm	0		
	280mm	0		
	315mm	0		
	355mm	0		
	400mm	0		
	450mm	0		
	500mm	0		

LEGEND	
⊗	Well
⊕	Monitoring Bore
■	Wellhead Station - Standard
●	J Trap
★	Barometric Trap
⋈	Isolation Valve
✳	Pit Pumpout
◉	Leachate Sump / Riser Pipes
⋈	Standalone Well
OKOP	Knock Out Pot
◎	Dual Purpose Well
▱	Flare / Power Station
A	Wellhead Station Name
A125	Well Number
MP1–1	Main Gas Pipe
	Fence Line
	Cell Boundary
	Communication
	Power
	63mm Flow Line
	32mm Air Line
	63mm Air Line
	63mm Leachate Line
	90mm Leachate Line
	125mm Leachate Line
	160mm Leachate Line
	90mm Horizontal Well
	90mm Main/Lateral Header
	125mm Main/Lateral Header
	160mm Main/Lateral Header
	200mm Main Header
	225mm Main Header
	250mm Main Header
	280mm Main Header
	315mm Main Header
	355mm Main Header
	400mm Main Header
	450mm Main Header
	500mm Main Header

NOTES:

WELLS A001 - A030 ARE 50MM WELLS. NOT SURVEYED, LOCATIONS ARE APPROXIMATED FROM SUPPLIED DRAWINGS AND AERIAL PHOTOGRAPHY.
MP1-1 AND MP1-2 ARE 225MM BELOW GROUND MAIN HEADER LINES.
MP2-1, MP2-2 AND MP2-3 ARE ABOVE GROUND 125MM LATERAL. MAIN 225MM HEADER BURIED. NO ISOLATION VALVES, CONNECTION POINTS.
WELLS 032 - 040 DRILLED BUT NOT CONNECTED TO GAS COLLECTION SYSTEM

REVISION HISTORY					
REV	DESCRIPTION	BY	CKD	APP	DATE
E					
D	Changed GCS installation from above ground to trenched.	ZB	RC	RC	12/06/2020
C	Added Baro Trap near valve	ZB			9/04/2020
B	Connect Wells B032 - B040	ZB	AD	AD	23/09/2019
A	Refer to Previous Drawing	KK	RC	RC	

runenergy
199C OSBORNE AVE, CLAYTON STH, VIC 3169
PH: (03) 9538 620
www.runenergy.com

PROJECT:	Armadale Landfill
DRAWING TITLE:	Gas Collection System Installation
DRAWING No:	139-DN-001
DRAWING TYPE:	Design in Progress
DRAWN:	ZB
CKD:	RC
DATE:	12/06/2020
APP:	RC
DESIGNED:	RC
APP DATE:	12/06/2020
SCALE:	DNS
SHEET:	1 of 1
REV:	D
SIZE:	A1

Figure 9: Existing landfill gas network and proposed temporary flare location

2.3.4 New vehicle wash facility

Vehicle washdown at the premises currently occurs on the active landfill surface using a mobile water tanker. This is due to the existing vehicle washdown bay not providing suitable management of washdown water and solids. Washdown on the landfill surface allows for liquids to be captured by the existing leachate management system and progressive leachate pond.

The applicant proposes to construct a new vehicle washdown bay located along the edge of an internal access road and immediately north of the proposed new leachate ponds. The proposed location of the washdown bay will allow the new leachate ponds to be used for managing washdown water from the activity. The new vehicle washdown will include the following key features:

- Three wash bays with a high-volume water hose, high pressure water hose, air hose and grease hose;
- Sealed sea container where the pumping systems, air compressor and grease containers are mounted;
- Water storage tanks;
- Graded 40 mm dense grade asphalt seal to prevent seepage of washdown water through the surface;
- Concrete retaining walls to achieve vertical separation between the vehicle washing area and the drainage area; and
- Washdown water and solids drainage system comprising:
    - Gravity feed of solids for separation through a wedge-wire screen;
    - Discharge of screened solids to a 600 L wheelie bin for removal;
    - Screened washdown water being directed to a sump, from where the wastewater is pumped into one of the two leachate ponds
    - Bunded concrete slab areas for screened solids storage and to control wastewater and direct it to the sump; and
    - A design that includes contingency to remove the wedge-wire screen and wheelie bin and replace them with a chute and large volume perforated hook-lift bin if the 600 L proves to be too small for the volume of solids being generated.

The existing and unused vehicle wash down facility will also be decommissioned as part of the works, with the existing wash down water sump cleaned out and backfilled with engineered fill. All contaminated material that is removed will be disposed of into the active landfill area.

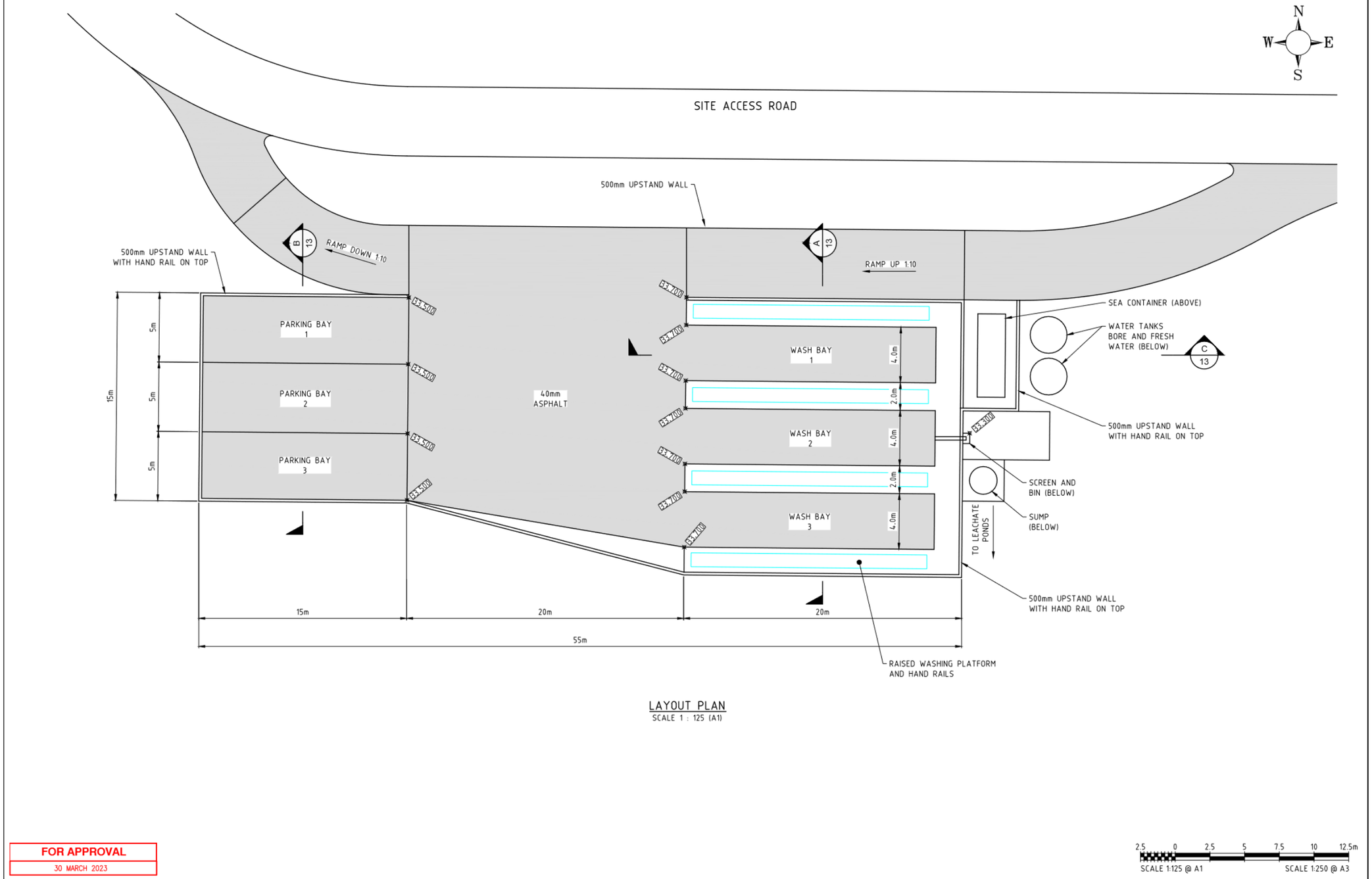
Construction of the new vehicle wash facility and decommissioning of the old facility is expected to occur in either the 2023/24 or 2024/25 financial year.

2.3.5 Internal access road and surface water management

The existing internal road forms a perimeter around the drop-off and recycling area, while also providing access to the south-eastern portion of the landfill. As the landfill progresses to closure, this south-eastern portion will be filled with waste and the surrounding levels increased accordingly.

The applicant proposes to raise the height of the access road by approximately 5 m to accommodate the future adjoining levels. The access road will follow a similar alignment to the existing road and form a stormwater catchment divide between the landfill area and the ongoing waste management activities on the eastern portion of the premises.

Construction of the new internal access road is expected to occur in the 2023/24 financial year.



LAYOUT PLAN
SCALE 1 : 125 (A1)

FOR APPROVAL
30 MARCH 2023

2.5 0 2.5 5 7.5 10 12.5m
SCALE 1:125 @ A1 SCALE 1:250 @ A3

REVISIONS							
	D	S.B.Y.	21/02/23	LINER DETAILS AMENDED	DRG. FILE		DATE
	C	S.B.Y.	27/07/22	GENERAL AMENDMENTS	DESIGN	I.W.	05/22
	B	S.B.Y.	23/05/22	ISSUED FOR APPROVAL	DRAWN	S.B.Y.	05/22
	A	S.B.Y.	28/10/21	ISSUED FOR APPROVAL	DES. CHK.	I.W.	
	No.	BY	DATE	DESCRIPTION	DWG. CHK.	I.W.	

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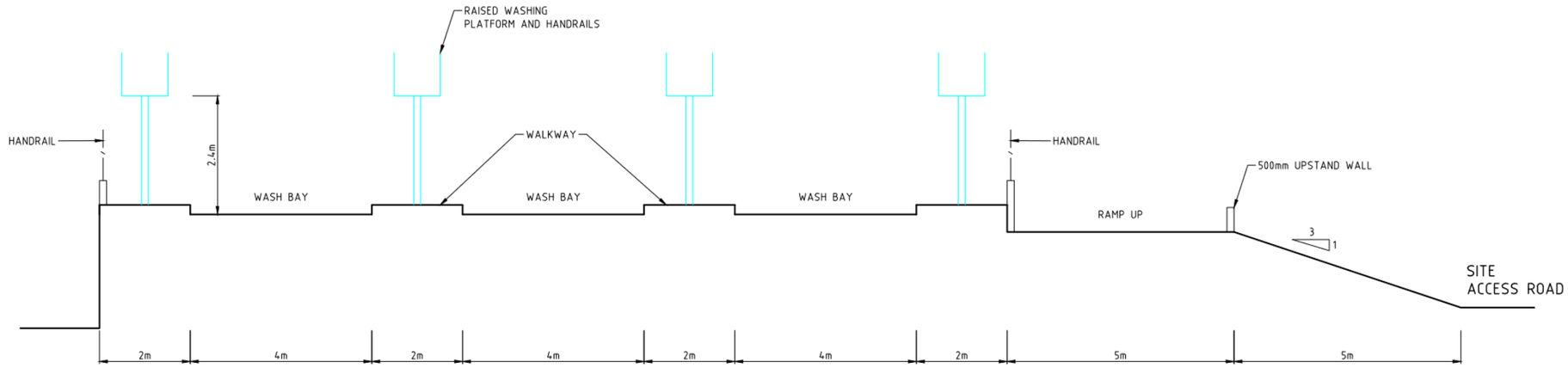
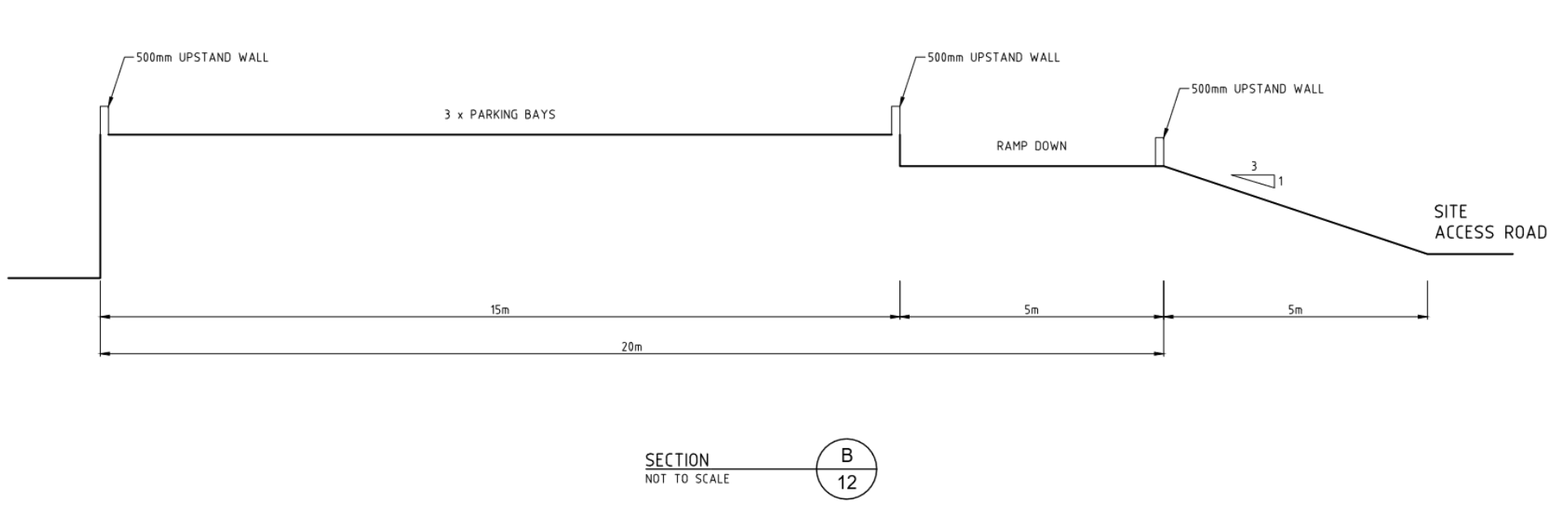
CITY OF ARMADALE

ARMADALE LANDFILL AND RECYCLING FACILITY
PROPOSED LANDFILL CAPPING
VEHICLE WASH BAY LAYOUT PLAN

SCALE: AS SHOWN
SHEET:
DRG No.: ARM–C–12
REVISION: D

Figure 10: Vehicle wash facility layout





SECTION B
NOT TO SCALE
12

FOR APPROVAL
30 MARCH 2023

NOTE:
SECTIONS ARE INDICATIVE ONLY AND SUBJECT TO DETAILED DESIGN OF INFRASTRUCTURE.

REVISIONS	No.	BY	DATE	DESCRIPTION
	D	S.BY.	21/02/23	LINER DETAILS AMENDED
	C	S.BY.	27/07/22	GENERAL AMENDMENTS
	B	S.BY.	23/05/22	ISSUED FOR APPROVAL
	A	S.BY.	28/10/21	ISSUED FOR APPROVAL

DRG. FILE		DATE
DESIGN	I.W.	05/22
DRAWN	S.B.Y.	05/22
DES. CHK.	I.W.	
DWG. CHK.	I.W.	

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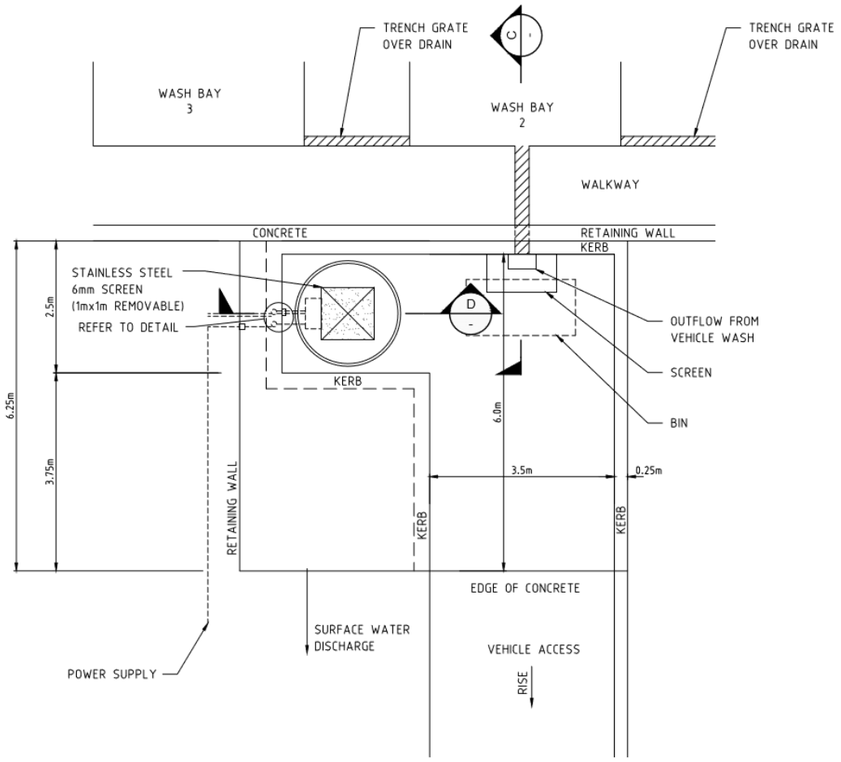
CITY OF ARMADALE

ARMADALE LANDFILL AND RECYCLING FACILITY
PROPOSED LANDFILL CAPPING
VEHICLE WASH BAY SECTIONS

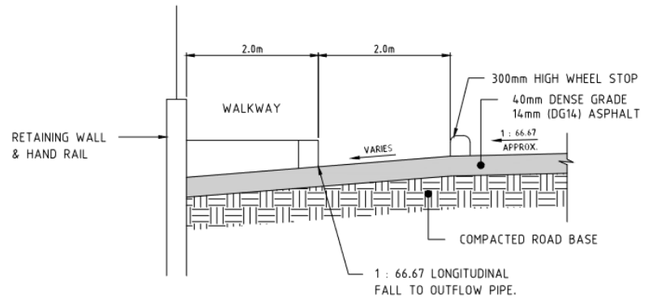
SCALE: AS SHOWN
SHEET:
DRG No.: ARM–C–13
REVISION: D

Figure 11: Vehicle wash facility sections



VEHICLE WASH LIQUID MANAGEMENT AREA PLAN

SCALE 1 : 50 (A1)



VEHICLE WASH SECTION

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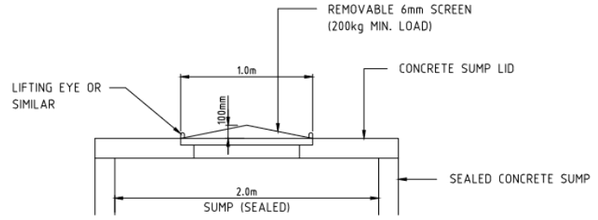
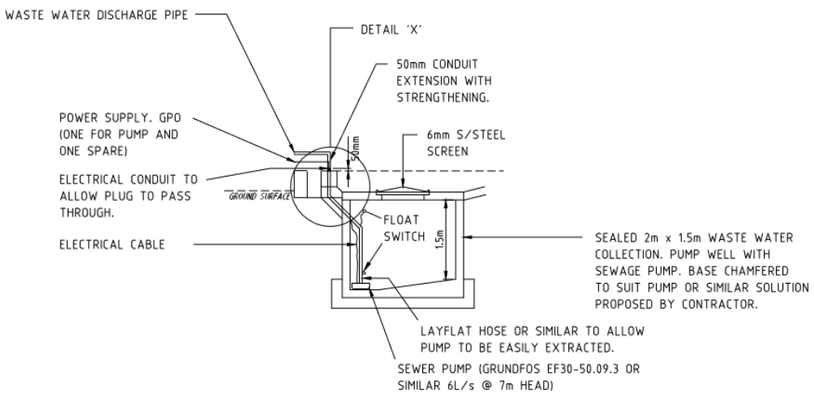


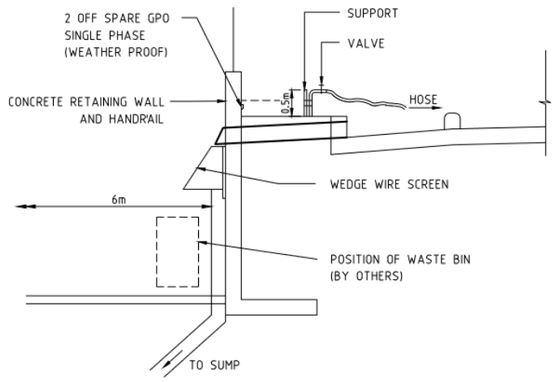
6mm STAINLESS STEEL SCREEN DETAIL

SCALE 1 : 20 (A1)



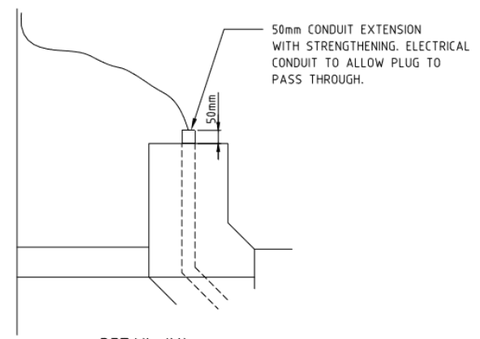
SECTION D-D

SCALE 1 : 50 (A1)



SECTION C-C

SCALE 1 : 50 (A1)



DETAIL 'X'

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30 MARCH 2023

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CITY OF ARMADALE

ARMADALE LANDFILL AND RECYCLING FACILITY
PROPOSED LANDFILL CAPPING
VEHICLE WASH BAY DETAILS

SCALE AS SHOWN

SHEET

DRG No. ARM–C–14

REVISION D

Figure 12: Vehicle wash facility details

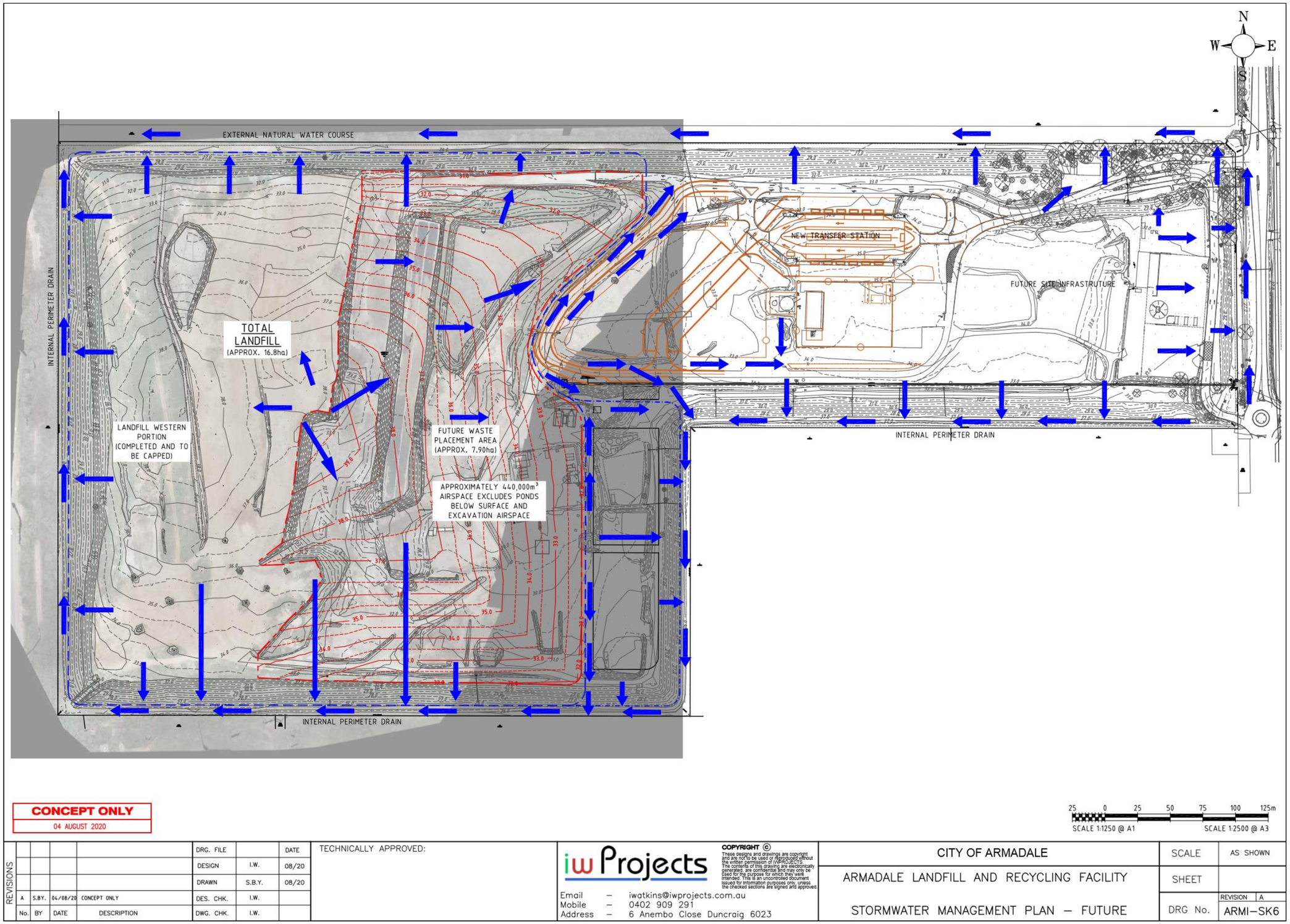


Figure 13: Stormwater management design concept following completion of all works and capping stages

2.4 Landfill background

2.4.1 Progression of landfilling at the premises

There are three distinct stages of landfilling that have occurred at the premises. Initial filling of the clay voids to ground level, an historical above ground waste mass that has been capped for a number of years and the current west to east progression of filling that is proposed for final capping and closure through this application.

There is no engineered liner present below any landfill stage. Landfilling at the premises has relied on in-situ clays for containment and minimisation of leachate impacts.

Herein the term Historical Landfill will be used to refer to the basal landfilling of waste within the original clay voids. The initial above ground landfilling that occurred between 1996 – 2011 will be referred to as the Intermediate Landfill and Current Landfill will refer to the west to east progression of cells above the historical waste mass.

A visual summary of historical filling at the premises is shown in Figure 14 below.

Historical Landfill

Prior to the development of the landfill in 1975, the lot is understood to have been historically used as a clay quarry. The site was chosen for the landfill as it was possible to fill the clay voids, while relying on the low permeability of the in-situ clays of the Guildford Formation. The applicant supposes that prior to landfilling, clay extraction was undertaken to approximately 3 mBGL.

Accepted wastes were pushed out into the clay pit without any specific landfill base design until the floor of the clay quarry had been filled to natural ground level. This basal stage of landfilling occurred in two phases, initially progressing westward from Hopkinson Road between 1975 – 1985 and then filling the remaining southwest portion of the lot between 1985 – 1996. When comparing the topographical levels of surrounding land, the pre-disturbance surface levels at the premises have been estimated as approximately 26 mAHD. Based on this, the historical landfill depth has been estimated between 23 – 24 mAHD.

There was no historical landfill base design, with wastes being deposited and pushed out into the former clay pit areas. As a result, there was no leachate collection system installed for the historical waste mass.

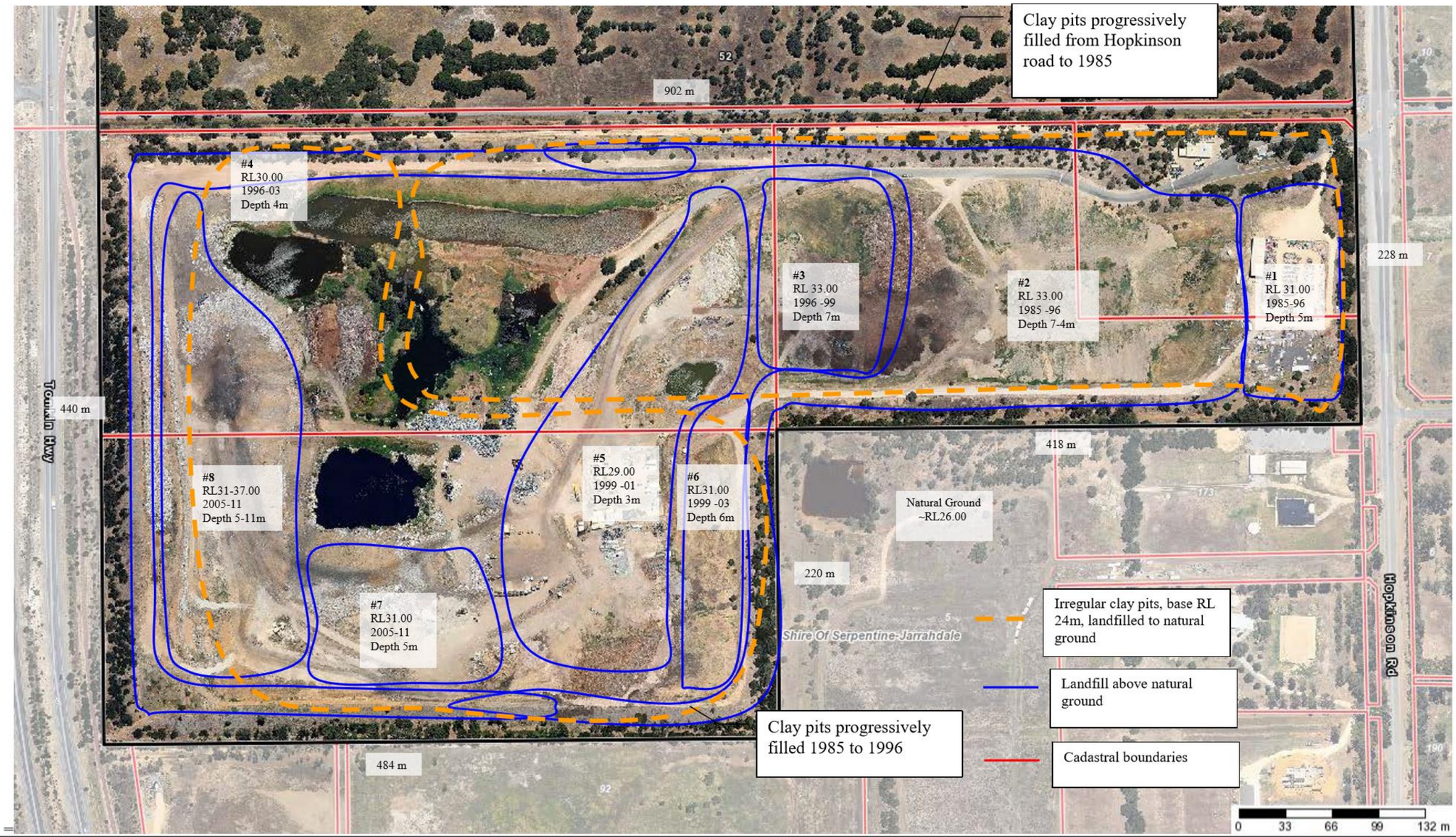
Intermediate Landfill

Further landfilling above natural ground levels occurred within the eastern portion of the lot between 1985 – 1996, with waste landfilled to a depth of between 5 – 7m, to approximately 5 m above natural ground level. This section was capped in 1999 with a minimum 300 mm thick clay layer that was overlain by a topsoil layer ranging between 700 mm to 2 m thick (Golder 2014).

Landfilling then progressed into the western portion of the site in an east to west direction between 1996 – 2011 at varying heights above natural ground level.

Current Landfill

The Current Landfill is constructed in a non-traditional manner and is located in the wider, western section of the premises. Rather than using conventional landfill cells for the deposition of waste, the applicant progressively fills the area until a final waste profile of approximately 20 metres is achieved. Once the waste mass reaches its final profile it is then covered and the leachate pond located directly east of the mass forms the base of the next landfill progression. The waste mass is aligned in a roughly north-south direction and progresses from west to east across the premises, above the historical landfill material (Historical Landfill and Intermediate Landfill).



Armadale Landfill Site

From the aerial photos 1972 to 1995 and the first survey in 1996 it appears that the clay pits on the site were filled first in the early years up till 1985. From 1985 to 1996 it appears that the remainder of the pits were filled in as area #1 and #2 were being developed above natural ground level. I suspect this would be due to the site being very wet in winter and needing high ground for tipping.

Figure 14: Summary of historical filling at the premises

2.4.2 Current Landfill design

Cell design

The Current Landfill has two sections present, one section located at the western edge of the premises that includes landfill gas wells and a temporary soil cap ranging from 200 mm to approximately 800 mm thickness, and the other being the active deposition area located within the central portion of the premises.

Approximately 50% of the Current Landfill area has attained the final design waste profile of 38.5 mAHD. The remaining landfill area has an indicative target waste height of 39.5 mAHD.

Design of the landfill capping and efficient progression towards closure has resulted in the Current Landfill being further divided into four stages:

- Stage 1 includes the completed section with the temporary cap present;
- Stage 2 is located in the southern portion of the active deposition area;
- Stage 3 is located in the centre of the active area; and
- Stage 4 is located in the north of the active area where the majority of the current leachate and stormwater ponds are located.

Liner properties

As the landfill was developed in the late 1970s within a disused clay quarry, there was no engineered basal and sidewall liner construction. The existing clay void was filled, as the intent was to rely on the natural low-permeability of the in-situ clay materials at the premises. As a result, the base and sidewalls of the landfill are lined with in-situ clay to a vertical height of 3 metres, corresponding to natural ground level (IW Projects 2020). There is no engineered liner separating the Current Landfill and historical waste mass, with separation occurring via the clay and soil capping layer.

Due to the placement of waste material over a number of years, there is no access available to determine the permeability of the underlying clay material, however the applicant considers that the natural clays have a low permeability. This assumption is based on a clay borrow pit located immediately to the south of the landfill being used as a source of clay for the development of the first landfill cell at the South Cardup landfill in 1999. The clay source was selected due to its suitability as a clay liner below a Class III putrescible landfill. Sandy clays in the area are described as having an undisturbed hydraulic conductivity ranging between 5×10^{-8} - 5×10^{-10} m/s (MRA 2017).

Information from the applicant implies that the area occupied by the leachate and stormwater ponds may be over areas of previous waste placement. This is due to the pond base level being located at approximately the same level as the surrounding natural ground and the understanding that historical clay extraction at the premises was to approximately 3 m below natural ground level. There are no historical landfilling records available to confirm what is below the current leachate pond and stormwater ponds.

The applicant considers that due to future landfilling being progressively developed on top of historical waste deposition areas, there is no opportunity to effectively line any natural ground in advance of future landfill progression. As a result, there is no proposal to line the future north-eastward progression of the landfill into the current locations of the leachate and stormwater ponds. The applicant considers if waste is present under the ponds, leachate from the surrounding waste mass would flow under the liner if one was used. If there is no waste present it is considered that the naturally occurring clay would provide a low permeability base.

Separation from groundwater

Licence L6964/1997/11 requires the applicant to maintain a separation distance of at least two m between the base of the current and future waste disposal areas and the highest level of groundwater. However, the exact separation distance from groundwater is not known. The applicant has indicated that landfilling is currently taking place above approximately 3 m of historically landfilled waste material.

It is uncertain what degree of separation exists between groundwater and historically landfilled material. The applicant considers that the historical clay quarry did not excavate below the water table. As there are uncertainties with the exact depth of the historical landfill, separation to groundwater is likely to range from minimal to approximately 1 m.

2.4.3 Leachate management system

Leachate system design

A leachate collection system is present below the current landfill progression and sitting above the historical waste mass. This system was installed after the current landfill progression had commenced and is not present below the far western end of the Stage 1 waste mass (Figure 8). The system has been gradually expanded as the waste mass moves towards the east. The applicant has stated that the location of the leachate pond progresses eastward with the tipping area, with the previous leachate pond forming the base of the next landfill progression.

Leachate drains through the waste mass and is collected by a series of 160 mm perforated pipes laid in a north-south arrangement within aggregate filled trenches. The pipes are connected to two vertical leachate extraction sumps. Accumulated leachate is then pumped or flows under gravity into a leachate pond, constructed immediately east of the current tipping face. The leachate pond is constructed from in-situ soils and has a clay base; however, it is unknown how thick or permeable the clay is.

Topographical survey levels undertaken at the premises in June 2020 determined that the leachate surface within the pond was at 25 mAHD, with the depth of leachate being approximately 1 m at the time. Accordingly, the base of the leachate pond has been estimated as approximately 24 m AHD. This is approximately 1 metre above the base of the historical landfill (23 m AHD).

As the leachate collection system was installed above the historical waste mass and after the current landfill had commenced, it is unable to drain leachate that accumulated within the historical waste mass or the western edge of the Stage 1 waste mass.

Leachate volume management

The applicant manages the volume of leachate generated at the premises using the following methods:

- Accumulation in the leachate pond (typically over winter);
- Passive evaporation (without operator effort) from the surface of the leachate pond; and
- Leachate recirculation onto the waste surface using drip irrigation and/or low-pressure sprays (large nozzle diameters to prevent blockage). This occurs on the active landfill areas and intermediate covered areas draining into the landfill footprint and towards the leachate pond.

Figure 15: Progressive leachate pond

Photo source: Taken by DWER Officer facing southward, 16 December 2020.

Leachate migration

The applicant considers that there is limited ability for lateral containment within the above natural ground level waste mass. The 3 m high vertical clay walls are only present where the walls correspond with the historical clay quarry. Based on the survey levels measured in June 2020, this corresponds to approximately 1 m of historical landfill and 2 m of the current landfill having lateral containment for leachate. It is considered that if the below ground waste mass were to become saturated, leachate would be able to seep out of the above ground external waste batters. It is assumed that at least 1 m (the historical landfill) is currently saturated with leachate, as the position of the leachate system is unable to drain this material.

Leachate monitoring and quality

Licence L6964/1997/11 does not require regular sampling and characterisation of leachate generated from the current landfill. However, the applicant has conducted intermittent leachate monitoring since approximately 2013 and provided the monitoring results to the department through their Annual Environmental Reports. Samples are taken directly from the surface of the leachate pond. A summary of the leachate sampling results since 2013 are shown in Table 2 below.

Table 2: Quality of leachate derived from sampling undertaken by the applicant

Parameter	Minimum concentration (mg/L)	Maximum concentration (mg/L)	Median concentration (mg/L)
Cadmium	0.00005	0.001	0.00005
Chromium	0.021	4.2	0.325
Copper	0.0005	0.035	0.0095
Potassium	129	1,200	740
Manganese	0.05	0.37	0.15
Nickel	0.025	0.62	0.12
Lead	0.0005	0.008	0.004
Zinc	0.016	0.49	0.088

Parameter	Minimum concentration (mg/L)	Maximum concentration (mg/L)	Median concentration (mg/L)
Total Nitrogen	46.1	880	425
Ammonia-N	32.6	710	250
NOx-N	0.005	2	0.005
Chloride	397	3,400	1,600
TDS	1,810	26,000	8,180

2.4.4 Stormwater management

Stormwater runoff is managed at the premises through a number of systems that have been progressively developed as modifications to the premises occurred. The system uses a combination of concrete drains, unlined drains and laminar flow, collecting stormwater from the following areas;

- Roads, hardstands and paved areas;
- Vegetated areas;
- On and around buildings;
- The active landfill area (managed as leachate); and
- Temporarily capped landfill areas.

Uncontaminated stormwater, where topography allows, is directed to internal perimeter drains located on the east, west and south boundary of the premises. The internal drains discharge to two drainage lines located adjacent to the north and south of the premises.

Uncontaminated stormwater that is unable to be directed off-site is captured within a stormwater pond located at the centre, low-point of the premises. The stormwater pond is situated above the historical waste layer and is located directly east of the leachate pond. A clay bund wall separates the stormwater and leachate ponds. The pond is maintained with a 500 mm freeboard and stormwater is used for dust suppression purposes or lost to evaporation. The applicant has indicated that capacity of the pond is increased, where required, by increasing the height of the bund wall separating the stormwater and leachate ponds. Historically this has not occurred, as the ponds are generally emptied before winter and dust suppression water needs to be supplemented through the on-site production bore.

The drainage network is inspected for sediment, litter or any flow blockages at the start of winter and following heavy rainfall events. Where required, vegetation is cleared from the drains to ensure flow is maintained. The depth of water and remaining freeboard in the stormwater pond is visually monitored at the end of winter.

The applicant has identified that the progressive manner in which the landfill is operated will result in the capacity of the current stormwater pond gradually being reduced over time before being used as a base for waste deposition. When this occurs, the applicant intends to maintain freeboard levels by pumping out excess stormwater to the internal perimeter drains. Encroachment and filling within the area of the stormwater pond is part of the final progression of the landfill (Stage 4).

An indicative plan showing existing surface runoff and stormwater management at the premises is contained in Figure 16 below.

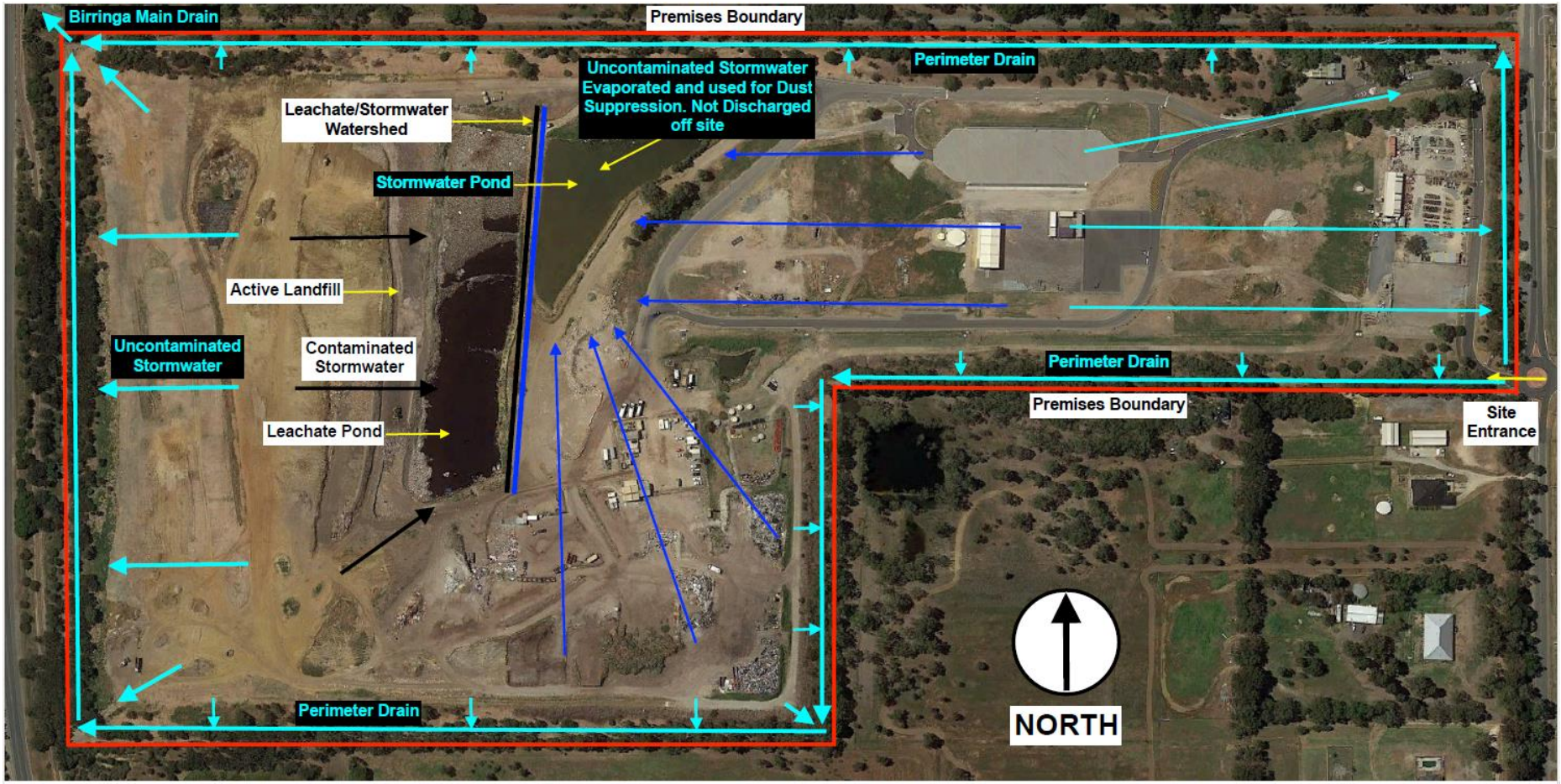


Figure 16: Existing management of surface runoff and stormwater flow at the premises

2.5 Groundwater monitoring

2.5.1 Monitoring network overview

Licence L6964/1997/11 requires the applicant to monitor groundwater quality at three monitoring bores. The bores have been constructed in a nested formation being comprised of shallow (S), intermediate (I) and deep (D) bores. The applicant has also installed and monitors three additional nested wells around the premises. There is no information available relating to the construction and installation of the groundwater monitoring bores.

Groundwater samples are analysed for nutrients, physio-chemical parameters and a suite of heavy metals. The locations of the monitoring bores are shown in Figure 17 below.

2.5.2 Groundwater levels

The Perth Groundwater Atlas lists maximum groundwater levels for the superficial aquifer between approximately 21 - 22 mAHD and minimum groundwater levels between 18 - 19 mAHD.

Monitoring of the shallow groundwater bores has noted that the water table present is likely to be a perched unit that is separated by a clay lens from the permanent superficial aquifer. Groundwater is generally only encountered in the shallow bores during spring monitoring events, occurring at approximately 24 - 26 mAHD. The perched unit is believed to sit approximately 3 m above permanent groundwater.

Sampling of intermediate and deep bores at the premises indicates these are connected and likely to be drilled within the same aquifer system, due to similar groundwater levels being encountered when sampling. Groundwater occurs at approximately 17.5 - 19.5 mAHD in these bores.

2.5.3 Flow direction

Regional groundwater flow direction is generally inferred to be towards the west. Interpolated groundwater contours based on measurements from the intermediate and deep bores, indicate that radial groundwater flow may be occurring in the vicinity of the landfill due to the mounding of groundwater. However further data is required to confirm this, as there has been no sampling from location SP1 since 2018 due to the nested bores being damaged.

Interpolation of shallow groundwater levels within the perched system has not been undertaken since 2018 due to insufficient data points.

2.5.4 Groundwater quality

Groundwater monitoring data from bores SP1, SP2 and SP3 was available from September 2011 to May 2022. The applicant installed additional monitoring bores P1, P2 and P3 in 2017 and monitoring data is available from November 2017 to May 2022 for these bores. Autumn monitoring data from the shallow depth wells is generally not available, as they are dry during this period of the year. There are also a number of damaged wells that have resulted in missing information at certain periods. The highest median concentrations for selected contaminants both up and down gradient of the premises are shown in Table 3 below.

Table 3: Highest median observed concentrations in mg/L for select parameters. Bore number is shown in brackets.

Bore location	TDS	Chloride	Potassium	Ammonia	TN	Copper	Nickel	Zinc
Shallow bores								
Upgradient (SP3)	11,100	6,100	2.5	0.065	0.45	0.0025	0.023	0.46
Downgradient	6,050 (P3)	2,200 (P3)	205 (P3)	305 (P3)	315 (P3)	0.014 (SP2)	0.0395 (P3)	0.015 (SP2)
Intermediate bores								
Upgradient (SP3)	4,100	2,300	4	0.12	0.1	0.001	0.002	0.005
Downgradient	2,550 (P3)	1,150 (P3)	11 (SP2)	4.35 (P2)	5.65 (P2)	0.002 (P3)	0.013 (SP2)	0.015 (P3)
Deep bores								
Upgradient (SP3)	5,675	2,950	2.5	0.07	0.2	0.0005	0.01	0.016
Downgradient	2,300 (P3)	1,200 (P3)	24 (SP2)	1.6 (SP2)	3.3 (SP2)	0.00075 (P1)	0.009 (P3)	0.011 (P3)

2.5.5 Key findings

The Delegated Officer has reviewed and sought advice on groundwater monitoring at the premises and has found:

1. Monitoring of shallow bores shows elevated concentrations of indicator species that are generally associated with landfill leachate are present. Water levels observed in the shallow bores are also similar to the inferred base of the historical landfill, indicating that the perched system may be in direct contact with landfill waste and leachate when it's present during winter and spring.
2. Monitoring of the intermediate and deep bores shows some evidence of elevated ammonia, total nitrogen and potassium concentrations. However, impacts to the permanent groundwater aquifer appear to be minor.
3. Limited monitoring data for shallow depth bores and for all depths at the SP1 location has hindered the ability to interpolate local groundwater flow direction.
4. The nested wells at location SP1 have not been monitored since November 2018 due to damage to all bore depths. Bores SP2-S and P1-S are also lacking monitoring data, as they are either damaged or have not been drilled to an appropriate depth to allow monitoring of the perched system to occur.
5. Groundwater monitoring at the premises would be improved through the installation of additional downgradient wells and analysis for other indicators of landfill leachate impacts. This would provide a greater understanding of potential impacts to groundwater and should replace the requirement to conduct ongoing monitoring of the deeper wells.

Figure 17: Nested groundwater bore locations

Works Approval: W6814/2023/1

2.6 *Contaminated Sites Act 2003*

The premises, being Lot 200 on Deposited Plan 400460, is classified under the *Contaminated Sites Act 2003* as '*possibly contaminated – investigation required'*. The site was classified based on information submitted in 2010 and the classification was revised in October 2013. DWER's Contaminated Sites Register sets out the reasons for classification as follows:

- The site is currently and historically used as a landfill facility, which is a land use that has the potential to cause contamination.
- Groundwater monitoring results covering the period 2008 to 2012 have identified elevated salinity, iron, chloride and sulfate in groundwater beneath the site. Groundwater monitoring results from December 2012 found that iron and chloride were present in concentrations exceeding Australian Drinking Water Guidelines (ADWG) and domestic non-potable use guidelines (NPUG).
- Soil investigations have not been carried out and the quality of soil at the site is unknown.
- Due to the exceedance of tier 1 screening criteria there are grounds to indicate possible contamination of the site. Further investigation is required to determine the risk to human health, the environment and environmental values.

3. Risk assessment

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

To establish a risk event there must be an emission, a receptor which may be exposed to that emission through an identified actual or likely pathway, and a potential adverse effect to the receptor from exposure to that emission.

3.1 Source-pathways and receptors

3.1.1 Emissions and controls

The key emissions and associated actual or likely pathway during construction and operation which have been considered in this decision report are detailed in Table 4 below. Table 4 also details the control measures the applicant has proposed to assist in controlling these emissions.

Table 4: Proposed applicant controls

Emission	Sources	Potential pathways	Proposed controls
Construction			
Dust	Construction activities during: - construction of leachate ponds; - installation of landfill capping system; - construction of vehicle washdown bay;	Air/windborne pathway	• Minimise dust generating construction activities during adverse wind conditions. • Wetting exposed soils or fill material as necessary when conducting earthworks. • Wetting down of haul roads and stockpiles as necessary. • Vehicles to use designated haul roads and slow speeds. • Application of dust suppressant chemicals if necessary (last resort).

Emission	Sources	Potential pathways	Proposed controls
Noise	- construction of new access road; and - relocation of landfill gas flare.	Air/windborne pathway	• Day-time hours of operations. • Low frequency “croaker” type reversing beacons.
Windblown waste	Exposure of existing waste mass during trimming of landfill surface for capping installation	Air/windborne pathway	• Exposure of the waste mass is not expected, as the design intent is to only trim the surface soil layer to remove excess thickness down to approximately 500 mm of soil that is retained over the waste surface. • Where waste is exposed, surface trimming will cease and the area will be immediately covered with minimum 500 mm of soil.
Odour	Decommissioning of old washdown bay sump		• Age of the waste likely to mean that the vast majority of the readily putrescible and odourous waste would have already decayed. • If the sump is saturated, odourous liquid will be removed via vacuum truck and disposed offsite. • If solids removal is odourous, the size of the exposed excavation area and volume of material being removed at one time will be reduced.
Landfill gas (including odour)	Relocation of landfill gas flare Excavation around landfill gas infrastructure during capping works	Air/windborne pathway	• Temporary relocation proposed to reduce period in which flare is not operating. • 99% methane destruction according to flare specifications. • Works within 5 m of any landfill gas infrastructure will be under supervision of a landfill gas management specialist.
Operation			
Dust	Final capped surface of landfill	Air/windborne pathway	• Capping design includes vegetated layer. • Drainage layer.
Sediment laden stormwater		Surface runoff	
Landfill gas (including odour)	Waste decomposition within capped landfill	Horizontal and lateral migration Air/windborne pathway	• Construction CQA. • Capping design including impermeable LLDPE liner. • Gas collection layer as part of capping design.

Emission	Sources	Potential pathways	Proposed controls
			• Gas extraction network and flare. • Where landfill gas odour emissions are identified, the extraction system will be adjusted to increase the rate of gas extraction.
Odour	Storage and evaporation of leachate within leachate ponds	Air/windborne pathway	• Limited pond depth to promote aerobic conditions. • Where significant odours occur, pumping of leachate and use of evaporation sprays will be scheduled to occur during more appropriate weather conditions such as easterly winds.
	Waste vehicle cleaning in wash facility		• Liquid drainage to prevent ponding. • Automated pumping system to remove liquid from sump to evaporation pond. • Separated solids stored in storage containers protected from wind. • Solids removed to onsite landfill for burial or disposed offsite after closure of landfill. • Only low volumes (2 kg) expected per vehicle, comprised mainly of plastics and paper. • Regular cleaning of wash bays.
Landfill leachate	Containment loss from leachate ponds	Surface runoff	• Construction CQA. • Pond sizing based on historical leachate pond sizing. • Improved leachate evaporation using spray system. • HDPE liner and anchor trenching. • Proposed contingency measures to control leachate volume. • Capping design including impermeable LLDPE liner and drainage layer to prevent rainfall infiltration to waste mass will reduce leachate generation over-time.
		Seepage to soil and groundwater	
	Containment loss from landfill waste mass	Surface runoff	• Construction CQA. • Capping design to have a lower permeability than in-situ clay landfill base. • Capping design including impermeable LLDPE liner and drainage layer to prevent rainfall infiltration to waste mass and reduce leachate generation potential.
		Seepage to soil and groundwater	

Emission	Sources	Potential pathways	Proposed controls
Vehicle Wash-water	Waste vehicle cleaning in wash facility	Surface runoff	• Low permeability of wash bays and drainage infrastructure due to concrete and asphalt construction. • Wash bay structure and surface grading to contain and direct wash water to drainage infrastructure. • Solids separation to prevent clogging of drainage infrastructure. • Wash-water to be contained in concrete sump fitted with float switch and 6 L/s pump at 7 m head pressure. • Automatic activation of pump by float switch to drain sump contents to leachate ponds.
		Seepage to soil and groundwater	
Windblown waste		Air/windborne pathway	• Separated solids stored in storage containers protected from wind. • Solids removed to onsite landfill for burial or disposed offsite after closure of landfill.

3.1.2 Receptors

In accordance with the *Guideline: Risk Assessment* (DWER 2020), the delegated officer has excluded the applicant's employees, visitors, and contractors from its assessment. Protection of these parties often involves different exposure risks and prevention strategies and is provided for under other state legislation.

Table 5 and Figure 18 below provides a summary of potential human and environmental receptors that may be impacted as a result of activities upon or emission and discharges from the prescribed premises *(Guideline: Environmental Siting* (DWER 2020)).

Table 5: Sensitive human and environmental receptors and distance from prescribed activity

Receptors	Distance from prescribed activity
Human receptors	
Closest sensitive receptors (south)– Rural residential homesteads (RR01-RR06)	Between approximately 350 - 375 m south of the landfill area
Closest sensitive receptors (southeast) – Rural residential homesteads (RR07-RR14)	Between approximately 415 m - 545 m southeast of the landfill area
Closest sensitive receptors (east) – Rural residential homesteads (RR15-RR18)	Between approximately 380 m - 545 m east of the landfill area
Closest sensitive receptors (northeast) – Rural residential homesteads (RR19-RR27)	Between approximately 585 m - 1,350 m northeast of the landfill area

Receptors	Distance from prescribed activity
Closest sensitive receptors (north) – Urban residential development	Approximately 855 m north of the landfill area
Closest sensitive receptors (northwest) – Rural residential homesteads (RR28-RR39)	Between approximately 310 m - 1,310 m northwest of the landfill area
Closest sensitive receptors (west) – Rural residential homesteads (RR40-RR45)	Between approximately 430 m - 500 m west of the landfill area
Closest sensitive receptors (southwest) – Rural residential homesteads (RR46-RR60)	Between approximately 490 m - 1,345 m southwest of the landfill area
Environmental receptors	
Underlying groundwater – Perched seasonal and permanent superficial aquifer	Groundwater monitoring undertaken by the applicant indicates that a perched groundwater system may be present during parts of the year, generally following winter rainfall. The perched system is located between approximately 21 – 26 mAHD across the premises. Permanent groundwater is located between approximately 17.8 to 20.8 mAHD across the premises. Based on information submitted by the Licence Holder, permanent groundwater is located approximately 5 m below the base of the current leachate pond. Survey levels suggest that there may not be separation between the leachate pond and perched groundwater when present. Regional and site-specific groundwater information indicates that flow is west-southwest towards the Birriga Main Drain, with groundwater maxima and minima being 22 mAHD and 19 mAHD respectively. The base of the superficial aquifer ranges from 5 – 10 mAHD across the Premises. There are approximately 17 beneficial users of groundwater licensed to abstract groundwater from the superficial aquifer located within 1 km of the western (downgradient) boundary of the premises.
Surface water – Major drains	Approximately 10 m north and south of the premises boundary. The drains connect to the Birriga Main Drain approximately 2.2 km west of the premises.

Receptors	Distance from prescribed activity
Surface water – Birriga Main Drain	Approximately 2.2 km west of the landfill area. The Birriga Main Drain drains the northern portion of the Serpentine catchment and was constructed to intercept both surface and groundwater. It flows from the north-east to the south-west and is around 2 m deep. Approximately 8.5 GL/yr of groundwater is discharged to the drain, as it receives groundwater flowing west from the Darling Scarp and southeast from the Jandakot Mound during winter. Groundwater moves laterally below the channel to the south in summer.
Geomorphic wetlands of the Swan Coastal Plain – Unnamed basin sumpland	Approximately 1,165 m west of the landfill area. The wetland is classified as resource enhancement.
Threatened and Priority Ecological Communities – Banksia Dominated Woodlands of the Swan Coastal Plain IBRA Region (EPBC Act Endangered) (BC Act Priority 3)	Approximately 1,050 m west of the landfill area.
Bush Forever site – Site 345: Forrestdale Lake and adjacent bushland.	Approximately 3.7 km west-southwest and down hydraulic gradient of the landfill area.
Bush Forever site – Site 347: Wandi nature reserve and Anketell Road Bushland	
Regional Park – Jandakot Regional Park (includes Bush Forever Site 347 and Modong nature reserve)	
Public Drinking Water Source Area – Jandakot Underground Water Pollution Control Area	Approximately 5.3 km west of the landfill area and potentially downgradient.

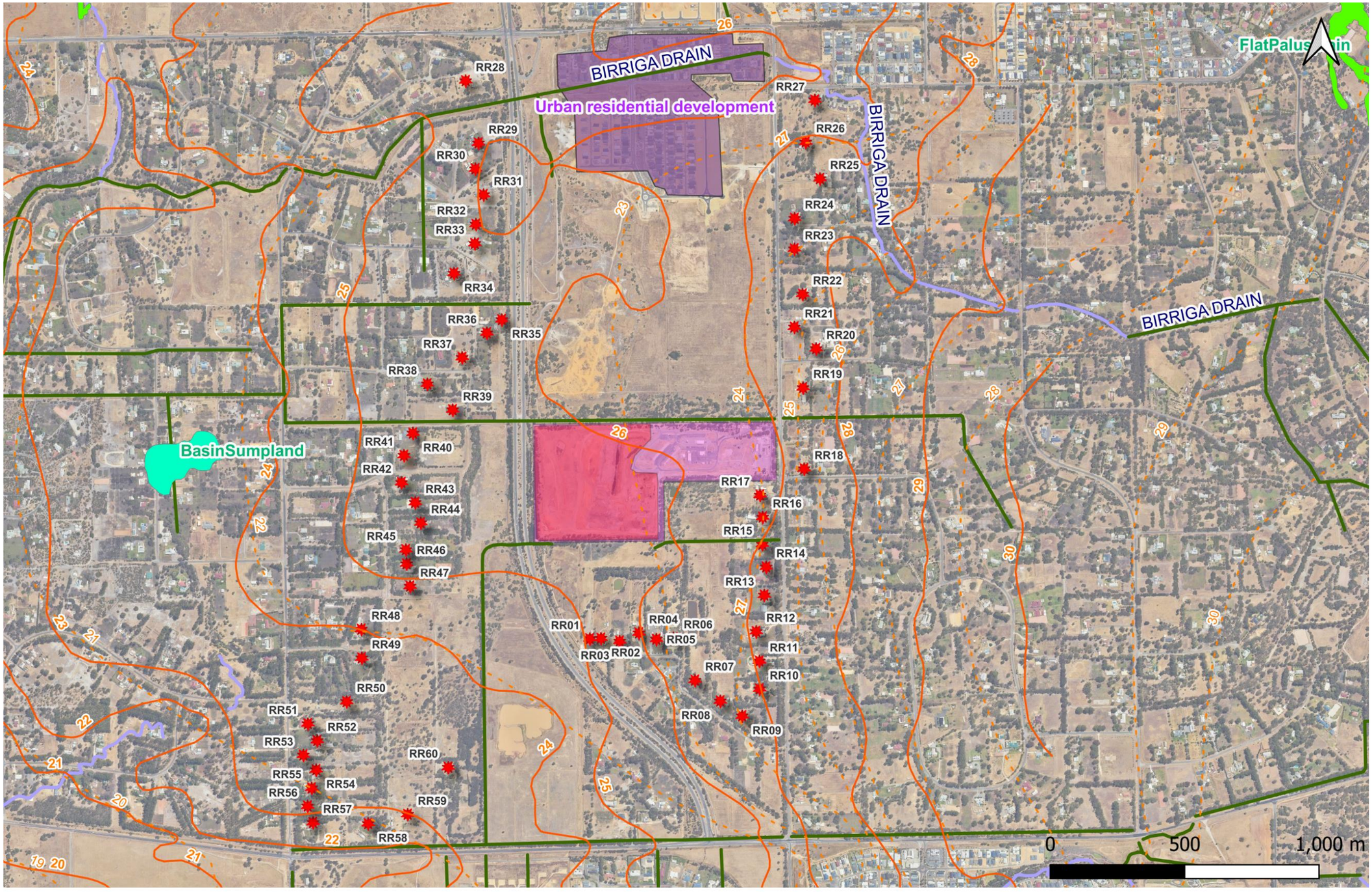
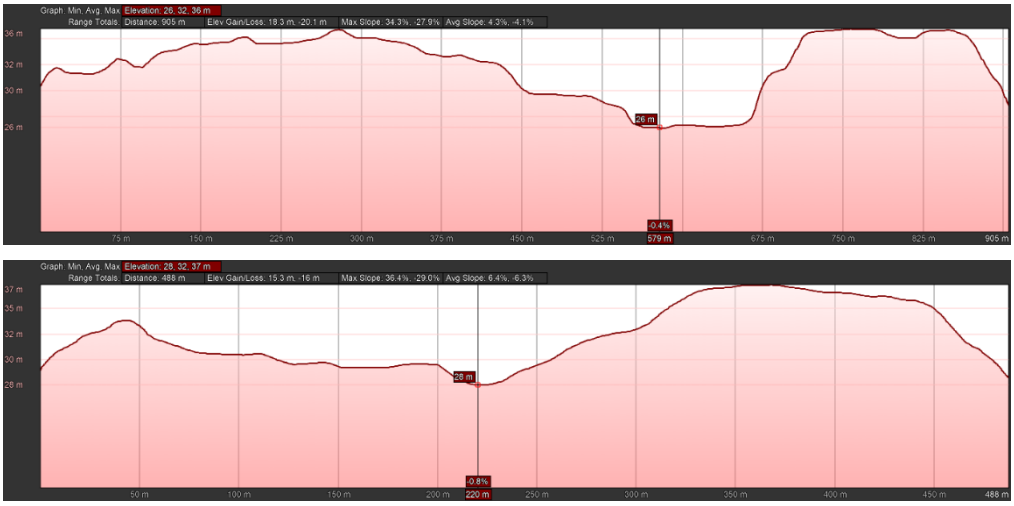
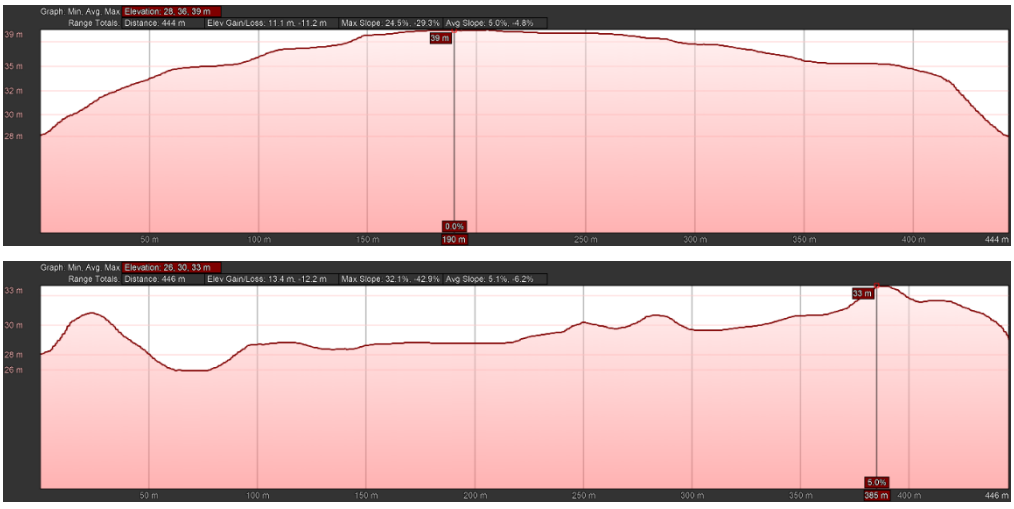


Figure 18: Potential receptors

3.1.3 Pathways

Information relating to potential pathways and site characteristics at the premises are provided in Table 6 below.

Table 6: Potential pathways and environmental conditions relevant to the premises

Aspect	Details
Topography	The premises sits on a highly modified land surface due to historical cut and fill activities. Accordingly, the premises topography is highly variable. The surrounding land to the north and south of the premises slopes down gently from east to west between approximately 27 to 25 mAHD. The premises is now raised above natural ground level, ranging from 25 to 39 mAHD, with higher areas attributed with completed portions of the landfill and lower areas being actively used for landfilling or leachate and stormwater containment. Surrounding land within 1 km west of the premises is situated between 22 – 25 mAHD. The approximate elevation profile across the premises as estimated by the Google Earth digital elevation model from 2022 data is contained in Figure 19 and Figure 20 below.  **Figure 19: Premises East to West elevation profile from the site entrance to western boundary (top) and the southern section of the premises (bottom)**  **Figure 20: Premises North to South elevation profile across the covered landfill area (top) and current operational filling/storage area (bottom)**

Aspect	Details
Surface geology	The premises overlies Guildford Clay of the Guildford Formation. Guildford Clay is predominantly of alluvial origin and is generally constrained to within 5 to 10 km of the Darling Scarp. It unconformably overlies the Yoganup and Ascot formations. Guildford Clay is described as pale grey, blue, but mostly brown silty and slightly sandy clay. It commonly contains lenses of fine- to coarse-grained very poorly sorted conglomeratic sand at its base. Its thickness is about 12 m in the east, thinning rapidly to the west. The Perth 1:50,000 Geological Series further describes surface geology at the Premises as containing: • SAND (S10) - white to pale grey at surface, yellow at depth, fine to medium-grained, moderately sorted, subangular to subrounded, minor heavy minerals, of eolian origin over sandy clay to clayey sand of the Guildford Formation. • SANDY CLAY (Cs) - white-grey to brown, fine to coarse-grained, subangular to rounded sand, clay of moderate plasticity. Gravel and silt layers are found nearer to the Darling Scarp. Surface soils at the premises are mapped as the Pinjarra System (Map Unit 213Pj). Soils of the zone are generally clayey to sandy alluvial soils with wet areas.
Hydrology and drainage	The premises is located in the Birriga sub-catchment of the Peel Estuary-Serpentine River catchment. The catchment has an extensive open drainage network that includes the Birrega, Oaklands, Peel and Punrak Main Drains, associated branch drains, and the lower Serpentine River, which eventually discharges to the Peel Harvey Estuary to the south. Parts of the catchment are prone to flooding and seasonal inundation from groundwater. The Dog Hill gauging station (614030) records very low flows from the Birriga Main Drain during summer, indicating that the drain does not intercept the groundwater table during the dry season. However, the drain is important for conveying water during winter because the low-lying area between the Jandakot Mound and Darling Scarp is prone both to flooding and inundation from groundwater. These winter flows discharge to the Serpentine River just upstream of the Dog Hill gauging station. The premises is also located within the mapped area for the Armadale Palusplain. The palusplain is a seasonally waterlogged, flat wetland typical of the duplex and sandy soils found on the Pinjarra Plain to the east of the Swan Coastal Plain (Hill et al., 1996). The wetland is classified multiple use due to its historical disturbance and limited environmental value. Multiple use wetlands have few remaining important attributes and functions (DBCA, 2017). Overland (surface) runoff through both on and off-site drainage are considered potential pathways to surface water. The premises is graded to direct stormwater flowing across the capped landfill area and the transfer station towards an internal perimeter drain. The perimeter drain directs stormwater to the northwest and southwest towards outlets which flows to the Birriga Main Drain located approximately 2.2 km west of the premises. Stormwater runoff occurring within operational storage areas is directed towards a stormwater pond where it is contained for evaporation and dust suppression. Contaminated stormwater runoff from the landfilling area and waste mass is directed towards the leachate pond. The premises drainage layout was shown previously in Figure 16.

<table>
<tr><th>Aspect</th><th>Details</th></tr>
<tr><td>Meteorology</td><td>The nearest Bureau of Meteorology weather station is the Jandakot Aero weather station (No. 009172). This weather station is located approximately 13 km northwest of the premises. The station provides the following wind speed and direction information, based on records from 1989 to 2022:
The prevailing wind direction is easterly in the morning (9am), changing direction to south-westerly in the afternoon (3pm).
Wind speeds during both periods are typically light to moderate in the morning and moderate in the afternoon according to the Beaufort Wind Scale.
Table 7: Mean evaporation and rainfall for the Jandakot area (1972-2023). Maximum and minimum values are shown in red and blue respectively
<table>
<tr><th>Parameter</th><th>Jan</th><th>Feb</th><th>Mar</th><th>Apr</th><th>May</th><th>Jun</th><th>Jul</th><th>Aug</th><th>Sep</th><th>Oct</th><th>Nov</th><th>Dec</th><th>Year</th></tr>
<tr><td>Evap. (mm)</td><td>286</td><td>240</td><td>205</td><td>125</td><td>83</td><td>60</td><td>62</td><td>76</td><td>100</td><td>151</td><td>204</td><td>262</td><td>1855</td></tr>
<tr><td>Rainfall (mm)</td><td>15.1</td><td>17.4</td><td>17.1</td><td>41.5</td><td>104.2</td><td>150.9</td><td>174.4</td><td>128.8</td><td>83.2</td><td>46.9</td><td>27.7</td><td>10</td><td>811.5</td></tr>
</table></td></tr>
</table>

3.2 Risk ratings

Risk ratings have been assessed in accordance with the *Guideline: Risk Assessments* (DWER 2020) for each identified emission source and takes into account potential source-pathway and receptor linkages as identified in Section 3.1. Where linkages are in-complete they have not been considered further in the risk assessment.

Where the applicant has proposed mitigation measures/controls (as detailed in Section 3.1), these have been considered when determining the final risk rating. Where the delegated officer considers the applicant's proposed controls to be critical to maintaining an acceptable level of risk, these will be incorporated into the works approval as regulatory controls.

Additional regulatory controls may be imposed where the applicant's controls are not deemed sufficient. Where this is the case the need for additional controls will be documented and justified in Table 8.

Works Approval W6814/2023/1 that accompanies this decision report authorises construction and time-limited operations. The conditions in the issued works approval, as outlined in Table 8 have been determined in accordance with *Guidance Statement: Setting Conditions* (DER 2015).

An amendment to Licence L6964/1997/11 is required following the time-limited operational phase authorised under the works approval, in order to authorise emissions associated with the ongoing operation of the new leachate ponds, vehicle washdown bay and permanent relocation of the landfill gas flare at the premises. A risk assessment for the operational phase has been included in this decision report, however licence conditions will not be finalised until the department assesses the licence amendment application.

Table 8: Risk assessment of potential emissions and discharges from the premises during construction and operation

Risk events					Risk rating [1] C = consequence L = likelihood	Applicant controls sufficient?	Conditions [2] of works approval	Justification for additional regulatory controls
Sources / activities	**Potential emission**	**Potential pathways and impact**	**Receptors**	**Applicant controls**				
Construction								
Construction activities during: - construction of leachate ponds; - installation of landfill capping system; - construction of vehicle washdown bay; - construction of new access road; and - relocation of landfill gas flare.	Dust	Air / windborne pathway causing impacts to health and amenity	Closest sensitive human receptors (Table 5 and Figure 18)	Refer to Table 4	C = Minor L = Possible **Medium Risk**	Y	The provisions of section 49 of the EP Act (causing pollution and unreasonable emissions) apply	N/A
	Noise			Refer to Table 4	C = Minor L = Possible **Medium Risk**	Y	The Environmental Protection (Noise) Regulations 1997 apply	N/A
Decommissioning of old washdown bay sump	Odour	Air / windborne pathway causing impacts to amenity	Closest sensitive human receptors (Table 5 and Figure 18)	Refer to Table 4	C = Minor L = Unlikely **Medium Risk**	Y	Condition 1: Table 1 Rows 1-4 (g) Condition 1: Table 1 Row 9	N/A
Exposure of existing waste mass during trimming of landfill surface for capping installation	Windblown waste			Refer to Table 4	C = Slight L = Unlikely **Low Risk**	Y	Condition 1: Table 1 Rows 1-4 (g)	N/A
Excavation around landfill gas infrastructure during capping works	Landfill gas (including odour)	Air/windborne pathway causing impacts to health and amenity	Closest sensitive human receptors (Table 5 and Figure 18)	Refer to Table 4	C = Minor L = Unlikely **Medium Risk**	Y	Condition 1: Table 1 Rows 1-4 (g)(h)	N/A
Relocation of landfill gas flare		Vertical and lateral migration through soil Air/windborne pathway causing impacts to health and amenity	Closest sensitive human receptors (Table 5 and Figure 18)		C = Minor L = Rare **Low Risk**	Y	Condition 1: Table 1 Row 7 (a)(b)(d)	N/A
Operation (including time-limited-operations operations)								
Final capped surface of landfill	Dust	Air / windborne pathway causing impacts to health and amenity	Closest sensitive human receptors (Table 5 and Figure 18)	Refer to Table 4	C = Minor L = Rare **Low Risk**	Y	Condition 1: Table 1 Rows 1-4 (a)(b)(c)(d) Conditions 3, 4, 5	N/A
	Sediment laden stormwater	Overland runoff potentially causing ecosystem disturbance or impacting surface water quality	Adjacent major drains Unnamed basin sumpland Birriga Main Drain		C = Minor L = Rare **Low Risk**	Y	Condition 1: Table 1 Rows 1-4 (a)(b)(c)(d)(e) Condition 1: Table 1 Row 10 Conditions 3, 4, 5	N/A
Waste decomposition within capped landfill	Landfill gas (including odour)	Vertical and lateral migration through soil Air/windborne pathway causing impacts to health and amenity	Closest sensitive human receptors (Table 5 and Figure 18)	Refer to Table 4	C = Slight L = Unlikely **Low Risk**	Y	Condition 1: Table 1 Rows 1, 2, 3, 4, 11 Condition 1: Table 1 Row 7 (c) Conditions 3, 4, 5, 9 Condition 8: Table 3 Row 2	N/A
Containment loss from landfill waste mass	Landfill leachate	Overland runoff potentially causing ecosystem disturbance or impacting surface water quality	Adjacent major drains Unnamed basin sumpland Birriga Main Drain	Refer to Table 4	C = Moderate L = Unlikely **Medium Risk**	Y	Condition 1: Table 1 Rows 1-4 (a)(b)(c)(d)(e) Condition 1: Table 1 Rows 6, 10, 11 Conditions 3, 4, 5, 8	N/A

Risk events Sources / activities	Potential emission	Potential pathways and impact	Receptors	Applicant controls	Risk rating [1] C = consequence L = likelihood	Applicant controls sufficient?	Conditions [2] of works approval	Justification for additional regulatory controls
Containment loss from landfill waste mass (cont.)	Landfill leachate (cont.)	Seepage to underlying soils and groundwater causing impacts to downgradient beneficial use and receptors	Underlying groundwater Downgradient beneficial users of groundwater	Refer to Table 4	C = Moderate L = Possible **Medium Risk**	N	Condition 1: Table 1 Rows 1-4 (a)(b)(c)(d)(e) Condition 1: Table 1 Rows 6, 10, 11 Conditions 3, 4, 5, 8 **<u>Condition 2</u>**	The delegated officer has reviewed historical information relating to the landfill outlined in Section 2.4 and the groundwater information outlined in Section 2.5. The information suggests that groundwater may be in contact with waste material and leachate at the premises during wet periods of the year. Available monitoring information provides evidence of landfill leachate impacts to the shallow perched system (when present) and some indicators of landfill leachate impacts to permanent groundwater. The delegated officer has sought advice from the department's Contaminated Sites Branch as there are a number of beneficial users of groundwater located downgradient of the premises. The advice received is that impacts to permanent groundwater appear minor (based on availbale information), although changes to the groundwater monitoring network and suite of parameters is required to provide a greater understanding of potential impacts. Accordingly, the delegated officer has specified a condition requiring the construction of two additional downgradient monitoring bores in the works approval. The condition will also require the repair or replacement of nested well SP1, bore SP2-S and bore P1-S, which have been unable to be monitored for a number of years. The delegated officer also intends to amend Licence L6964/1997/11 to improve the suite of monitoring parameters, remove the requirement to monitor deep bores and include the three wells monitored by the applicant which are not currently on the licence.
Storage and evaporation of leachate within leachate ponds	Odour	Air / windborne pathway causing impacts to amenity	Closest sensitive human receptors (Table 5 and Figure 18)	Refer to Table 4	C = Moderate L = Possible **Medium Risk**	Y	Condition 8: Table 3 Row 1(d)	N/A
Containment loss from leachate ponds	Landfill leachate and vehicle wash-water	Overland runoff potentially causing ecosystem disturbance or impacting surface water quality	Adjacent major drains Unnamed basin sumpland Birriga Main Drain	Refer to Table 4	C = Moderate L = Rare **Medium Risk**	Y	Condition 1: Table 1 Row 5 (a)(d)(f)(g)(h)(i)(j) Condition 1: Table 1 Rows 10, 11 Conditions 3, 4, 5 Condition 8: Table 3 Row 1(b)(c)	N/A
		Seepage to underlying soils and groundwater causing impacts to downgradient beneficial use and receptors	Underlying groundwater Downgradient beneficial users of groundwater				Condition 1: Table 1 Row 5 (a)(b)(c)(d)(e) Condition 1: Table 1 Row 11 Conditions 3, 4, 5 Condition 8: Table 3 Row 1(a)	N/A
Waste vehicle cleaning in wash facility	Odour	Air / windborne pathway causing impacts to amenity	Closest sensitive human receptors (Table 5 and Figure 18)	Refer to Table 4	C = Slight L = Unlikely **Low Risk**	Y	Condition 1: Table 1 Row 8 Conditions 3, 4 Condition 8: Table 3 Row 3	N/A
	Windblown waste			Refer to Table 4	C = Slight L = Unlikely **Low Risk**	Y	Condition 1: Table 1 Row 8(a)(c) Conditions 3, 4 Condition 8: Table 3 Row 3(b)	N/A

Risk events Sources / activities	Potential emission	Potential pathways and impact	Receptors	Applicant controls	Risk rating [1] C = consequence L = likelihood	Applicant controls sufficient?	Conditions [2] of works approval	Justification for additional regulatory controls
Waste vehicle cleaning in wash facility (cont.)	Wash-water	Overland runoff potentially causing ecosystem disturbance or impacting surface water quality	Adjacent major drains Unnamed basin sumpland Birriga Main Drain	Refer to Table 4	C = Minor L = Rare **Low Risk**	Y	Condition 1: Table 1 Rows 8, 10, 11 Conditions 3, 4 Condition 8: Table 3 Row 3(a)(c)	N/A
		Seepage to underlying soils and groundwater causing impacts to downgradient beneficial use and receptors	Underlying groundwater Downgradient beneficial users of groundwater				Condition 1: Table 1 Rows 8, 11 Conditions 3, 4 Condition 8: Table 3 Row 3(a)	N/A

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

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

4. Consultation

Table 9 provides a summary of the consultation undertaken by the department.

Table 9: Consultation

Consultation method	Comments received	Department response
Application advertised on the department's website on 29 June 2023	None received.	N/A
Individuals submitting complaints in relation to the premises between 2022 – 2023 advised of application on 29 June 2023	None received.	N/A
Applicant was provided with draft documents on 17 August 2023	The applicant responded on 18 August 2023 that they had no comments and waived the remainder of the comment period.	N/A

5. Conclusion

Based on the assessment in this decision report, the delegated officer has determined that a works approval will be granted, subject to conditions commensurate with the determined controls and necessary for administration and reporting requirements.

The delegated officer has also determined that amendments to Licence L6964/1997/11, which the applicant holds in relation to the premises, are also required. These amendments have been initiated by the department in parallel with the granting of this works approval. The amendments relate to:

- Condition 4 (final cover requirements): This condition requires amending, as it contradicts the capping works proposed in this application and Works Approval W6814/2023/1.
- Condition 16 (groundwater monitoring): This condition will be amended as follows:
    - a requirement to adequately maintain monitoring bores will be included;
    - monitoring well locations P1, P2 and P3 will be added;
    - the requirement to monitor deep bores will be removed; and
    - the monitoring suite will be updated to include the below parameters.

Field measurements	General water quality parameters	Metals	Hydrocarbons
Oxidation-reduction potential, temperature and dissolved oxygen	Total organic carbon, major cations (calcium, magnesium and sodium), major anions (sulphate, bicarbonate and carbonate), methane, total phosphorus, total Kjeldahl nitrogen and oxidised nitrogen	Arsenic and ferrous iron	BTEX (benzene, toluene, ethylbenzene, xylene) and total recoverable hydrocarbons

References

1. Department of Biodiversity, Conservation and Attractions (DBCA) 2017, *A methodology for the evaluation of wetlands on the Swan Coastal Plain, Western Australia*, Perth, Western Australia.
2. Department of Environment Regulation (DER) 2015, *Guidance Statement: Setting Conditions*, Perth, Western Australia.
3. Department of Water (DoW) 2015, *Birrega and Oaklands flood modelling and drainage study*, Water Science Technical Series Report No. 71, Perth, Western Australia.
4. Department of Water and Environmental Regulation (DWER) 2020, *Guideline: Environmental Siting*, Perth, Western Australia.
5. DWER 2020, *Guideline: Risk Assessments*, Perth, Western Australia.
6. Environmental Protection Authority Victora (EPAV) 2015, *788.3: Siting, design, operation and rehabilitation of landfills,* Best Practice Environmental Management Series, Melbourne, Victoria.
7. Golder 2014, *Armadale Landfill and Recycling Facility Gas System Works Approval Application Supporting Information*, document prepared for the City of Armadale.
8. IW Projects 2020, *Armadale Landfill and Recycling Facility Leachate Management Plan*, document prepared for the City of Armadale.
9. MRA Consulting Group 2017, *Review of the City of Armadale Landfill & Recycling Facility Licence: Information for Department of Environment Regulation*, document prepared for the City of Armadale.

Appendix 1: Application validation summary

SECTION 1: APPLICATION SUMMARY					
Application type					
Works approval	☒				
Licence	☐	Relevant works approval number:		None	☐
		Has the works approval been complied with?		Yes ☐	No ☐
		Has time limited operations under the works approval demonstrated acceptable operations?		Yes ☐	No ☐ N/A ☐
		Environmental Compliance Report / Critical Containment Infrastructure Report submitted?		Yes ☐	No ☐
		Date Report received:			
Renewal	☐	Current licence number:			
Amendment to works approval	☐	Current works approval number:			
Amendment to licence	☐	Current licence number:			
		Relevant works approval number:		N/A	☐
Registration	☐	Current works approval number:		None	☐
Date application received		29 May 2023			
Applicant and Premises details					
Applicant name/s (full legal name/s)		City of Armadale			
Premises name		City of Armadale Landfill and Recycling Facility			
Premises location		Lot 600 on Deposited Plan 400460 CoT Volume 2828 Folio 800 145 – 147 Hopkinson Road HILBERT WA 6112			
Local Government Authority		City of Armadale			
Application documents					
HPCM file reference number:		A2179383			
Key application documents (additional to application form):		Supporting Document Appendix 1 – Landfill Closure and Post Closure Management Plan Appendix 2 – Landfill capping and Other Works Drawings Appendix 3 – Capping and Other Works Specification Appendix 4 – Capping and Other Works CQA Plan Appendix 5 – Leachate Pond Evaporation Potential Appendix 6 – IFD Design Rainfall Depth Appendix 7 – Leachate Management Plan Appendix 8 – Landfill Gas Management Plan Appendix 9 – Stormwater Management Plan			
Scope of application/assessment					

Summary of proposed activities or changes to existing operations.	**Works approval** Construction of landfill capping, leachate pond construction, new vehicle washdown facility construction including backfill of existing washdown, relocation of landfill gas flares/infrastructure and a new internal access road. Leachate ponds and new vehicle wash down facility will need time-limited operations. The landfill capping component of the application covers the complete closure of the landfill over multiple stages. Stage 1 covers capping of already completed areas and other stages are for capping of areas to be completed in the near future. The landfill is expected to stop accepting waste and reach final waste profile heights by 31 December 2024. The new leachate ponds are both for ongoing landfill operations up to the end of 2024 and for post-closure leachate collection from the capped waste mass.

Category number/s (activities that cause the premises to become prescribed premises)

Table 1: Prescribed premises categories

Prescribed premises category and description	Assessed production or design capacity	Proposed changes to the production or design capacity (amendments only)
Category 57: Used tyre storage (general)	Works approval not related to this activity	
Category 61: Liquid waste facility	Works approval not related to this activity	
Category 62: Solid waste depot	Works approval not related to this activity	
Category 64: Class II or III putrescible landfill site	No change to existing 100,000 tonnes per annual period capacity on licence.	

Legislative context and other approvals

Has the applicant referred, or do they intend to refer, their proposal to the EPA under Part IV of the EP Act as a significant proposal?	Yes ☐ No ☒	Referral decision No: Managed under Part V ☐ Assessed under Part IV ☐
Does the applicant hold any existing Part IV Ministerial Statements relevant to the application?	Yes ☐ No ☒	Ministerial statement No: EPA Report No:
Has the proposal been referred and/or assessed under the EPBC Act?	Yes ☐ No ☒	Reference No:
Has the applicant demonstrated occupancy (proof of occupier status)?	Yes ☒ No ☐	Certificate of title ☐ General lease ☐ Expiry: Mining lease / tenement ☐ Expiry: Other evidence ☒: LGA landowner and previously demonstrated
Has the applicant obtained all relevant planning approvals?	Yes ☐ No ☐ N/A ☒	Approval: Expiry date: If N/A explain why? Public works by LGA

Has the applicant applied for, or have an existing EP Act clearing permit in relation to this proposal?	Yes ☐ No ☒	CPS No: N/A No clearing is proposed.
Has the applicant applied for, or have an existing CAWS Act clearing licence in relation to this proposal?	Yes ☐ No ☒	Application reference No: N/A Licence/permit No: N/A No clearing is proposed.
Has the applicant applied for, or have an existing RIWI Act licence or permit in relation to this proposal?	Yes ☐ No ☒	Application reference No: Licence/permit No: GWL178204
Does the proposal involve a discharge of waste into a designated area (as defined in section 57 of the EP Act)?	Yes ☐ No ☒	Name: N/A Type: N/A Has Regulatory Services (Water) been consulted? Yes ☐ No ☐ N/A ☒ Regional office: Swan Avon
Is the Premises situated in a Public Drinking Water Source Area (PDWSA)?	Yes ☐ No ☒	Name: N/A Priority: N/A Are the proposed activities/ landuse compatible with the PDWSA (refer to WQPN 25)? Yes ☐ No ☐ N/A ☒
Is the Premises subject to any other Acts or subsidiary regulations (e.g. *Dangerous Goods Safety Act 2004, Environmental Protection (Controlled Waste) Regulations 2004, State Agreement Act xxxx*)	Yes ☒ No ☐	Environmental Protection (Controlled Waste) Regulations
Is the Premises within an Environmental Protection Policy (EPP) Area?	Yes ☐ No ☒	
Is the Premises subject to any EPP requirements?	Yes ☐ No ☒	
Is the Premises a known or suspected contaminated site under the *Contaminated Sites Act 2003*?	Yes ☒ No ☐	Classification: possibly contaminated – investigation required (PC–IR) Groundwater investigations have identified elevated concentrations of chloride and nitrogen in groundwater beneath the site. Date of classification: 22 October 2013