Carbon Recycling Facility

Surface Water and Leachate Management Plan

Prepared for C-WISE

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1 Introduction

Talis Consultants Pty Ltd (Talis) was commissioned by C-Wise Holdings Pty Ltd (C-Wise) to prepare a Surface Water and Leachate Management Plan (SWLMP) for its new Carbon Recycling Facility (the Facility) that summarises the assessments and strategy for managing surface water and leachate at the Facility.

1.1 Background

C-Wise is proposing to develop a new Carbon Recycling Facility to accept a range of organic materials for composting as well as accepting materials for resale to market (the Project).

The Project will support the adoption of a three-bin kerbside collection system by providing increased capacity and services to process organic waste for the surrounding regions. It will be delivered in a two-stage approach, with the initial processing capacity doubling as C-Wise's existing site in Nambeelup is decommissioned and operations are moved to the new site. C-Wise is seeking approval for both Stage 1 and Stage 2 of the Project at this stage to reduce overall timeframes for approval and future administrative burden.

The Facility will be located at 320 Gull Road, Keralup, WA on a portion of Lot 9500 on Deposited Plan 414516 (the Site). Due to the Site's proximity to conservation and resource enhancement category wetlands, C-Wise recognises that it is critical to demonstrate that potential impacts to surface water and groundwater have been considered and that appropriate management measures are in place to minimise the risk of any significant environmental impacts.

1.2 Objectives

This Surface Water and Leachate Management Plan (SWLMP) summarises the design and staged development of the better practice and operationally flexible leachate and surface water management systems for the Site. The SWLMP has been developed in general accordance with the Department of Water and Environmental Regulation's (DWER's) *Guideline: Better Practice Organics Recycling* (the Organics Recycling Guideline), which provide environmental performance objectives and benchmark controls for the planning, design and operations of organics recycling facilities regulated under Part V of the *Environmental Protection Act 1986* (EP Act).

The SWLMP shall address the following minimum overall infrastructure design standards for surface water and leachate management at the Site:

- Separate uncontaminated stormwater run-off from the area defined by the leachate containment system by using, for example, surface-grade changes, bunds, interceptor drains, piping and other drainage systems;
- Design the leachate containment system based on quantitative assessment of the potential leachate and stormwater runoff generated from a one in 20 (5 per cent) annual exceedance probability (AEP) 24-hour storm event; and
- Design and construct drainage infrastructure to convey the runoff from the leachate containment system that would result from a one in 20 (5 per cent) AEP 24-hour rainfall event.

The SWLMP will also outline where the design or operation of the facility supports the Environmental Performance Objectives (EPOs) or Benchmark Controls described in the Organics Recycling Guidelines.

1.3 Scope of Report

In order to meet the objectives discussed in Section 1.2, the SWLMP contains the following elements:

- Site Information;
- Surface Water Strategy:
  - Surface water management requirements;
  - Surface water generation modelling;
  - Surface water infrastructure requirements; and
  - Operational management and monitoring strategy.
- Leachate Management Strategy:
  - Leachate management requirements;
  - Leachate generation modelling;
  - Leachate infrastructure requirements; and
  - Operational management and monitoring strategy.
- Appendices:
  - Drawings; and
  - Surface Water & Leachate Modelling.

2 Site Information

The following sections provides general information of the Site, including current layout, licencing, and environmental attributes.

2.1 Site Layout

The Project will be located on 269.4ha of land at 320 Gull Road, Keralup, within a portion of Lot 9500 on Deposited Plan 414516 in Certificate of Title Volume 2991 Folio 741, of which the Development Footprint encompasses approximately 17.2ha. Access to the Site will be from the northwestern boundary, directly on to Gull Road.

The proposed layout of the Carbon Recycling Facility is shown in Drawing C-100, provided in Appendix A. The Facility will consist of the following key elements:

- Access Road;
- Weighbridge;
- Administration Office;
- Carbon storage area;
- Liquid waste tanks and receival area;
- Receival building;
- Cocoons (fully enclosed);
- Mobile Aerated Floor (MAF) System (under cover);
- Final maturation area (under cover);
- Screening and dispatch area
- Leachate Ponds;
- Stormwater ponds;
- Wetland fencing and firebreaks;
- Fuel store and service area; and
- Workshop, crib room and office.

The majority of infrastructure is roofed to minimise high-risk leachate generation resulting from stormwater contact with materials. The Facility will be delivered in two stages, with Stage 2 of the Project having an identical processing setup to Stage 1, located directly to the east. As such, the same infrastructure and controls will be present in both facilities, although minor layout changes will exist.

2.2 Works Approval

Certain industrial premises with the potential to cause emissions and discharges to air, land or water are classified as 'Prescribed Premises' and trigger regulations and associated approvals under Part V of the EP Act. Those activities that are considered to be Prescribed Premises, and their associated production or design thresholds, are listed in Schedule 1 of the *Environmental Protection Regulations 1987*. The DWER is responsible for the regulation of Prescribed Premises under Part V of the EP Act, approval under which is granted in the form of Works Approvals for construction and Licences for operation.

This SWLMP has been developed to support C-Wise's application for a Works Approval to construct the Facility, as it is anticipated that it will be considered a Prescribed Premises. The Prescribed Premises categories relevant to the Project are outlined in Table 2-1.

Table 2-1: Summary of Prescribed Premises Categories

Category No.	Name	Description	Production or Design Capacity
61	Liquid waste facility	Premises on which liquid waste produced on other premises (other than sewerage waste) is stored, reprocessed, treated or irrigated	100 tonnes or more per year
67A	Compost manufacturing and soil blending	Premises on which organic material (excluding silage) or waste is stored pending processing, mixing, drying or composting to produce commercial quantities of compost or blended soils	1,000 tonnes or more per year

C-Wise is proposing to accept 200,000 tonnes per annum of materials under Category 67A, and 60,000 tonnes per annum of liquid wastes under Category 61 at the Facility.

2.3 Environmental Attributes

The following section outlines the key environmental attributes of the Site, including climate, topography, geology, groundwater, and surface water.

2.3.1 Climate

The local and regional climate data sources will be utilised for the design of the Site's surface water and leachate management systems, including rainfall and pan evaporation.

The Site is located within a warm temperate climactic zone that experiences dry and hot summers and cool wet winters. According to the Bureau of Meteorology (BOM), the closest weather station with long-term data is Mandurah (Station 009977), approximately 15km southwest of the Site. However, since there is limited quality controlled BOM data available for rainfall and pan evaporation, this data was sourced from SILO, a database of Australian climate data from 1889 to the present day that is hosted by the Queensland Department of Environment and Science. It provides daily meteorological datasets for a range of climate variables in ready-to-use formats suitable for biophysical modelling, research, and climate applications. The datasets are constructed from observational data obtained from BOM, using mathematical interpolation techniques to infill gaps in time series and construct spatial grids. The spatial grid selected (Latitude: -32.50, Longitude: 115.85) is for Keralup, WA and encompasses the majority of the Site.

2.3.1.1 *Rainfall*

Being in a temperate zone, rainfall is seasonal with higher rainfall generally in the months of May to September. Table 2-2 presents a summary of rainfall records, from 1971 to 2022.

Table 2-2: Rainfall Overview in Millimetres (1971-2022)

Aspect	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average	14.4	14.2	18.6	41.9	111	145	154	121	83.9	43.3	29.2	10.8	788
50th Percentile	44.1	10.7	0.0	60.0	76.7	195	47.1	108	109	26.0	59.5	63.6	799
90th Percentile	0.2	2.7	22.4	43.5	245	222	65.1	127	115	78.6	20.4	13.4	955
Highest	2.2	10.7	0.1	69.2	245	138	303	147	31.7	82.8	16.4	0.0	1,046

The mean annual rainfall for the Site is calculated as 788 millimetres (mm) with the highest recorded annual rainfall at 1,046mm, which occurred in 1974. The 50th percentile rainfall year occurred in 2012 and was equal to 799mm of rain. The 90th percentile rainfall year occurred in 2005, and recorded 955mm of rain.

Short Duration Design Rainfall

Rainfall Intensity Frequency Duration (IFD) data for the Site was obtained using the BOM Computerised Design IFD Rainfall System (CDIRS) and the Australian Rainfall and Runoff 2016 database (ARR2016). CDIRS produces a complete set of IFD curves and associated weather data based on user-defined coordinates (http://www.bom.gov.au/water/designRainfalls/revised-ifd/?year=2016).

Table 2-3 summarises the Annual Exceedance Probability (AEP) of storms with 1 to 72-hour durations. The equivalent Average Recurrence Intervals (ARIs) for each storm event is also outlined. These values can be used to estimate precipitation rates at the Site for a range of events.

Table 2-3: Summary of Annual Exceedance Probabilities for Site (ARR2016)

Storm Duration	1 in 1 yr 63%	1 in 10 yr 10%	1 in 20 yr 5%	1 in 50 yr 2%	1 in 100 yr 1%
	Rainfall Depth (mm)				
1 hour	19	29	33	38	42
2 hour	24	38	42	49	54
3 hour	28	44	49	57	63
6 hour	35	57	65	76	86
12 hour	44	73	84	101	115
24 hour	54	91	106	127	145
48 hour	65	109	126	149	168
72 hour	73	119	137	159	178

A 1-in-20-year, 24-hour storm event has a rainfall depth of 106mm, and a 1-in-100-year AEP, 24-hour storm event has a rainfall dept of 145mm. According to SILO, the highest daily rainfall rate from 1970-2022 was 124mm in January 1982, which is approximately equivalent to a 1-in-50-year, 24-hour storm event.

2.3.1.2 *Pan Evaporation*

The approximate average daily pan evaporation rates for the Site are based on the calculated monthly rates from SILO. Table 2-4 outlines the pan evaporation data during an average, maximum, 50th and 90th percentile rainfall year, from 1971 to 2022.

Table 2-4: Pan Evaporation Data for the Site in Millimetres (mm)

Rainfall Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average	265	222	188	114	76.8	57.7	60.5	73.0	94.1	138	186	243	1,719
50th Percentile	285	216	216	109	68.1	56.0	54.1	69.9	98.3	148	177	234	1,732
90th Percentile	267	203	173	101	76.0	51.4	56.7	69.3	86.6	111	178	189	1,563
Highest	318	240	208	108	77.2	58.8	70.6	75.9	98.5	125	174	256	1,810

The total annual pan evaporation in the assessed rainfall years ranges from 1,563mm to 1,810mm and monthly from 51.4mm to 318mm. The total average annual pan evaporation for the Site is calculated as 1,719mm. This potential evaporation rate for the Site is greater than the highest recorded rainfall year, indicating that evaporation can be a useful tool for managing stormwater and leachate generated at the Site.

2.3.2 Topography

The topography at the Site ranges from 10m Australian Height Datum (AHD) to the northeast to 18mAHD to the southeast. The topography within the proposed location of the Facility ranges from 18mAHD to 20mAHD, with a drop to 12mAHD on the south-western corner of the proposed development footprint. The Site topography is shown in Drawing C-100, provided in Appendix A.

2.3.3 Geology

Surface geology at the Site is classified as predominantly 'Qag', or alluvial sand and clay with shallow marine and estuarine lenses and local basal conglomerate.

A contamination investigation undertaken by Western Environmental in February 2021 indicated that soils within 0.5m of the surface at the Site predominantly consist of sand, well sorted, dark to light grey (tending lighter with depth), dry, homogenous, with trace organic material at surface (grass roots) and depth (minor grass root fibres) (Western Environmental, 2021).

2.3.4 Hydrology

To protect water sources, surface water proclaimed areas have been allocated under the *Rights in Water and Irrigation Act 1914* (RIWI Act). Surface water areas are proclaimed for the purpose of controlling the taking of water from watercourses and wetlands in order to systematically manage their use. The Site is located in a Surface Water Proclaimed Area, specifically the Serpentine River System.

Portions of two conservation category wetlands are located in the southern and western sections of the Site. Surrounding the Site boundary in all directions are a number of small wetlands. To the west of the Site, there is the Serpentine River which ultimately discharges into the Peel Inlet and Harvey Estuary.

2.3.5 Hydrogeology

Under the RIWI Act, proclaimed groundwater areas in WA are areas in which licences are required to construct or alter a well and to take groundwater. The Site is located within Murray Groundwater Area.

Regional groundwater flows in a westerly direction towards the Serpentine River (Coterra Environment, 2021). A Groundwater Level Study was undertaken by WSP Australia Pty Ltd (WSP) to determine the 50-year Design Groundwater Levels (DGWL) at the Site and to inform any containment pond design proposed for the Project. The DGWL was determined using historic groundwater levels, hydrogeological features and key parameters such as climate, surface water, drains, groundwater abstraction and land use. WSP developed two sets of DGWL contours as follows:

- Average Annual Maximum Groundwater Level (AAMGL), 50% Annual Exceedance Probability (AEP):
    - The AAMGL ranges from reduced level (RL) 9mAHD at the north-western Site boundary to RL 19mAHD at the eastern boundary;
    - The AAMGL within the Stage 1 Development Footprint ranges from RL 13mAHD to RL 14.5mAHD; and
    - The AAMGL within the Stage 2 Development Footprint ranges from RL 14.5mAHD to RL 16mAHD.
- 50 Year DGWL, 2% AEP:
    - The 50 Year DGWL ranges from RL 9.5mAHD at the north-western boundary Site to RL 19.5mAHD at the eastern boundary;
    - The 50 Year DGWL within the Stage 1 Development Footprint ranges from RL 13.9mAHD to RL 15.2mAHD; and
    - The 50 Year DGWL within the Stage 2 Development Footprint ranges from RL 15.1mAHD to RL 16.5mAHD.

FSG Geotechnics was engaged by C-Wise to undertake the design of a controlled groundwater level drainage system across the Facility to ensure a minimum separation distance of 1.5m is maintained between the base of each pond and the estimated 50 Year Design Groundwater Level at the Site. The groundwater drainage system modelled by FSG Geotechnics will be staged with the development of the Facility. Stage 1 will initially comprise an open swale along its eastern and southern site edges, which will control groundwater levels beneath the three ponds to no higher than 14mAHD. At the development of Stage 2, the eastern swale between Stage 1 and Stage 2 will be converted into a sub-soil drain pipe, and Stage 2 will have its own swale installed along the Stage 2 eastern and southern boundaries to control the groundwater level beneath the Stage 2 ponds to no more than 15mAHD.

The investigation found that the groundwater designs for the Facility are able to control groundwater to the required depth underneath all leachate and surface water ponds. The controls within Stage 1 are designed to only remove the seasonal peak groundwater level, with any flows and associated discharge only likely to occur during the wet winter months. The final design of the Stage 2 groundwater control will be refined prior to construction, once additional groundwater data has been gathered across the Site as part of the operation of Stage 1 of the Facility. The set groundwater control level under each stage has been used to design the minimum separation distance for each proposed pond, which is discussed further in Sections 3 and 4.

3 Surface Water Management Strategy

Environmental risks associated with leachate and surface water within the overall Site boundary will be managed through the establishment of a better practice and operationally flexible surface water management system (SWMS). To appropriately manage these risks, the SWMS needs to achieve two key objectives, including minimising leachate generation and proactively managing surface water. These objectives, and the design features incorporated to achieve these, are shown in Table 3-1.

Table 3-1: Objectives and Associated Design Features of the Surface Water Management System

Objective	Design Feature
Minimise Leachate Generation	Implement a best practice surface water management system in general accordance with the Organics Recycling Guideline
	Ensure that the processing areas are covered to eliminate leachate generation through precipitation
	Construct the processing areas such that stormwater run-off inflow is mitigated
	Develop a drainage system across the Site's operational areas that includes strategically located discharge points away from the processing and storage areas
Proactively Manage Surface Water	Develop hardstands that are graded to ensure the capture of all stormwater run-off within the Site's operational areas
	Ensure the surface water management system is appropriately sized to manage a 1-in-20-year Annual Exceedance Probability (AEP), 24-hour duration storm event
	Consideration of the environmentally sensitive areas around the Site (i.e., wetlands)
	Establish controlled discharge points for surface water

The proposed SWMS to meet the objectives outlined in Table 3-1 is discussed in the following sub-sections.

3.1 Key Infrastructure

3.1.1 Hardstands, Surfacing and Bunding

Surface water at the Site will be generated by runoff from roofed areas and from concrete or bitumen sealed hardstands which are kept hydraulically separate from sealed hardstands containing leachate-generating materials.

The capture and conveyance of surface water from these areas will be established at the detailed design stage for the Site. However, it is anticipated that a combination of overland flow and drainage pipes will divert captured surface water to a designed surface water pond.

3.1.2 Surface Water Ponds

Two surface water ponds will be constructed at the Site to effectively retain surface water during small rainfall events and provide attenuation during larger events. These two surface water attenuation ponds will be located around the perimeter of the operational areas (both Stage 1 and Stage 2). Each pond will be constructed in the Site's low points and will consist of a 300mm compacted subgrade layer using onsite soil material and a high-density polyethylene (HDPE) geomembrane. Each pond will feature a passive spillway, which will allow for a controlled release of surface water offsite. The base of each pond will have a minimum groundwater separation distance of 1.5m from the controlled groundwater level, as outlined in Section 2.3.5.

3.2 Surface Water Modelling

In accordance with the Organics Recycling Guideline, the SWMS has been designed to contain and control surface water runoff from a 1-in-20-year AEP, 24-hour storm event, at a minimum.

The Site's proposed surface water management infrastructure consists of hardstands and surface water attenuation ponds as discussed in Section 3.1. To determine the appropriate design for this infrastructure, modelling was undertaken utilising a Microsoft Excel surface water pond sizing algorithm based on local climate data including rainfall depth and intensity.

3.2.1 Catchment Areas

To assist with the modelling, non-leachate generating areas in each stage of the Site were identified, with a total area of approximately 31,500m^2 for potentially generating clean stormwater run-off.

3.3 Surface Water Infrastructure Design

The following sections describe the modelling results and the finalised design characteristics of the key infrastructure proposed for the Site's SWMS.

3.3.1 Surface Water Runoff Generation

As discussed in Section 3.2.1, an area of approximately 31,550m^2, consisting of roofing and sealed hardstands, is capable of generating runoff in each stage at the Site. In accordance with the Organics Recycling Guideline, the runoff coefficient for these areas was assumed to be 1.0, to model a worst-case scenario where all rainfall within this area generates runoff that requires management via a surface water pond.

Therefore, in the 1-in-20-year, 24-hour design storm event of 106mm, approximately 3,345m^3 of surface water will require attenuation in each stage of development.

3.3.2 Surface Water Ponds

Once the required runoff had been calculated, it was used to size the two surface water ponds proposed for the Site. Table 3-2 outlines the key design criteria for each proposed surface water pond.

Table 3-2: Summary of Surface Water Pond Design Criteria

Pond	Approx. Dimensions [LxWxh] (m)	Side Slopes (V:H)	Surface Area (m^2)	Operational Pond Capacity* (m^3)	Required Capacity (m^3)	Storm Check Pass?
Stage 1	93x40x1.8	1:4	3,720	3,367	3,345	PASS
Stage 2	93x40x1.8	1:4	3,720	3,367	3,345	PASS

**Operational Pond Capacity assumes a 500mm freeboard for the ponds to account for the proposed passive spillway.*

All ponds are capable of handling a 1-in-20-year, 24-hour storm event, and can safely overtop during larger storm events without backing up or causing failure at other points of the SWMS.

As discussed in Section 3.1.2, each pond will be lined with a HDPE geomembrane and will be excavated to a depth of 1.8m with the cut faces at a gradient of 1:4 (V:H). The geomembrane will be secured in a 0.6m deep anchor trench around the perimeter of each pond. The ponds will have a 4m wide track around the perimeter to allow for full access by a light vehicle. The base of each pond will have a minimum separation distance of 1.5m from the controlled groundwater level discussed in Section 2.3.5.

Though not anticipated to occur except during rainfall events exceeding a 1-in-100-year, 24-hour rainfall event, each surface water pond has been designed to accept leachate from the two leachate ponds that will also be constructed for each stage of the Project. Therefore, each surface water pond also contains two HDPE-lined inlet swales from these leachate ponds, which are discussed in further detail in Section 4.1.5.

3.4 Management and Monitoring Strategy

Regular monitoring and maintenance of the SWMS should be undertaken on a regular basis to ensure the system meets the Environmental Performance Objectives within the Organics Recycling Guideline.

C-Wise currently has a Dam Management Procedure for their existing Site, which will be adapted to cover the surface water ponds at the new Facility. Table 3-3 outlines the minimum monitoring and maintenance schedule adapted from the Dam Management Procedure.

Table 3-3: Monitoring and Maintenance Schedule for the SWMS

Activity	Frequency
Integrity of each surface water attenuation pond	Quarterly
Integrity of all overflow points and inlets	Quarterly
Water levels within each surface water attenuation pond	Weekly
Surface water quality monitoring from each pond (pH, Conductivity, Total Dissolved Salts, Oxidation Reduction Potential, Temperature, Dissolved Oxygen)	Weekly
Surface water quality monitoring from each pond (Chemical Oxygen Demand)	Monthly

Activity	Frequency
Surface water quality monitoring from each pond (Biological Oxygen Demand)	Quarterly
Occurrence of overflow events	Whenever an overflow occurs

The surface water monitoring regime will be defined within the Site Licence and will be undertaken in accordance with it. The proposed surface water monitoring points for the Site are presented in Drawing C-110 in Appendix A.

4 Leachate Management Strategy

The Organics Recycling Guideline defines leachate as liquid that has percolated through and/or been generated by the decomposition of waste material, including water that has interacted with feedstocks, materials undergoing processing (i.e., mechanical, pasteurisation or composting) or products. Leachate emissions from compositing facilities have the potential to contain nutrients, metals, salts and other soluble or suspended components and decomposition products of the waste.

The Organics Recycling Guideline states that the design and construction of the leachate management system must consider the higher-risk leachate generated from the composting process, including liquids generated during the decomposition of waste or from the addition of liquids to the composting process (i.e., water, re-use leachate and liquid waste feedstocks), as well as lower-risk leachate generated from rainwater/stormwater entering the leachate containment system.

The following sections discuss the key infrastructure that will manage the leachate generated at the Site and how it was designed through modelling the estimated volume of leachate that will be produced.

4.1 Key Infrastructure

4.1.1 Covered Infrastructure

C-Wise has pursued a strategy of elimination regarding leachate generation at the Site wherever possible and has roofed high-risk leachate generating areas to prevent generation via rainfall. Of particular note is the receival building, and all stages of the composting process will occur under a roof in both Stages 1 and 2 of the Site.

The roofs will be constructed from impermeable materials and surface water generated from these roofs will be captured and managed via the SWMS outlined in Section 3.

4.1.2 Hardstands, Surfacing and Bunding

All of the Site's operational areas will feature hardstands comprised of compacted limestone or impermeable bitumen, or concrete slab. These hardstands provide a lower permeability surface to mitigate rainfall percolation in the Site's operational areas. The following subsections outline the characteristics of each hardstand type.

4.1.2.1 Concrete, Asphalt and Bitumen

Concrete hardstands will be used beneath roofed Process Areas in the receival building, and the space between the receival building and the cocoons. These areas will generate high-risk leachate from Food Organics and Garden Organics (FOGO) products and liquid wastes used in the process and will feature falls at a 1:80 (V:H) slope towards drainage pits, located centrally within each area. These pits will then be pumped to the tank farm, discussed further in Section 4.1.3.

Bitumen or asphalt will be used in open-air areas of each stage, including the screening and dispatch area. The hardstand at the screening and dispatch area will store completed compost products which generate a low-risk leachate as defined within the Organics Recycling Guideline. This hardstand area will drain at a 1:100 (V:H) fall toward a low-risk leachate evaporation pond, detailed further in Section 4.1.4. Bunding will be installed at the edge of the hardstand to assist in directing leachate toward the pond.

The concrete and bitumen/asphalt hardstands will meet the requirement of the Organics Recycling Guideline, including the following criteria:

- Constructed to an adequate thickness to achieve a sealed impermeable;
- Designed by a person who has appropriate accreditation, competency and experience in the design of impermeable hardstands; and
- Construction will be subject to suitable construction quality assurance regime determined by the designer of the hardstand.

4.1.2.2 *Crushed Limestone*

A crushed limestone hardstand will be used for the carbon storage areas within Stage 1 and 2. These hardstands will be used to store green waste, natural fibrous organics, and forestry residues, and will generate a low-risk leachate as defined within the Organics Recycling Guideline.

The limestone material will be applied in a minimum 300mm thick layer, which has been shown to achieve an effective permeability of 2.8×10^{-8}m/s. This hardstand will be designed by a suitably qualified person and undergo a construction quality assurance regime determined by the designer of the hardstand, inclusive of geotechnical testing in accordance with *AS1289 – Methods of testing soils for engineering purposes*.

This hardstand area will drain at a 1:100 (V:H) fall toward a low-risk leachate evaporation pond, detailed further in Section 4.1.4. Any leachate generated in this area will free flow across the surface of the hardstand, which will be maintained to ensure ponding of leachate on the surface does not occur. Bunding will be installed at the edge of the hardstand to assist in directing leachate toward the pond.

4.1.3 High-Risk Leachate Storage Tanks

While the composting process activities will be undertaken under cover, leachate from the process will still be produced and must be managed appropriately.

All sealed surfaces within the processing areas, the receival buildings, and the hardstands in-between the two, will direct any leachate generated to a series of collection pits. These pits will capture the leachate, which will then be pumped to a designated above-ground tank farm for each stage, located on the northern edge of the Facility.

Though the overall tank farm will be used for managing both leachate and liquid wastes accepted at the Site, each of the tank farms includes a dedicated tank system for the management of high-risk leachate. Each tank has a design capacity of 340m^3, and the tank farm for each stage is comprised of 12 tanks, with a minimum of 702m^3 of storage (i.e. three tanks) within each tank farm dedicated to high-risk leachate.

The tanks within the farm for each stage will be arranged in banks of three, with the tank farm bunded to a capacity of 110% that of volume of a single bank within the bund. The tanks will also be equipped with monitoring equipment (e.g. high-level alarms) to ensure that they do not overfill.

Both liquid waste and high-risk leachate will be extracted from the tank farms for use in the early stages of the composting process. Tank storage of high-risk leachate contributes to the overall strategy of elimination of high-risk leachate, with no additional leachate generation caused by rainfall on the surface of a pond or similar storage device.

4.1.4 Leachate Evaporation Ponds

Each stage of the Project will include two leachate evaporation ponds which will accept the low-risk leachate produced from precipitation falling onto the uncovered operational areas of the Site. Each Stage will feature a Carbon Storage Pond (CS), and a Screening & Dispatch Pond (S&D).

To prevent leachate stored in the evaporation ponds from percolating into the groundwater system, the ponds will be lined in general accordance with the Organics Recycling Guideline (from bottom to top):

- 300mm thick Compacted Subgrade Layer;
- Geosynthetic Clay Liner (GCL); and
- 2mm thick HDPE Geomembrane.

The proposed leachate ponds have been designed to manage a 'worst case', peak leachate generation scenario, which considers:

- Five consecutive 90th percentile rainfall years; and
- A 1-in-100 year, 24-hour storm event check.

The storm check was applied to assess the impact of a 1-in-100-year, 24-hour storm event on the pond and hardstand system to ensure that leachate generated during that event can be accommodated by the pond during a wet, 90th rainfall year.

Details on the generation modelling are discussed in Section 4.2.

4.1.5 Leachate Conveyance System

Leachate drains in the form of open trapezoidal channels, which will be used to effectively transport any leachate from the hardstand areas to the leachate evaporation ponds. These channels will also allow for the safe overtopping of leachate into the surface water pond for each stage during storm events larger than a 1-in-100, 24-hour storm event. These swales will be lined with a 2mm HDPE geomembrane to minimise any leachate percolation into the ground.

4.2 Leachate Generation Modelling

To ensure the leachate pond system has the appropriate capacity, the potential volume of leachate that will be generated by Site activities must be modelled. The modelling for the Site aims to determine the 'worst case' scenario for leachate generation, which is later used as an input for the required Water Balance Assessment. Leachate generated from Site activities is dependent on the surface area of the operational areas and rainfall into those areas. The following sections outline the approach to determining leachate generation at the Site.

4.2.1 High-Risk Leachate Generation

High-risk leachate will be generated from three areas at the Site: the receival building, the process areas (including the cocoon, MAF and settling Areas), and the concrete hardstand in-between the two.

As the receival building and process areas are roofed, leachate generation in these areas is driven by the composting process rather than rainfall. This level of generation is not anticipated to be significant and will be reused within the composting process via the tank farm.

Generation of leachate from the bitumen hardstand is not roofed and will be rainfall driven. Therefore, rainfall runoff from the hardstand was calculated during both a 50th and 90th percentile rainfall year, with an assumed hardstand runoff coefficient of 1.0 in line with the Organics Recycling Guideline. Table 4-1 provides a summary of high-risk leachate generation at the Site during both 50th and 90th percentile rainfall years.

Table 4-1: Summary of High-Risk Leachate Generation for Each Stage (m^3)

Aspect	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
50th Percentile	102	25	0	139	178	450	109	249	253	60	138	147	1,850
90th Percentile	0	6	52	101	568	514	151	293	266	182	47	31	2,211

The Site is anticipated to generate 1,850m^3 of high-risk leachate during a 50th percentile rainfall year, and 2,211m^3 of high-risk leachate during a 90th percentile rainfall year in each stage. The highest rates of leachate generation occur particularly during the winter months when significant rainfall events are more likely to arise.

4.2.2 Low-Risk Leachate Generation

Low-risk leachate will be generated from the carbon storage area and the screening and dispatch area at the Site. These areas are outdoors, and generation of low-risk leachate will be rainfall driven. Therefore, rainfall runoff from these hardstands was calculated during both a 50th and 90th percentile rainfall year, with an assumed hardstand runoff coefficient of 1.0 in line with the Organics Recycling Guideline. Table 4-2 provides a summary of low-risk leachate generation at the Site during both 50th and 90th percentile rainfall years.

Table 4-2: Summary of Low-Risk Leachate Generation for Each Stage (m^3)

Aspect	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
50th Percentile	1,159	281	0	1,577	2,016	5,115	1,238	2,825	2,875	683	1,564	1,672	21,006
90th Percentile	5	71	589	1,143	6,450	5,838	1,711	3,325	3,017	2,066	536	352	25,104

The Site is anticipated to generate 21,006m^3 of low-risk leachate during a 50th percentile rainfall year, and 25,104m^3 of low-risk leachate during a 90th percentile rainfall year in each stage.

4.2.3 Leachate Usage Modelling

The composting process at the Site requires water inputs, which will be met by using a combination of liquid waste, leachate reuse and licenced groundwater abstraction, used preferentially in that order. As the process is occurring under roofs, for every tonne of incoming material to be composted, one tonne of liquid is required to be added to the process. Therefore, as each stage has a 100,000 tonne per annum of incoming solid material to be composted, and 30,000 tonnes of liquid waste input, an additional 70,000 tonnes of water will be required for the process, of which leachate will be preferentially used over surface and groundwater. The monthly abstraction of leachate from the ponds was determined for each stage from the annual total assuming an average daily requirement of 192m^3 and has been presented in Table 4-3.

Table 4-3: Summary of Leachate Abstraction from Each Stage (m^3)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
5,945	5,370	5,945	5,753	5,945	5,753	5,945	5,945	5,753	5,945	5,753	5,945	70,000

4.3 Leachate Management Infrastructure Design

4.3.1 Pond Water Balance Assessment

A Water Balance Assessment was utilised to determine the appropriate size of the proposed leachate evaporation ponds and to assess their subsequent performance. It was developed in general accordance with the Organics Recycling Guideline to ensure the system is suitably sized to manage the leachate. Using a Microsoft Excel algorithm, the assessment presented a simplified input and output system based on the following:

- Inputs:
  - Leachate; and
  - Monthly rainfall.
- Outputs:
  - Evaporation; and
  - Process Requirements.

4.3.1.1 *System Inputs*

The leachate generation volumes presented in Table 4-1 and Table 4-2 were utilised as part of the Water Balance Assessment for the ponds in addition to the monthly rainfall for the 90th percentile rainfall year. This represents a highly conservative measure, in which five-consecutive wet rainfall years occur in a row. As detailed in Section 2.3.1.1, the 90th percentile rainfall scenario equates to an annual rainfall of 955mm.

4.3.1.2 *System Outputs*

To quantify the amount of leachate evaporated each year, the following parameters were assumed:

- The freeboard was set at 500mm to determine the operational volume of each pond;
- The actual evaporation rate was assumed to be 70% of the potential pan evaporation rate;
- Leachate is recirculated into the processing areas for reuse/product conditioning at a 1:1 solids to liquids ratio;
- No rainfall within an evaporation pond's catchment area was lost to run-off; and
- For the purpose of the calculations, the evaporation area was set at half the pond depth for each evaporation pond.

The volumes within the evaporation ponds for a given month included the initial leachate inputs transferred from the Site's operational areas, the remaining leachate from the previous month (if any), any further leachate inputs for the month, and the rainfall within the pond's catchment area based on the rainfall scenario.

Details on the evaporation outputs are provided in Appendix B.

4.3.1.3 *Results*

As shown in Drawing C-101, four leachate evaporation ponds are proposed across Stages 1 and 2 of the Project, a Carbon Storage Pond (CS) and a Screening & Dispatch Pond (S&D) in each stage.

Each pond will be lined with a GCL overlain with a HDPE geomembrane and would be excavated to a depth of 2m with the cut faces at a gradient of 1:4 (V:H). The geomembrane will be secured in a 0.6m deep anchor trench around the perimeter of each pond. The ponds will have a 4m wide track around the perimeter to allow for full access by a light vehicle. The base of each pond will have a minimum separation distance of 1.5m from the controlled groundwater level discussed in Section 2.3.5.

Typical construction details for the leachate evaporation pond system can be seen in Drawing C-301 provided in Appendix A. The design characteristics of the evaporation ponds are provided in Table 4-4.

Table 4-4: Leachate Evaporation Pond Design Characteristics

Location	Pond	Catchment Area (m^2)	Evaporation Area* (m^2)	Operational Volume** (m^3)	Total Volume (m^3)
Stage 1	CS 1	3,565	2,205	2,846	4,453
	S&D 1	2,760	1,848	2,478	3,739
Stage 2	CS 2	3,565	2,205	2,846	4,453
	S&D 2	2,760	1,848	2,478	3,739

**Maximum Evaporation Area is considered to be at 1,000mm freeboard from pond crest.*
*** Operational Volume is considered to be at 500mm freeboard from pond crest.*

The ponds are designed to be empty at least once per year prior to maximum levels being reached, which may be achieved either by evaporation or transferring leachate between ponds. This will allow inspection and maintenance of the pond lining system to ensure long-term integrity of the system.

The results of the modelling are provided in Appendix B.

4.3.1.4 *Storm Event Check*

The Organics Recycling Guideline states that a leachate pond must have a freeboard that can accept rainfall directly on the pond from a 24-hour rainfall event with a 1-in-20-year average recurrence interval without overflowing. The design for the Site goes above this requirement, with a 1-in-100-year, 24-hour storm event being used to assess the overall capacity of the ponds. The results of the storm event check are summarised in Table 4-5.

Table 4-5: Storm Event Check

Location	Pond	Catchment Size (m^2)	Runoff Coefficient	1-in-100-Year, 24-Hr Rainfall Event (mm)	Required Storage (m^3)	Storm Check Pass?
Stage 1	CS 1	16,094	1.0	145	2,334	PASS
	S&D 1	16,515			2,395	PASS
Stage 2	CS 2	16,094			2,334	PASS
	S&D 2	16,515			2,395	PASS

The storm event check model verified that the pond system has adequate capacity to cater for leachate generated during a 1-in-100-year, 24-hour storm event while remaining beneath the pond's operational capacity, in accordance with the Organics Recycling Guideline.

4.3.2 High-Risk Leachate Storage Tanks

Due to the high-risk nature of leachate to be stored in the proposed tank farms, a highly conservative approach has been used to assess the required storage volume. Similarly to the leachate ponds, a 1-in-100-year, 24-hour storm event was assessed to determine the minimum storage requirement of the high-risk leachate storage. However, as the only method of drawdown from the tank farm is reuse within the composting process, an additional check was also undertaken to ensure that the tanks are capable of storing the leachate generated during the wettest recorded month between 1921 and 2022. Table 4-6 provides a summary of the high-risk leachate tank design criteria and assessments.

Table 4-6: High-Risk Leachate Tank Design Summary

Aspect	Value
High-Risk Leachate Catchment (m^2)	2,315
Catchment Runoff Coefficient	1.0
1-in-100-year, 24-hour rainfall event (mm)	145
Design Storm Event Leachate Generation (m^3)	336
Maximum monthly rainfall from 1971-2022 (mm)	303
Leachate Generation from Rainfall (m^3)	702
Maximum Monthly Leachate Generation (m^3)	**702**

Therefore, using the standard tank farm tank size of 340m^3, three tanks will be required to meet the minimum storage requirement of 702m^3 for each stage. Should smaller tanks be nominated, or a different tank farm configuration be developed during the Site's detailed design, the minimum storage of 702m^3 will be maintained.

4.4 Management and Monitoring Strategy

The leachate management system (LMS) will be regularly inspected, maintained, and repaired when necessary. Leachate monitoring will be undertaken on a regular basis to ensure the leachate management system (i.e., ponds, drain, pipes, etc.) is operating effectively. C-Wise currently has a Dam Management Procedure for their existing Site, which will be adapted to cover the leachate ponds at the new Facility.

Table 4-7 shows the recommended monitoring and maintenance schedule to preserve the integrity of the leachate management system and to determine leachate quality.

Table 4-7: Monitoring and Maintenance Schedule for the LMS

Activity	Frequency
Integrity of each leachate pond	Quarterly
Integrity of all overflow points and inlets	Quarterly
Water levels within each leachate pond	Weekly
Leachate quality monitoring from each pond (pH, Conductivity, Total Dissolved Salts, Oxidation Reduction Potential, Temperature, Dissolved Oxygen)	Weekly
Leachate quality monitoring from each pond (Chemical Oxygen Demand)	Monthly
Leachate quality monitoring from each pond (Biological Oxygen Demand)	Quarterly
Occurrence of overflow events	Whenever an overflow occurs
Groundwater quality monitoring	Quarterly

The groundwater and leachate monitoring regime will be defined within the Site Licence and will be undertaken in accordance with it. The proposed monitoring points for the Site are presented in Drawing C-110 in Appendix A.

APPENDIX A
Drawings

Drawing C-100: General Arrangement

Drawing C-101: Site Plan Layout

Drawing C-106: Surface Water and Leachate Management Layout – Stage 1

Drawing C-107: Surface Water and Leachate Management Layout – Stage 2

Drawing C-110: Environmental Monitoring Point Layout

Drawing C-300: Ponds and Containment Infrastructure

Drawing C-301: Channels and Conveyance Infrastructure

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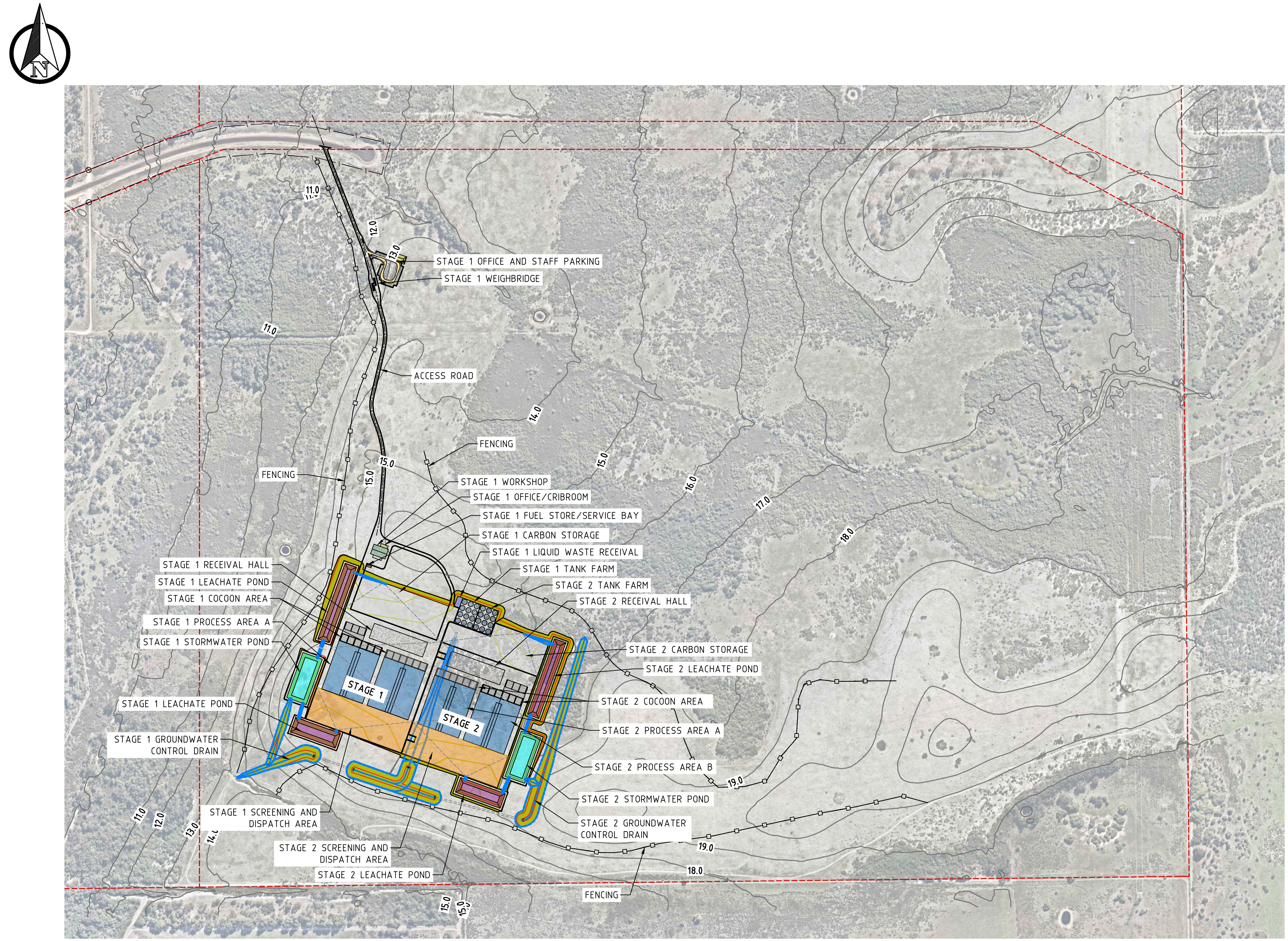

LEGEND:

- LEASE BOUNDARY
- ACCESS ROAD
- LEACHATE POND
- RECEPTION/OFFICES
- WORKSHOP
- STORMWATER POND
- SCREENING/DISPATCH
- LIQUID WASTE RECEIVAL
- FUEL STORE/SERVICE BAY
- TANK FARM
- RECEIVAL HALL
- COCOON AREA
- CARBON STORAGE
- OPEN DRAIN
- EXISTING FENCING
- FENCING

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150m 0m 150m 300m

1:7500 @ A3

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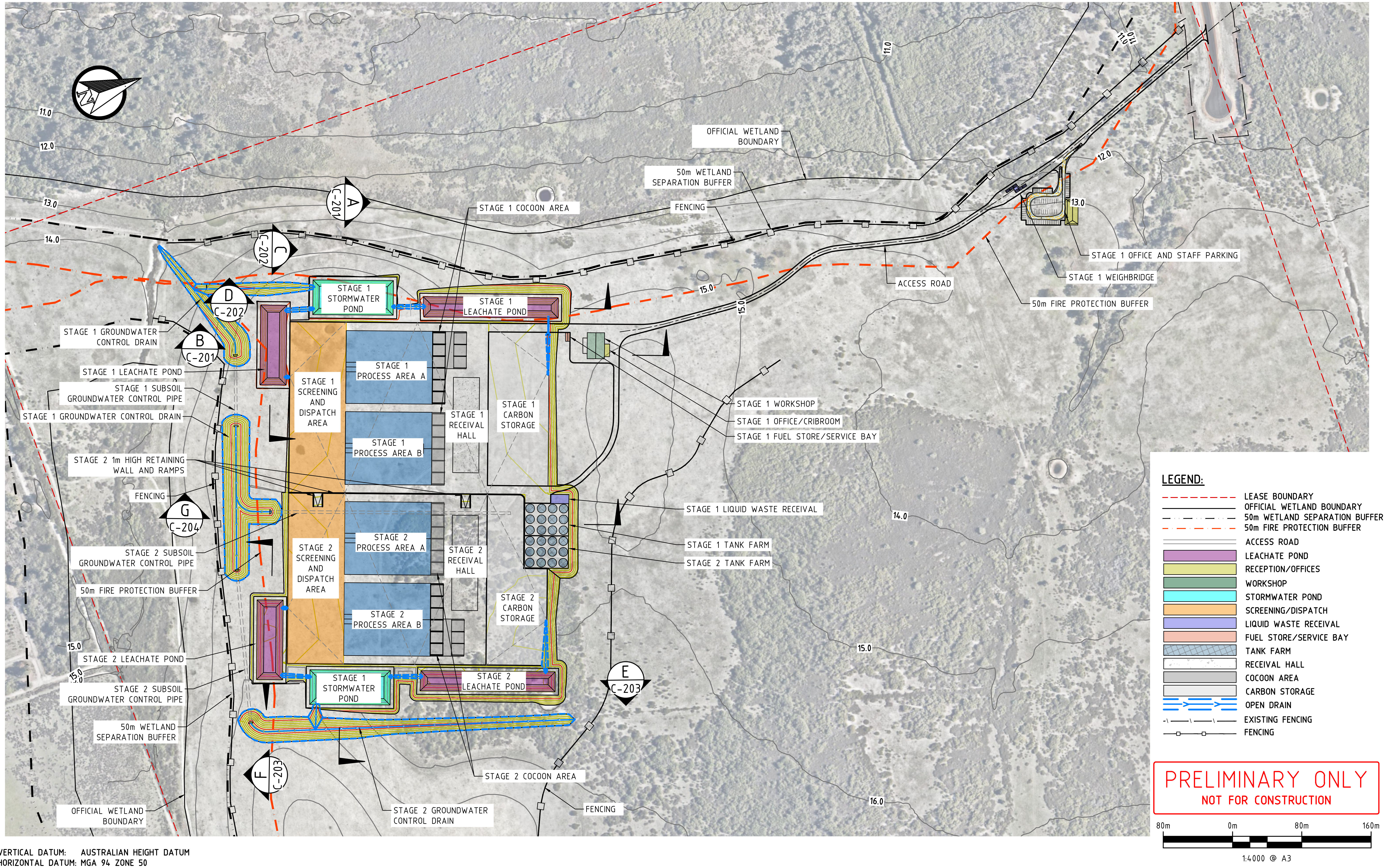
F	26.09.2023	YJ	AB	EARTH WORK VOLUME UPDATED	MH
E	10.07.2023	JS	AB	SITE LAYOUT UPDATED	MH
D	16.01.2023	MM	AB	SITE LAYOUT UPDATED	MH
C	15.11.2022	AB	MH	BOUNDARIES UPDATED	MH
B	03.02.2022	YJ	AB	SECTIONS AND ISOPACHYTE LAYOUT ADDED	MH
A	15.11.2021	YJ	AB	PRELIMINARY ISSUE	MH

Project: C-WISE DUE DILIGENCE AND APPROVALS

Title: GENERAL ARRANGEMENT

Scale: 1:7500 @ A3 Date: 02.03.2022
Drawn: YJ Checked: AB Approved: MH
Job No: TW21124 Drg. No: C-100 Rev: F
Filename: TW21124-SET.DWG

FILENAME: \\SERVER\TALIS\SECTIONS\WASTE\PROJECTS\TW2021\TW21124 - C-WISE DUE DILIGENCE AND APPROVALS\DRAWINGS\DRAWINGS\TW21124-SET.DWG



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E	24.09.2023	YJ	AB	EARTH WORK VOLUME UPDATED	MH
D	16.01.2023	MM	AB	SITE LAYOUT UPDATED	MH
C	15.11.2022	AB	MH	BOUNDARIES UPDATED	MH
B	02.03.2022	YJ	AB	SECTIONS AND ISOPACHYTE LAYOUT ADDED	MH
A	15.11.2021	YJ	AB	PRELIMINARY ISSUE	MH

Project: C-WISE DUE DILIGENCE AND APPROVALS

Title: SITE PLAN LAYOUT

Scale: 1:4000 @ A3 Date: 02.03.2022
Drawn: YJ Checked: AB Approved: MH
Job No: TW21124 Drg. No: C-101 Rev: E
Filename: TW21124-SET.DWG

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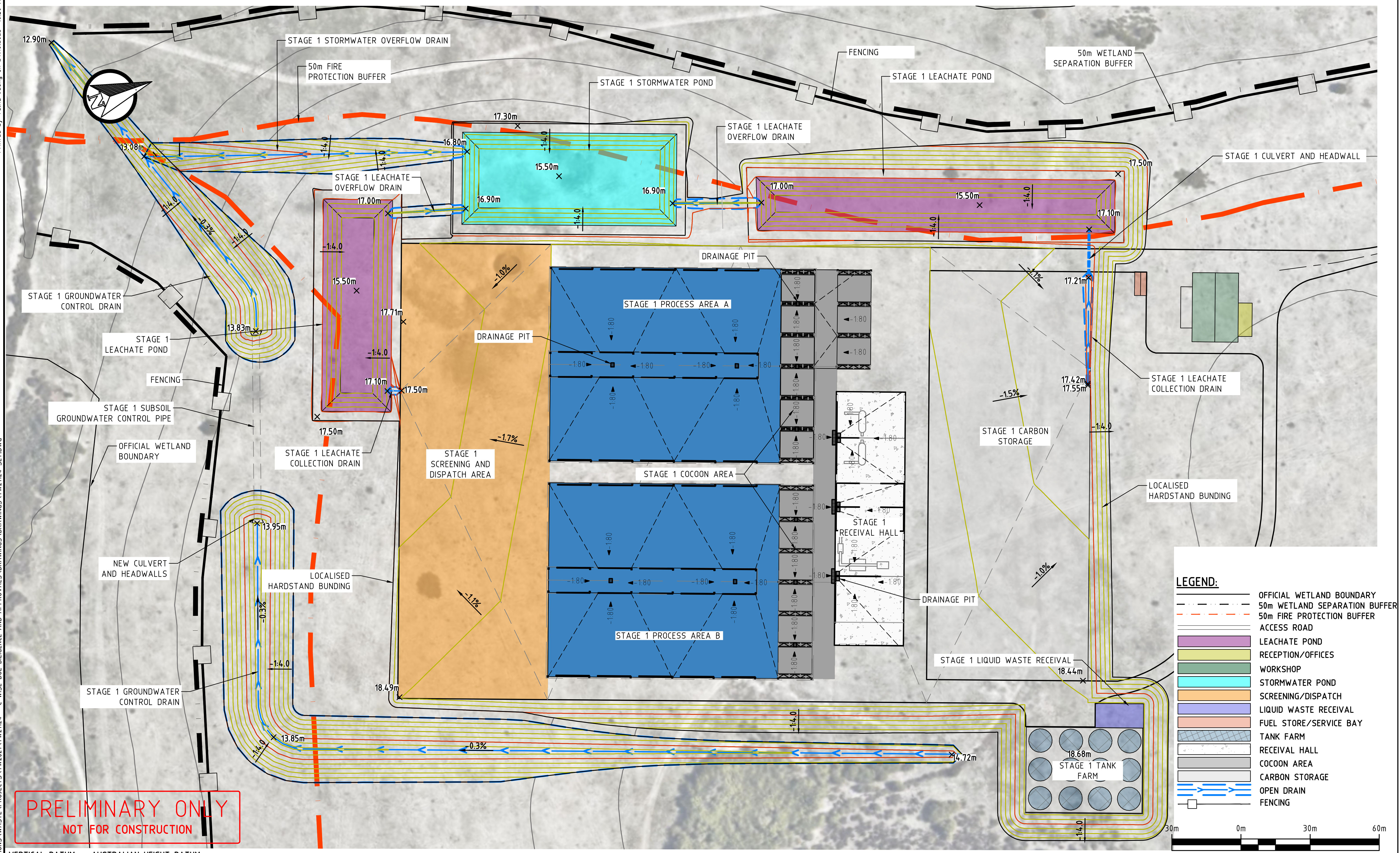

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A	11.10.2023	YJ	AB	PRELIMINARY ISSUE	MH

Project: C-WISE DUE DILIGENCE AND APPROVALS

Title: SURFACE WATER & LEACHATE MANAGEMENT LAYOUT - STAGE 1

Scale: 1:1500 @ A3 | Date: 02.03.2022
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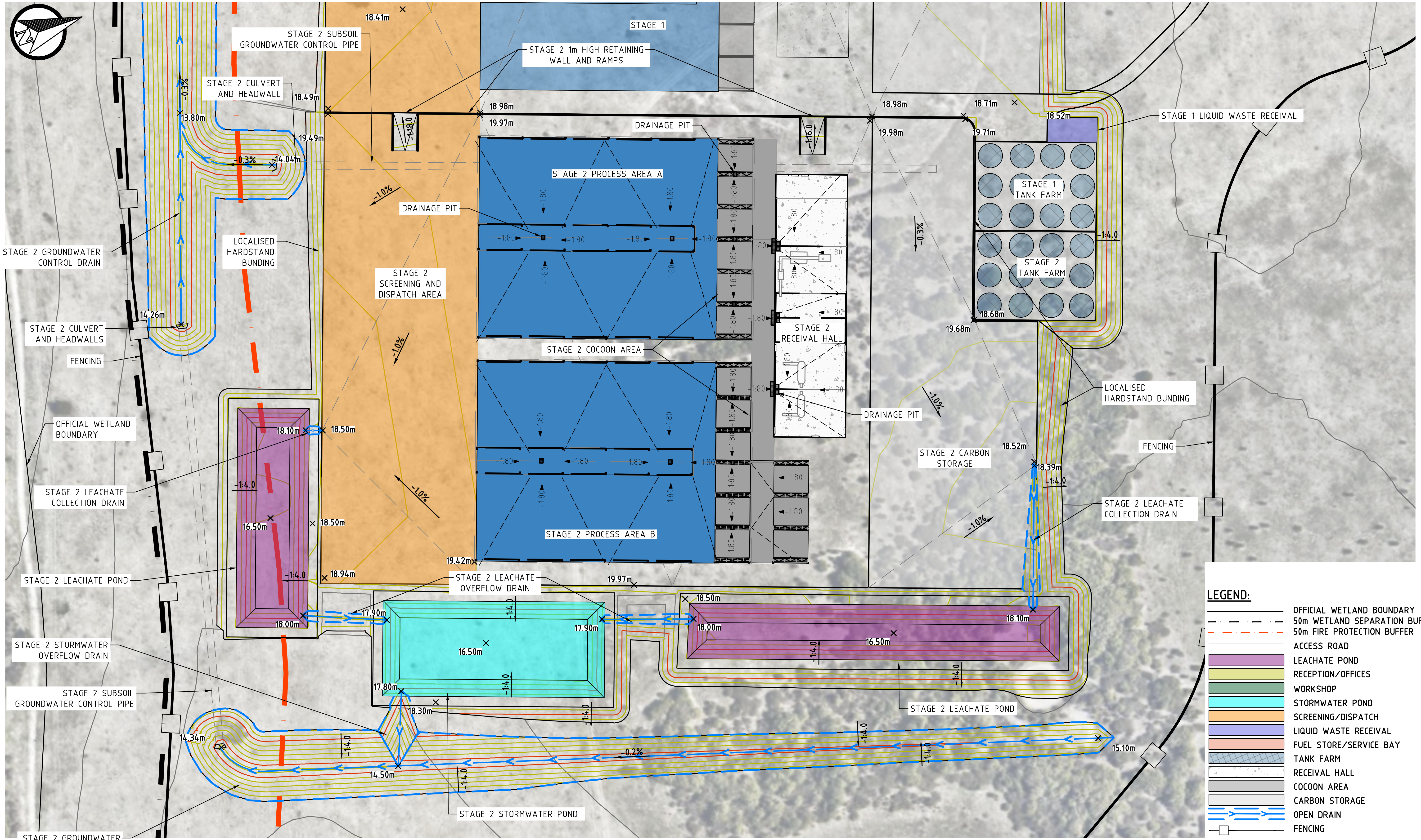

LEGEND:

- OFFICIAL WETLAND BOUNDARY
- 50m WETLAND SEPARATION BUFFER
- 50m FIRE PROTECTION BUFFER
- ACCESS ROAD
- LEACHATE POND
- RECEPTION/OFFICES
- WORKSHOP
- STORMWATER POND
- SCREENING/DISPATCH
- LIQUID WASTE RECEIVAL
- FUEL STORE/SERVICE BAY
- TANK FARM
- RECEIVAL HALL
- COCOON AREA
- CARBON STORAGE
- OPEN DRAIN
- FENCING

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A	11.10.2023	YJ	AB	PRELIMINARY ISSUE	MH

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Title: SURFACE WATER & LEACHATE MANAGEMENT LAYOUT - STAGE 2

Scale: 1:1500 @ A3	Date: 02.03.2022	
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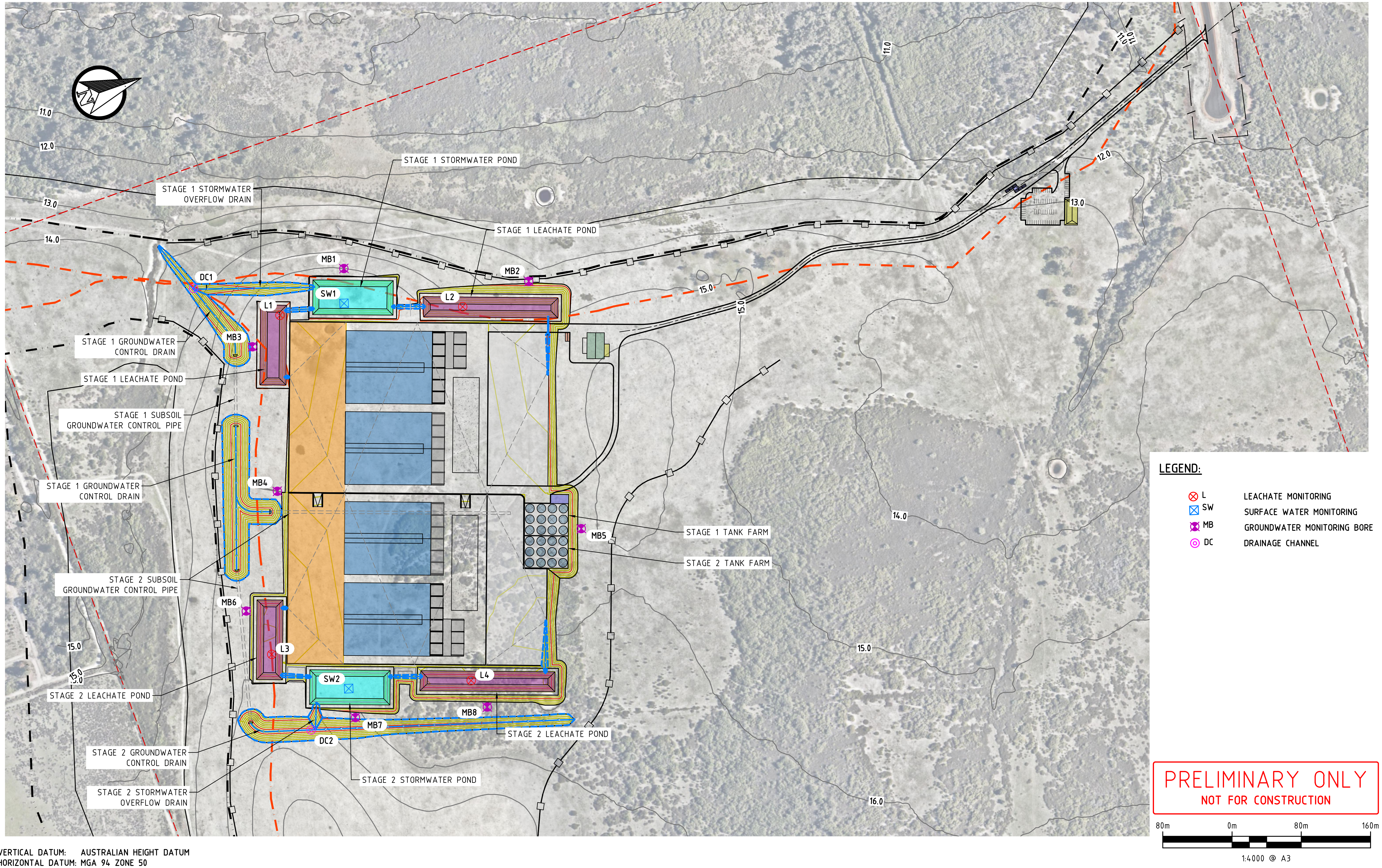
Job No: TW21124	Drg. No: C-107	Rev: A
Filename: TW21124-SET.DWG		



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A	24.10.2023	VS	AB	MONITORING POINT LAYOUT ADDED	MH

Project: C-WISE DUE DILIGENCE AND APPROVALS

Title: ENVIRONMENTAL MONITORING POINT LAYOUT

Scale: 1:4000 @ A3		Date: 02.03.2022
Drawn: YJ	Checked: AB	Approved: MH
Job No: TW21124	Drg. No: C-110	Rev: A
Filename: TW21124-SET.DWG		

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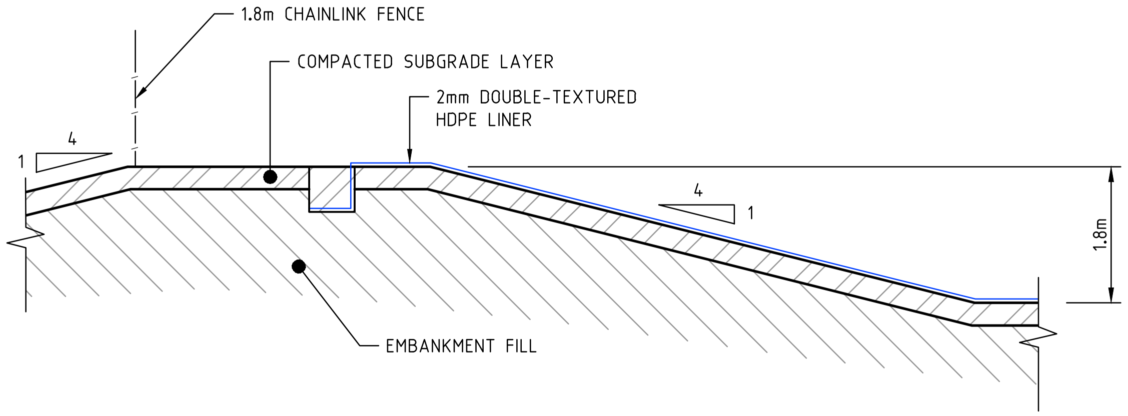

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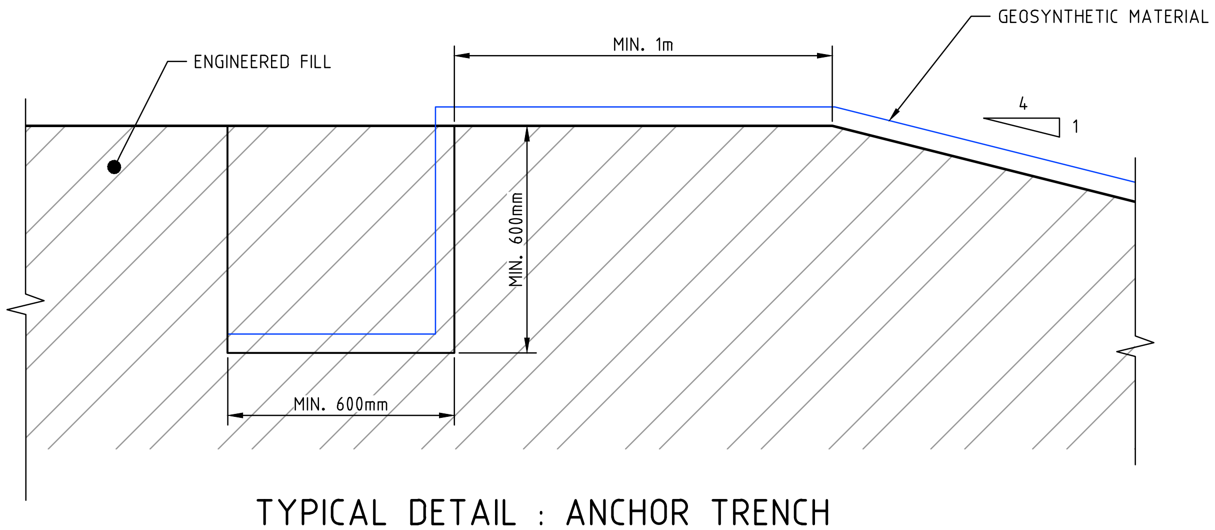

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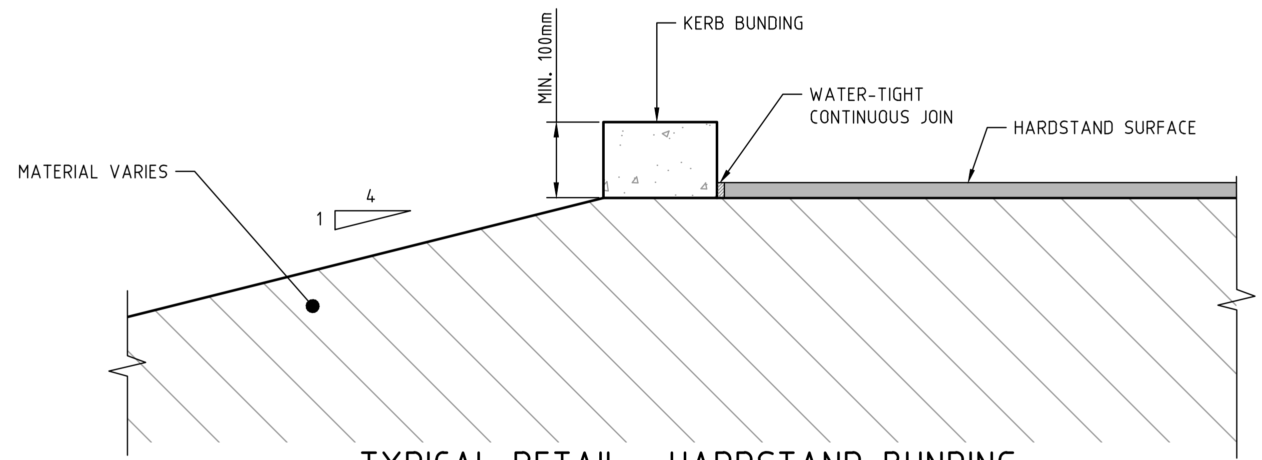

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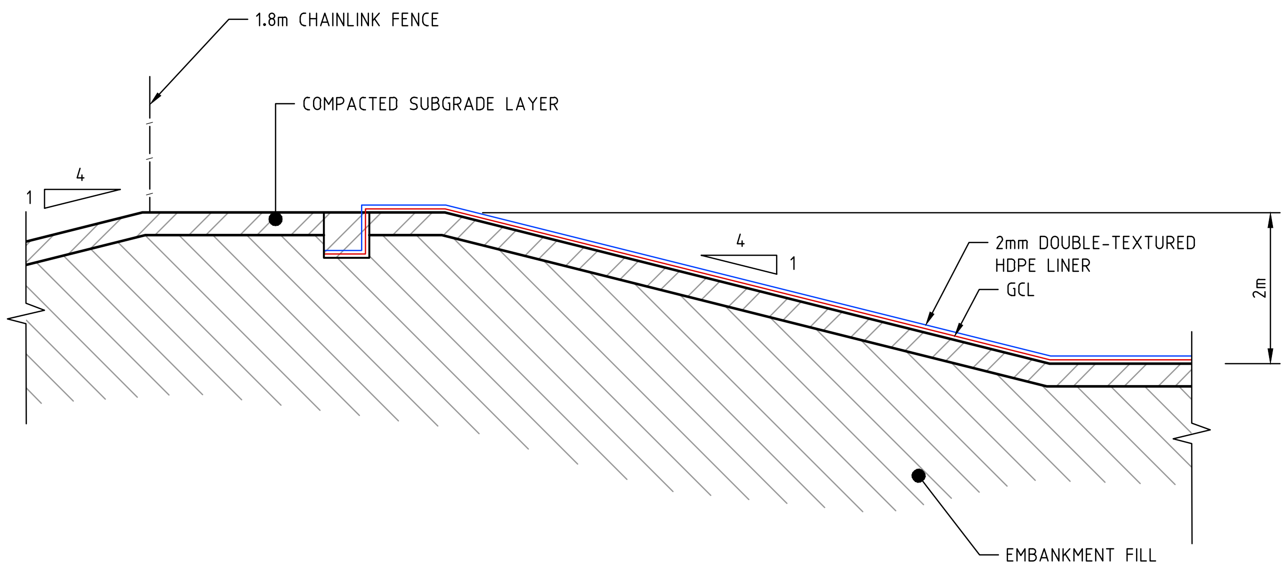

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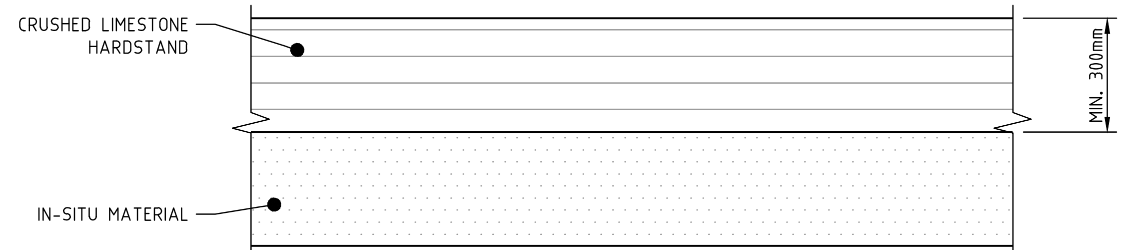

TYPICAL DETAIL : CRUSHED LIMESTONE HARDSTAND
SCALE: N.T.S

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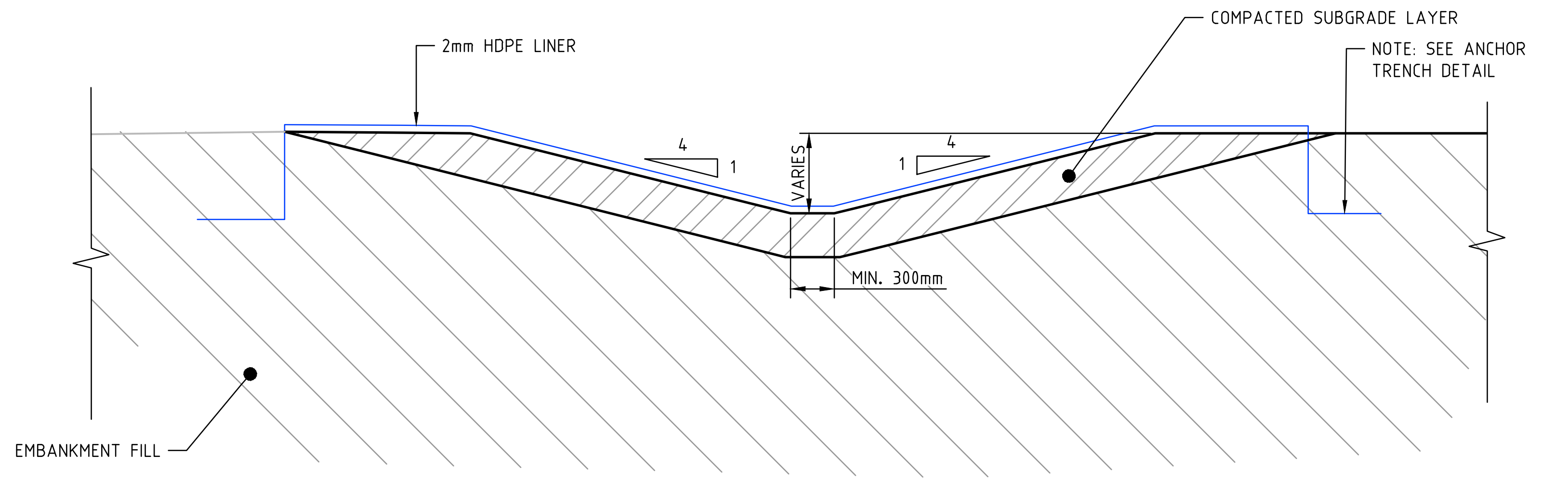
A	24.10.2023	YJ	AB	TYPICAL DETAIL DRAWING ADDED	MH

Project: C-WISE DUE DILIGENCE AND APPROVALS

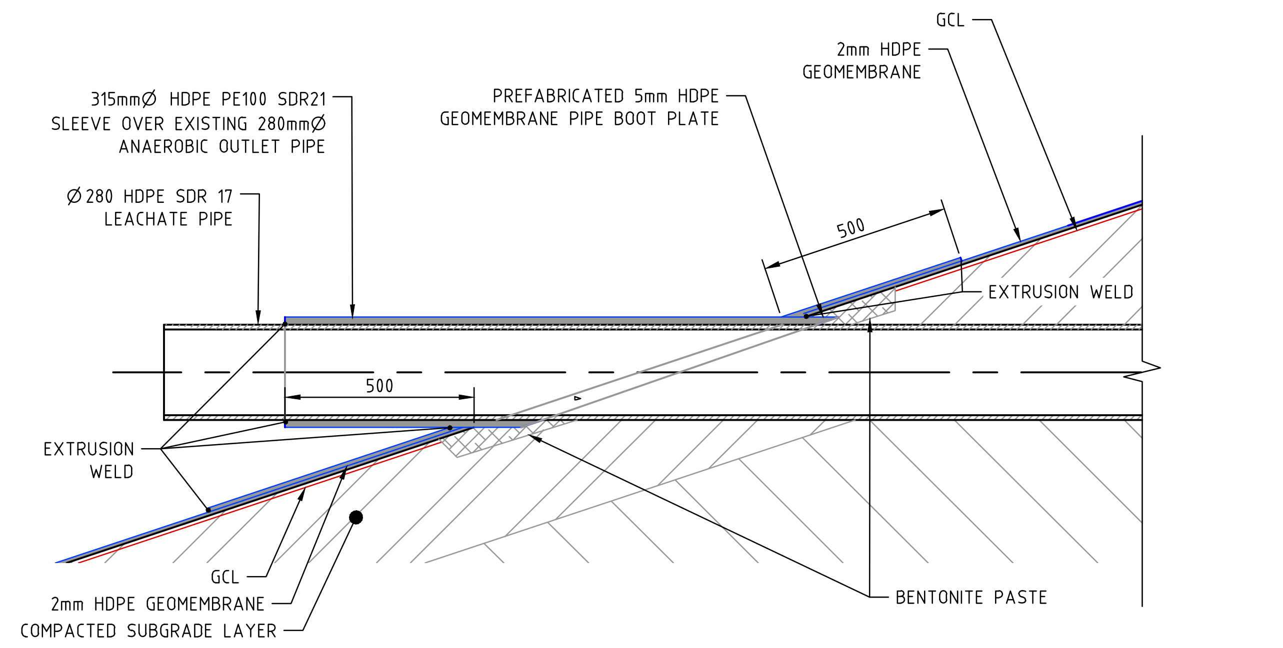
Title: PONDS AND CONTAINMENT INFRASTRUCTURE

Scale: AS SHOWN @ A3	Date: 02.03.2022	
Drawn: YJ	Checked: AB	Approved: MH
Job No: TW21124	Drg. No: C-300	Rev: A
Filename: TW21124-SET.DWG		



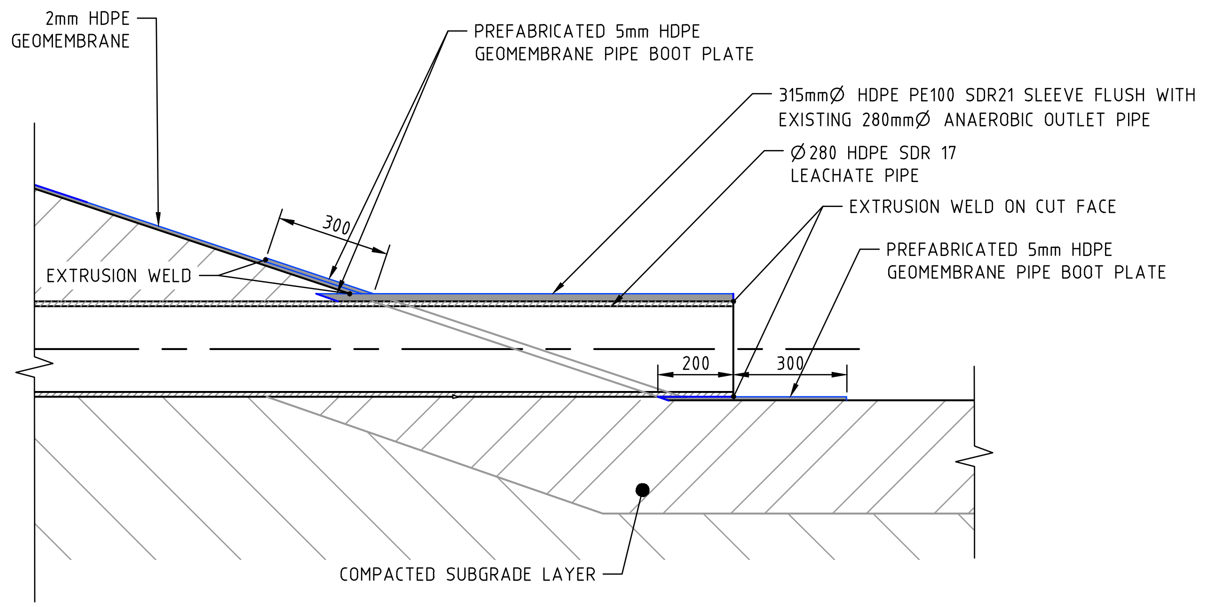
TYPICAL DETAIL : LINED CHANNEL

SCALE: 1:50



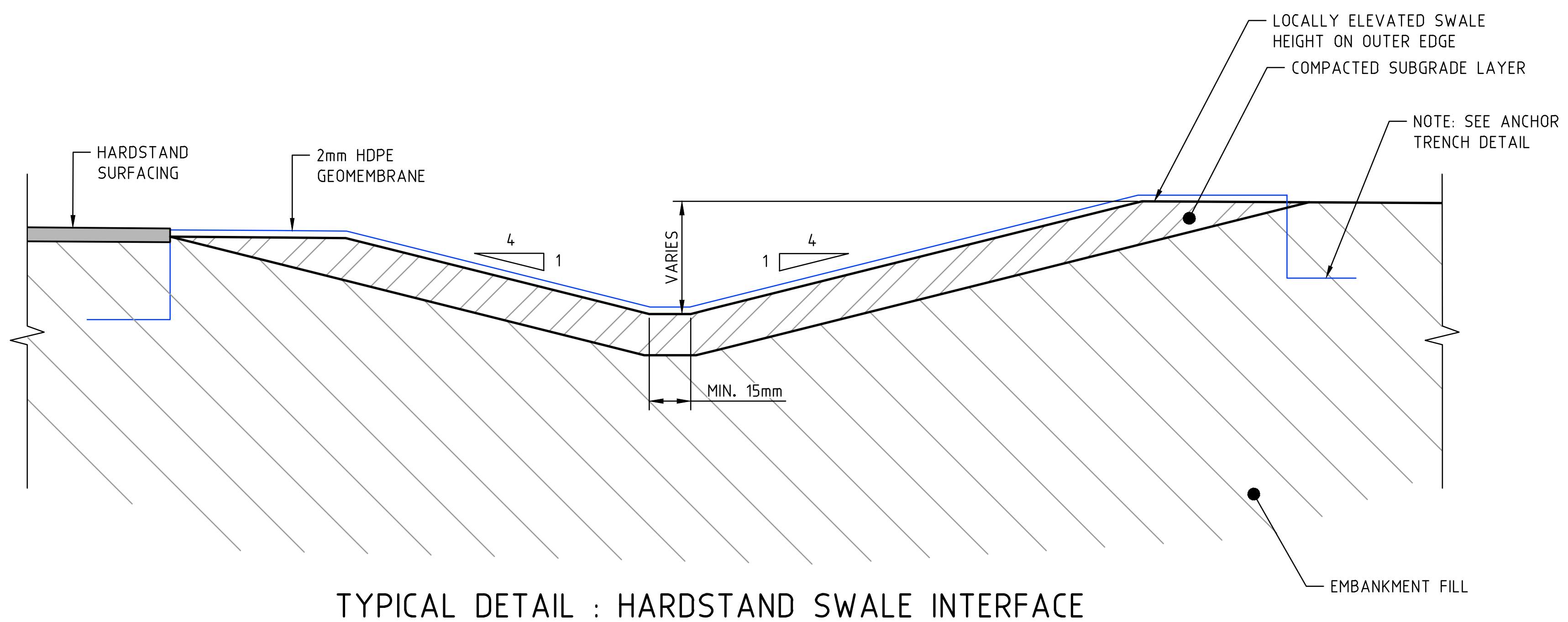
TYPICAL DETAIL : HDPE LEACHATE CULVERT OUTLET

SCALE: N.T.S



TYPICAL DETAIL : HDPE LEACHATE CULVERT INLET

SCALE: N.T.S



TYPICAL DETAIL : HARDSTAND SWALE INTERFACE

SCALE: 1:50

PRELIMINARY ONLY
NOT FOR CONSTRUCTION

VERTICAL DATUM: AUSTRALIAN HEIGHT DATUM
HORIZONTAL DATUM: MGA 94 ZONE 50

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Client: C·WISE™ Soil Carbon Solutions

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No.	Date	Drwn.	Chk.	Amendment / Issue	App.
A	24.10.2023	YJ	AB	TYPICAL DETAIL DRAWING ADDED	MH

Project: C-WISE DUE DILIGENCE AND APPROVALS

Title: CHANNELS AND CONVEYANCE INFRASTRUCTURE

Scale: AS SHOWN @ A3 | Date: 02.03.2022
Drawn: YJ | Checked: AB | Approved: MH
Job No: TW21124 | Drg. No: C-301 | Rev: A
Filename: TW21124-SET.DWG

APPENDIX B

Surface Water & Leachate Modelling

Weather Data

Table 1.1: Site Details

Site Location:	C-Wise
Latitutde:	-32.479255
Longitude:	115.846847

Table 1.2: SILO Rainfall Data (mm)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total Annual	Percentile
1971	5	7	74	5	126	130	148	99	167	87	15	3	865	68%
1972	0	0	4	30	60	123	172	169	63	43	15	2	680	21%
1973	8	2	0	79	135	186	218	132	180	40	23	0	1,002	92%
1974	**2**	**11**	**0**	**69**	**245**	**138**	**303**	**147**	**32**	**83**	**16**	**0**	**1,046**	**98%**
1975	0	1	18	21	111	153	190	98	90	49	18	1	749	40%
1976	48	21	0	79	103	90	105	127	63	43	60	9	748	38%
1977	6	4	5	0	118	96	86	132	26	71	12	0	556	8%
1978	2	19	10	8	161	195	181	39	115	71	13	11	824	57%
1979	2	7	22	56	77	138	125	94	67	31	48	5	673	19%
1980	0	31	3	90	126	169	189	137	63	52	15	53	927	87%
1981	0	16	11	33	171	161	189	132	72	52	48	6	890	79%
1982	181	5	25	0	65	145	189	99	110	40	7	8	873	72%
1983	0	50	4	21	54	272	125	175	120	9	33	13	876	74%
1984	1	3	16	74	282	161	92	142	90	37	113	19	1,030	94%
1985	0	4	18	90	77	145	181	175	72	37	36	11	843	60%
1986	1	78	18	8	161	145	181	152	52	34	27	1	858	66%
1987	2	0	16	118	54	161	164	94	63	26	33	29	760	42%
1988	1	1	13	74	152	186	155	108	110	46	45	3	892	83%
1989	25	37	7	60	190	90	190	90	76	115	9	6	894	85%
1990	22	11	46	106	83	84	172	103	85	52	18	6	788	47%
1991	6	31	3	56	161	222	190	127	104	37	64	34	1,034	96%
1992	0	78	42	21	111	242	118	163	72	19	56	13	934	89%
1993	2	21	33	13	96	96	164	82	126	31	30	1	695	25%
1994	2	3	4	5	135	204	118	112	55	17	10	0	665	15%
1995	1	0	6	16	152	116	248	94	94	92	33	17	868	70%
1996	3	0	10	26	65	222	199	137	120	43	45	15	884	75%
1997	1	9	42	33	111	161	125	142	85	29	9	0	746	34%
1998	2	0	95	23	65	169	87	158	120	43	48	12	821	55%
1999	10	0	11	23	111	204	147	98	120	79	2	4	809	53%
2000	87	0	33	36	54	169	269	152	55	7	20	1	885	77%
2001	0	5	3	5	118	73	105	112	115	29	27	11	603	11%
2002	11	0	3	56	65	169	164	108	63	46	30	4	718	28%
2003	5	19	57	106	96	153	172	112	99	37	33	1	890	81%
2004	0	3	0	13	119	138	140	163	52	52	23	4	706	26%
2005	**0**	**3**	**22**	**44**	**245**	**222**	**65**	**127**	**115**	**79**	**20**	**13**	**955**	**91%**
2006	48	2	10	30	54	22	118	163	41	31	23	1	543	6%
2007	17	7	8	69	77	109	181	127	120	63	3	13	794	49%
2008	0	37	5	137	111	169	181	26	63	49	68	11	856	64%
2009	11	11	8	2	65	195	140	127	115	9	48	1	731	32%
2010	0	1	39	40	77	79	118	62	24	17	11	7	474	2%
2011	37	0	0	30	83	177	140	117	110	31	52	68	843	62%
2012	**44**	**11**	**0**	**60**	**77**	**195**	**47**	**108**	**109**	**26**	**60**	**64**	**799**	**51%**
2013	10	4	46	13	135	40	140	158	155	34	13	1	747	36%
2014	0	0	20	21	171	109	140	98	59	26	25	0	669	17%
2015	0	11	22	60	65	84	105	112	38	17	16	11	542	4%
2016	40	1	20	51	111	116	86	137	72	34	15	9	692	23%
2017	3	115	25	0	96	68	181	147	76	34	4	34	782	45%
2018	93	6	5	9	83	161	164	163	26	52	7	2	772	43%
2019	6	0	14	36	26	169	118	108	38	37	12	2	565	9%
2020	3	7	33	9	83	116	111	74	85	21	72	1	616	13%
2021	1	46	28	65	104	96	237	86	67	92	6	3	831	58%
2022	0	1	8	51	104	123	155	147	59	26	33	17	724	30%
Average	14	14	19	42	111	145	154	121	84	43	29	11	788	

Table 1.3: SILO Pan Evaporation Data (mm)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total Annual
1971	205	192	172	98	69	56	55	71	91	118	145	229	1,502
1972	265	254	196	119	93	55	69	72	87	146	223	282	1,862
1973	299	229	203	108	78	56	53	67	96	126	200	255	1,769
1974	**318**	**240**	**208**	**108**	**77**	**59**	**71**	**76**	**99**	**125**	**174**	**256**	**1,810**
1975	262	260	203	105	81	71	74	77	100	126	166	259	1,783
1976	254	235	196	117	82	56	70	79	89	142	174	225	1,718
1977	258	224	181	134	73	65	67	81	93	133	185	246	1,738
1978	260	224	208	133	90	59	65	72	92	161	209	241	1,812
1979	252	208	185	109	84	50	62	67	90	142	161	250	1,659
1980	284	217	183	93	75	59	61	77	89	126	154	212	1,630
1981	283	217	198	105	99	64	68	85	95	133	160	224	1,730
1982	226	224	182	117	71	64	71	71	92	156	186	218	1,678
1983	282	169	210	112	71	60	58	78	90	141	186	214	1,672
1984	273	243	160	123	69	55	56	68	100	133	166	193	1,639
1985	242	239	191	115	80	52	54	68	93	139	177	208	1,657
1986	276	166	149	105	61	51	51	58	79	119	177	230	1,522
1987	239	234	174	103	61	52	51	68	102	135	175	217	1,608
1988	243	264	203	122	71	61	61	72	91	117	192	235	1,731
1989	239	193	205	111	74	51	49	75	83	117	194	220	1,609
1990	229	199	160	104	64	53	67	73	95	119	174	223	1,560
1991	274	210	176	120	79	53	58	75	84	130	156	221	1,635
1992	271	187	153	114	65	66	58	69	87	134	171	233	1,608
1993	258	221	173	99	76	55	62	73	94	122	162	258	1,651
1994	263	210	199	132	89	54	60	80	106	153	206	279	1,830
1995	292	256	217	126	85	62	61	75	87	145	181	235	1,821
1996	283	270	201	131	92	65	74	73	99	138	176	233	1,834
1997	284	205	177	105	72	53	61	71	84	151	173	253	1,688
1998	269	225	187	108	81	64	47	70	94	146	185	235	1,711
1999	255	236	175	137	66	61	62	73	85	132	208	258	1,749
2000	228	231	185	125	76	62	65	71	91	151	191	258	1,732
2001	244	211	203	124	73	50	56	70	86	139	200	230	1,684
2002	257	237	193	109	75	58	60	72	96	129	196	256	1,739
2003	272	206	196	104	82	55	56	71	91	138	195	238	1,704
2004	265	216	194	117	78	61	57	70	98	135	182	249	1,722
2005	**267**	**203**	**173**	**101**	**76**	**51**	**57**	**69**	**87**	**111**	**178**	**189**	**1,563**
2006	217	204	194	102	76	59	58	74	97	159	186	257	1,681
2007	237	197	195	102	66	64	68	63	88	135	213	225	1,653
2008	273	236	192	99	64	58	53	80	91	139	161	219	1,665
2009	250	215	179	136	94	56	58	67	91	148	179	259	1,731
2010	288	215	190	100	74	48	52	70	114	162	214	252	1,779
2011	256	256	232	140	85	62	55	77	96	139	183	231	1,812
2012	**285**	**216**	**216**	**109**	**68**	**56**	**54**	**70**	**98**	**148**	**177**	**234**	**1,732**
2013	255	237	165	104	70	53	57	72	92	142	214	265	1,724
2014	284	252	195	117	63	53	59	81	98	149	180	256	1,785
2015	291	212	183	110	79	60	55	75	112	156	216	270	1,817
2016	258	243	187	96	71	54	61	69	88	137	214	253	1,733
2017	277	195	166	120	77	62	66	74	103	150	229	254	1,774
2018	268	209	191	111	97	51	72	73	95	134	195	252	1,746
2019	267	230	192	118	80	67	54	89	112	148	225	287	1,869
2020	274	217	177	115	84	65	62	75	102	177	168	285	1,801
2021	329	205	176	128	74	55	71	76	111	134	204	289	1,850
2022	316	258	197	126	86	61	69	78	96	137	186	268	1,876
Average	265	222	188	114	77	58	60	73	94	138	186	243	1,719

Table 1.4: Rainfall AEP

AEP		Rainfall (mm)											
Duration		63.2%	50.0%	20.0%	10.0%	5.0%	2.0%	1.0%	0.5%	0.2%	0.1%	0.05%	4.0%
Hours	BoM	1:1	1:2	1:5	1:10	1:20	1:50	1:100	1:200	1:500	1:1000	1:2000	1:25
0.02	1 min	1.9	2.09	2.68	3.09	3.5	4.05	4.47	5.12	6.06	6.87	7.77	3.68
0.03	2 min	3.34	3.63	4.54	5.14	5.72	6.45	6.99	7.92	9.24	10.4	11.6	5.96
0.05	3 min	4.46	4.87	6.12	6.97	7.79	8.84	9.63	10.9	12.8	14.4	16.2	8.14
0.07	4 min	5.38	5.88	7.46	8.53	9.58	11	12	13.7	16.1	18.2	20.4	10.05
0.08	5 min	6.15	6.74	8.61	9.88	11.1	12.8	14.1	16.1	19	21.5	24.2	11.67
0.17	10 min	8.87	9.76	12.6	14.6	16.6	19.3	21.3	24.5	29.1	33	37.4	17.50
0.25	15 min	10.7	11.8	15.2	17.6	20	23.2	25.7	29.6	35.1	39.8	45.1	21.07
0.33	20 min	12.1	13.3	17.1	19.8	22.5	26.1	28.9	33.1	39.3	44.5	50.4	23.70
0.42	25 min	13.2	14.5	18.7	21.6	24.4	28.3	31.3	35.8	42.4	48.1	54.4	25.70
0.50	30 min	14.2	15.6	20	23.1	26.1	30.1	33.3	38.1	45.1	51.1	57.7	27.43
0.75	45 min	16.6	18.2	23.2	26.6	30	34.5	38	43.5	51.3	58	65.5	31.50
1.00	1 hour	18.5	20.2	25.6	29.4	33.1	38	41.8	47.8	56.3	63.6	71.8	34.73
1.50	1.5 hour	21.5	23.4	29.6	33.8	38.1	43.8	48.2	55	64.9	73.3	82.6	40.00
2.00	2 hour	23.8	26	32.8	37.5	42.2	48.6	53.7	61.3	72.4	81.8	92.4	44.33
3.00	3 hour	27.6	30	37.9	43.5	49.2	57	63.2	72.4	85.7	97.1	110	51.80
4.50	4.5 hour	31.8	34.6	44	50.7	57.7	67.4	75.3	86.6	103	117	132	60.93
6.00	6 hour	35.1	38.3	48.8	56.6	64.6	76.1	85.6	98.5	117	133	152	68.43
9.00	9 hour	40.1	43.8	56.4	65.8	75.7	90.1	102	118	140	160	182	80.50
12.00	12 hour	43.9	48.1	62.2	72.9	84.3	101	115	132	158	180	205	89.87
18.00	18 hour	49.6	54.3	70.8	83.4	97	117	133	153	182	207	235	103.67
24.00	24 hour	53.8	59	77.1	90.9	106	127	145	166	197	223	252	113.00
30.00	30 hour	57.2	62.7	81.9	96.7	113	135	154	176	206	233	260	120.33
36.00	36 hour	60.1	65.9	86	101	118	141	160	181	212	237	264	125.67
48.00	48 hour	65	71.2	92.5	109	126	149	168	188	217	241	266	133.67
72.00	72 hour	73.3	80	103	119	137	159	178	196	222	244	266	144.33
96.00	96 hour	80.7	88	112	129	146	168	185	204	229	249	270	153.33
120.00	120 hour	88.1	95.9	121	138	155	177	194	213	238	257	277	162.33
144.00	144 hour	95.8	104	130	148	165	188	206	224	249	268	289	172.67
168.00	168 hour	104	113	140	158	175	200	219	237	263	283	302	183.33

Table 1.5: Pan Evaporation Data (mm)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total Annual
90th %-ile Daily	8.6	6.5	5.6	3.3	2.5	1.7	1.8	2.2	2.8	3.6	5.7	6.1	1,563
90th Percentile	267.2	202.9	173.4	100.9	76.0	51.4	56.7	69.3	86.6	111.1	178.0	189.1	
50th %-ile Daily	9.2	7.0	7.0	3.5	2.2	1.8	1.7	2.3	3.2	4.8	5.7	7.6	1,732
50th Percentile	284.7	216.0	216.4	109.3	68.1	56.0	54.1	69.9	98.3	147.6	177.3	234.1	
Maximum Daily	10.3	7.7	6.7	3.5	2.5	1.9	2.3	2.4	3.2	4.0	5.6	8.3	1,810
Maximum	318.4	239.5	208.2	107.9	77.2	58.8	70.6	75.9	98.5	124.5	174.0	256.4	
Average Daily	8.6	7.2	6.1	3.7	2.5	1.9	2.0	2.4	3.0	4.5	6.0	7.8	1,719
Average	265.3	222.1	188.3	113.9	76.8	57.7	60.5	73.0	94.1	138.4	186.2	242.6	
# Days	31	28	31	30	31	30	31	31	30	31	30	31	365

Table 1.6: Rainfall Year Summary (mm)

Scenario	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average	14.4	14.2	18.6	41.9	111.1	145.2	154.3	120.9	83.9	43.3	29.2	10.8	787.8
50th Percentile	44.1	10.7	0.0	60.0	76.7	194.6	47.1	107.5	109.4	26.0	59.5	63.6	799.2
90th Percentile	0.2	2.7	22.4	43.5	245.4	222.1	65.1	126.5	114.8	78.6	20.4	13.4	955.1
Maximum	2.2	10.7	0.1	69.2	245.4	137.5	303.2	147.1	31.7	82.8	16.4	0.0	1,046.3

Table 2.1: Total Leachate Generation (m3)

Generation Scenario	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Average	-5,567	-4,996	-5,456	-4,653	-3,025	-1,936	-1,890	-2,768	-3,548	-4,808	-4,986	-5,662	-49,295
50th Percentile	-4,786	-5,089	-5,945	-4,176	-3,929	-639	-4,707	-3,120	-2,878	-5,262	-4,190	-4,274	-48,994
90th Percentile	-5,940	-5,299	-5,356	-4,610	505	84	-4,234	-2,620	-2,736	-3,879	-5,217	-5,593	-44,896
Maximum	-5,887	-5,089	-5,943	-3,935	505	-2,139	2,024	-2,079	-4,920	-3,769	-5,322	-5,945	-42,499

Table 2.2: Individual Leachate Generation (m3)

Generation Scenario	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
High Risk Leachate													
Average Rainfall	33	33	43	97	257	336	357	280	194	100	68	25	1,824
50th Percentile Rainfall	102	25	0	139	178	450	109	249	253	60	138	147	1,850
90th Percentile Rainfall	0	6	52	101	568	514	151	293	266	182	47	31	2,211
Maximum Rainfall	5	25	0	160	568	318	702	341	73	192	38	0	2,422
Low Risk Leachate													
Average Rainfall	180	178	233	525	1,392	1,820	1,933	1,514	1,051	542	366	135	9,870
50th Percentile Rainfall	553	134	0	752	961	2,438	590	1,347	1,371	326	745	797	10,013
90th Percentile Rainfall	3	34	281	545	3,075	2,783	816	1,585	1,438	985	256	168	11,966
Maximum Rainfall	28	134	1	867	3,075	1,723	3,799	1,843	397	1,037	205	0	13,109
Leachate Reuse													
Average Rainfall	-5,945	-5,370	-5,945	-5,753	-5,945	-5,753	-5,945	-5,945	-5,753	-5,945	-5,753	-5,945	-70,000
50th Percentile Rainfall	-5,945	-5,370	-5,945	-5,753	-5,945	-5,753	-5,945	-5,945	-5,753	-5,945	-5,753	-5,945	-70,000
90th Percentile Rainfall	-5,945	-5,370	-5,945	-5,753	-5,945	-5,753	-5,945	-5,945	-5,753	-5,945	-5,753	-5,945	-70,000
Maximum Rainfall	-5,945	-5,370	-5,945	-5,753	-5,945	-5,753	-5,945	-5,945	-5,753	-5,945	-5,753	-5,945	-70,000
Finished Product Leachate													
Average Rainfall	198	196	256	576	1,528	1,998	2,122	1,663	1,154	595	402	148	10,835
50th Percentile Rainfall	607	147	0	825	1,055	2,677	648	1,479	1,505	358	818	875	10,993
90th Percentile Rainfall	3	37	308	598	3,375	3,055	895	1,740	1,579	1,081	281	184	13,137
Maximum Rainfall	30	147	1	952	3,375	1,891	4,170	2,023	436	1,139	226	0	14,392

Table 2.3: Key Leachate Generation Parameters

Aspect	Value
High Risk Leachate Area (m^2)	2,315
Low Risk Leachate Area (m^2)	12,529
Finished Product Leachate Area (m^2)	13,755
Surface Water Catchment (m^2)	31,553
Runoff Coefficient	1

Table 2.4: Leachate Generation Inclusion

Aspect	Value
High Risk Leachate	NO
Low Risk Leachate	YES
Leachate Reuse	YES
Finished Product Leachate	YES

Table 2.5 Leachate Reuse Rates

Input	Value
Annual Greenwaste Input (t)	100,000
Annual Liquid Waste Input (t)	30,000
Water Use (greenwaste:water)	
Average Rainfall	1.0
50th Percentile Rainfall	1.0
90th Percentile Rainfall	1.0
Maximum Rainfall	1.0

*1:1 for all as compost is undercover and will have no rainfall input

Table 3.1: Pond Design Characteristics

Aspect	Pond 1	Pond 2	Pond 3
W (m)	23	30	40
L (m)	155	92	93
h (m)	2	2	1.8
Side Slope (1:V)	4	4	4
Freeboard (m)	0.5	0.5	0.5
Evaporation Depth (m)	1	1	0.9
Base Width (m)	7	14	25.6
Base Length (m)	139	76	78.6
Operational Width (m)	19	26	36
Operational Length (m)	151	88	89
Evaporation Width (m)	15	22	32.8
Evaporation Length (m)	147	84	85.8
Pond Catchment Area (m^2)	3,565	2,760	3,720
Pond Evaporation Area (m^2)	2,205	1,848	2,814
Operational Capacity (m^3)	2,846	2,478	3,367
Total Capacity (m^3)	4,453	3,739	5,097

Table 3.2: Surface Water Check

Aspect	Value
Storm Event Duration	24 hour
Storm Event AEP	1:20
Storm Event Rainfall (mm)	106
Required Stormwater Capacity (m^3)	3,345
Storage Check?	PASS

Table 3.3: High Risk Leachate

Aspect	Value
Storm Event Duration	24 hour
Storm Event AEP	1:100
Storm Event Rainfall (mm)	145
Required Stormwater Capacity (m^3)	336
Maximum Monthly Storage (m^3)	702
Required # of 340m^3 Tanks	**3**
Required Pumping Capacity (L/s)	3.9

NOTES:

- Volume of Pond: $V=(h/6)*((LxW)+((W+W_b)*(LxL_b))+(L_b*W_b))$
- Passing Minimum Storage Requirement means Operational Capacity is not exceeded during minimum storm event
- Passing Maximum Storage Requirement means Total Capacity is not exceeded during maximum storm event
- Maximum storage check can be failed provided there is an allowable discharge point
- Pond 1 is for the Low Risk Leachate Catchment
- Pond 2 is for the Dispatch Leachate Catchment
- Pond 3 is for the Surface Water Catchment

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Table 4.1: Water Balance Inputs

Aspect	Value
Runoff Coefficient	1
Evaporation Coefficient	0.7

Table 4.2: Rainfall Scenario Inputs

Year	Rainfall
1	90th Percentile
2	90th Percentile
3	90th Percentile
4	90th Percentile
5	90th Percentile

Table 4.3: Leachate Inputs

Pond	% of Leachate in Pond
Pond 1	48%
Pond 2	52%

Table 4.4: Storm Check Inputs

Aspect	Value
Storm Event Duration	24 hour
Storm Event AEP	1:100
Storm Event Rainfall (mm)	145

Table 4.5: Water Balance

Year	Month	Pond 1	Pond 2
1	Jan	0	0
1	Feb	0	0
1	Mar	0	0
1	Apr	0	0
1	May	998	843
1	Jun	1,751	1,434
1	Jul	0	0
1	Aug	0	0
1	Sep	0	0
1	Oct	0	0
1	Nov	0	0
1	Dec	0	0
2	Jan	0	0
2	Feb	0	0
2	Mar	0	0
2	Apr	0	0
2	May	998	843
2	Jun	1,751	1,434
2	Jul	0	0
2	Aug	0	0
2	Sep	0	0
2	Oct	0	0
2	Nov	0	0
2	Dec	0	0
3	Jan	0	0
3	Feb	0	0
3	Mar	0	0
3	Apr	0	0
3	May	998	843
3	Jun	1,751	1,434
3	Jul	0	0
3	Aug	0	0
3	Sep	0	0
3	Oct	0	0
3	Nov	0	0
3	Dec	0	0
4	Jan	0	0
4	Feb	0	0
4	Mar	0	0
4	Apr	0	0
4	May	998	843
4	Jun	1,751	1,434
4	Jul	0	0
4	Aug	0	0
4	Sep	0	0
4	Oct	0	0
4	Nov	0	0
4	Dec	0	0
5	Jan	0	0
5	Feb	0	0
5	Mar	0	0
5	Apr	0	0
5	May	998	843
5	Jun	1,751	1,434
5	Jul	0	0
5	Aug	0	0
5	Sep	0	0
5	Oct	0	0
5	Nov	0	0
5	Dec	0	0

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