Appendix I

Nutrient Management Plan, (Emerge 2025)

Nutrient Management Plan

Lot 101 (no. 752) Wallcliffe Road, Margaret River

Project No: EP18-128(19)

Prepared for Wallcliffe House Pty Ltd

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Abbreviations

Table A1: *Abbreviations – General terms*

General terms	
AEP	Annual exceedance probability
ANZECC	Australian and New Zealand Environment and Conservation Council
ARMCANZ	Agriculture and Resource Management Council of Australia and New Zealand
CHRMAP	Coastal Hazard Risk Management and Adaption Plan
DLR	Design loading rate
EC	Electrical conductivity
LTV	Long-term trigger value
MGL	Maximum groundwater level
NWQMS	National Water Quality Management Strategy
RWT	Rainwater tanks
TN	Total nitrogen
TP	Total phosphorous
TWL	Top water level
WWTP	Wastewater treatment plant

Table A2: Abbreviations – Organisations

Organisations	
BoM	Bureau of Meteorology
DBCA	Department of Biodiversity Conservation and Attractions
DoH	Department of Health
DWER	Department of Water and Environmental Regulation
SAMR	Shire of Augusta Margaret River
WAPC	Western Australian Planning Commission
WC	Water Corporation of Western Australia

Table A3: Abbreviations – units of measurement

Units of measurement	
cm	Centimetre
ha	Hectare
m	Metre
m^2	Square metre
m AHD	Metres in relation to the Australian height datum
mm	Millimetre
°C	Degrees Celsius
mg/L	Milligrams per litre
mS/cm	Millisiemens per centimetre
µS/cm	Microsiemens per centimetre

1 Introduction

1.1 Background

Wallcliffe House Pty Ltd (the proponent) are proposing to redevelop Lot 101 Wallcliffe Road, Margaret River (herein referred to as 'the site') for tourism purposes. The site is located within the Shire of Augusta Margaret River (SAMR) and is currently zoned as 'tourism' (and 'tourist area') under the SAMR LPS No.1.

The site is approximately 5.2 ha in size and is located approximately 8 km south-west of the Margaret River townsite. The site is generally bounded by the Margaret River and associated riparian vegetation to the north-west, a nature reserve to the south and existing residential and tourism (chalet and camping land uses) to the east (which includes the Margaret River rowing club). The location and boundaries of the site are shown in Figure 1.

1.2 Purpose of this report

This *Nutrient Management Plan* (NMP) has been prepared to document the manner in which the proposed approach to managing wastewater onsite will protect the groundwater and surface water resources. The NMP has been prepared in consideration of the *Water Quality Protection Note (WQPN) 33 Nutrient and irrigation management plans* (DoW 2010) and intends to support the Works Approval application process.

1.3 Policy framework

There are a number of key legislation, policies and guidelines relevant to the site. These policies include:

- *Water Quality Protection Note (WQPN) 33: Nutrient and irrigation management plans* (DoW 2010)
- *Water Quality Information Sheet 04: Nutrient and irrigation management plan checklist* (DoW 2010)
- *State Planning Policy 2.9 Water Resources* (DPLH 2021)
- *Draft State Planning Policy 2.9 Planning for Water* (Government of WA 2022)
- *National Water Quality Management Strategy (NWQMS)* (ANZECC and ARMCANZ 2000)
- *Draft Margaret River Protection Strategy* (SAMR 2018)
- *Australian Standard 1547:2012 Onsite Domestic Wastewater Management* (SAI Global 2012).

2 Existing Environment

2.1 Climate

The closest weather station to the site which records rainfall and temperature data is located in Witchcliffe (Bureau of Meteorology (BoM) station number 9746), situated approximately 11.7 km south-east of the site. Based on weather data collected from 1999 to 2021, the local area experiences an average of 951.7 mm of annual rainfall, as detailed in **Table 1**. Temperature data is also recorded at the Witchcliffe station, indicating the mean maximum temperature of 27.1°C is in February, while the mean minimum temperature of 8.2°C is in July and August (BoM 2023).

Table 1: Median (decile 5) annual rainfall from 1919 to 2023 at Witchcliffe (station number 9746) (BoM 2023)

Witchcliffe	Month												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Total
Median rainfall (mm)	12.3	12.2	27.8	62.6	132.3	179.7	194.1	157.7	108.7	63.8	34.7	17.9	**951.7**

2.2 Topography

The topography of the site slopes down from Wallcliffe Road in the east towards Margaret River in the west-northwest. Existing ground levels range from 2 m Australian height datum (AHD) along the western boundary adjacent to Margaret River, to 12 mAHD at its northern extent, 22 mAHD in the south-west near the Wallcliffe Cliffs and 64 mAHD at the southeastern extent (i.e., closest to Wallcliffe Road). The land generally slopes from southeast to northwest, with an average grade between 10-15%. The site includes small localised flat portions where the landscape has been modified to accommodate historical habitation of the site.

Topographic contours of the site are shown in **Figure 2**.

2.3 Geotechnical conditions

An understanding of the soils underlying the portions of the site that may be used for infiltration purposes is required to guide the wastewater treatment plan (WWTP) design process. The following sections discuss the soil characteristics.

2.3.1 Site investigations

The following investigations have been conducted to form an understanding of the geotechnical conditions across the site:

- CMW Geosciences Geotechnical Investigation (CMW Geosciences 2018)

- Douglas Partners Geophysical and Geotechnical Investigation(Douglas Partners 2020, 2021, 2022, 2023, 2024).

In summary, these investigations noted:

- The presence of limestone outcrops/pinnacles at various locations.
- Surficial layers of fill overlying sand and limestone.
- Fill within some test pits comprised sand and limestone cobbles and boulders.
- Natural dune sand in the north-eastern portion of the site, east of the existing pond and east of the existing boat house.
- Seven hand auger boreholes were drilled (up to 3 m) to provide information on the ground profile and soil permeability at the proposed infiltration areas.
- The ground conditions at the location of the proposed WWTP aligned with previous investigations, with Units 0 to 3 observed in the boreholes:
  - Unit 1: SANDY FILL (SAND SP) – fine to medium grained, brown, encountered to a depth of 0.2 m at BH102, in the D6 area (between the two existing tanks).
  - Unit 2: Residual Sand of Spearwood System (SAND SP) – loose to medium dense, fine to medium grained, brown and grey-orange-brown sand encountered to depths of between 1.35 m and borehole termination depths at BH102, BH105 and BH107 and inferred from PSP data to depths of between 0.5 m greater than 4.2 m.
  - Unit 3: Limestone of the Spearwood System – Limestone (rock strength assessment not possible) underlying the sand of Unit 2 either encountered or inferred from depths of between 0.5 m and greater than 4.2 m.
- The limestone surface was comparatively shallow at the location of the proposed WWTP and was encountered at depths between 1.5 m and 4 m below ground. It was noted that the limestone was encountered within 1 m of the existing surface approximately 10 m to the west of the existing tanks.
- The shallow limestone constrains infiltration over part of the area around the proposed WWTP.
- No groundwater was encountered at any of the 2024 infiltration test locations in the vicinity of the WWTP and is expected to be at a significantly greater depth based on previous investigations.
- The ground conditions at the proposed infiltration location in the arrivals paddock aligned with previous investigations, with units 0 to 3 observed in the boreholes:
  - Until 1: encountered to a depth of 0.2 m at BH102, in the D1 area (west of the proposed staff carpark).
  - Unit 2: encountered at depths of between 2.4 m and 9.5 m below ground.
  - Unti 3: encountered from depths of 2.4 m, however, was recorded at depths greater that 4 m at the proposed infiltration site.
- No groundwater was encountered at any of the 2024 infiltration test locations in the arrivals paddock and is expected to be at a significantly greater depth based on previous investigations.

A cross section of the measured ground conditions beneath the potential infiltration and lower portions of the site, based on the geotechnical and geophysical investigations performed across the site, is shown in **Plate 1.** It is noted that the location of infiltration infrastructure to support the WWTP would be located to the extreme right of the cross section shown. This cross section indicated a significant permeable (sand and limestone) soil profile beneath the site overlying granite/bedrock. It also demonstrates significant horizontal separation from the Wallcliffe surficial aquifer and Margaret River.

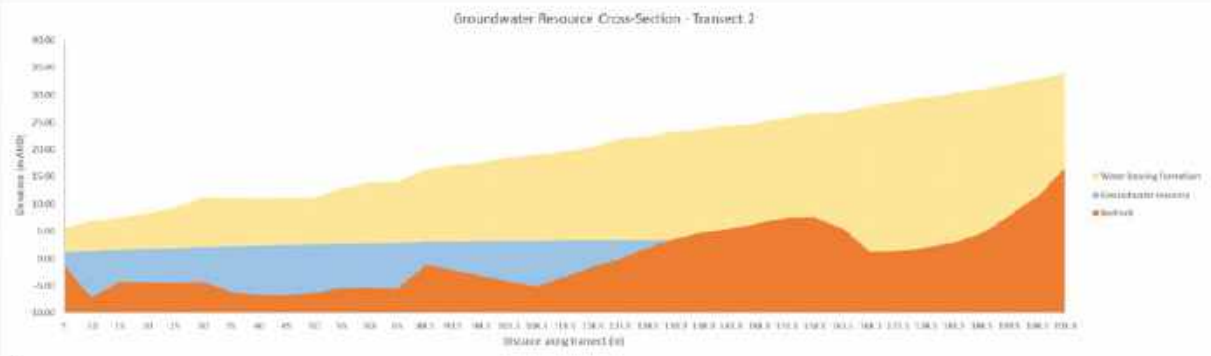

Plate 1: *Conceptual model of the ground conditions beneath the site (Emerge Associates 2022)*

2.3.2 Soil permeability

A number of in-situ infiltration tests using falling head method and constant head method were carried out within residual sand (Unit 2), at depths of between 0.5 m and 4.2 m during the Douglas Partners 2024 investigations (Douglas Partners 2024). Soil permeability at the proposed WWTP and arrivals paddock locations were recorded at 17 m/day and 4.9 m/day respectively.

The infiltration testing undertaken demonstrates that infiltration at source approaches are appropriate for the site.

2.4 Hydrology

2.4.1 Surface water

There are no waterways or surface flow channels present on site.

Runoff from most rainfall events is expected to infiltrate at source within the sandy layer of soils present. Major rainfall events (e.g. 1% AEP event) may result in localised sheet flow due to the steep slope of the site. The historical development has included some minor runoff capture features which have been integrated into small portions of paved areas, and infiltrate locally. The majority of paved areas within the site discharge to permeable areas immediately adjacent to the pavement via sheet flow where it infiltrates to the existing soils.

2.4.1.1 Margaret River

The Margaret River is located directly adjacent to the western boundary of the site. While the topography of the site would direct extreme rainfall event runoff towards Margaret River (as

indicated above), runoff from the majority of rainfall events is expected to infiltrate at source within the sandy layer of soils. The location of Margaret River is shown on **Figure 1.**

The portion of the Margaret River adjacent to the site forms part of the lower reaches of the River, with the river mouth (where it connects with the Indian Ocean) located approximately 1.2 km west of the site (based on the meandering river channel). Margaret River retains a diversity of habitats including pools, riffles, cascades, low flow channels, floodplains, and backwaters.

Riparian vegetation values associated with the Margaret River is largely located outside the site boundary and is located between the site and the waterbody of the River. The width of the riparian vegetation adjacent to the site varies between 0 m and 25 m, with a small portion of the site having direct access to Margaret River.

The hydrology of Margaret River and its catchment has been summarised by the former Department of Water (now DWER) in the Margaret River Hydrology Summary (DoW 2008) and Emerge Associates in the Hydrogeological Assessment (Emerge Associates 2022b).

The peak flood levels are more likely to be influenced by coastal processes (tide, storm surge, seasonal formation of sand bar blocking the River) than flow rates within Margaret River, and preliminary guidance regarding potential peak water elevation at the coast is provided in the Shire of Margaret River CHRMAP (Shore Coastal 2015).

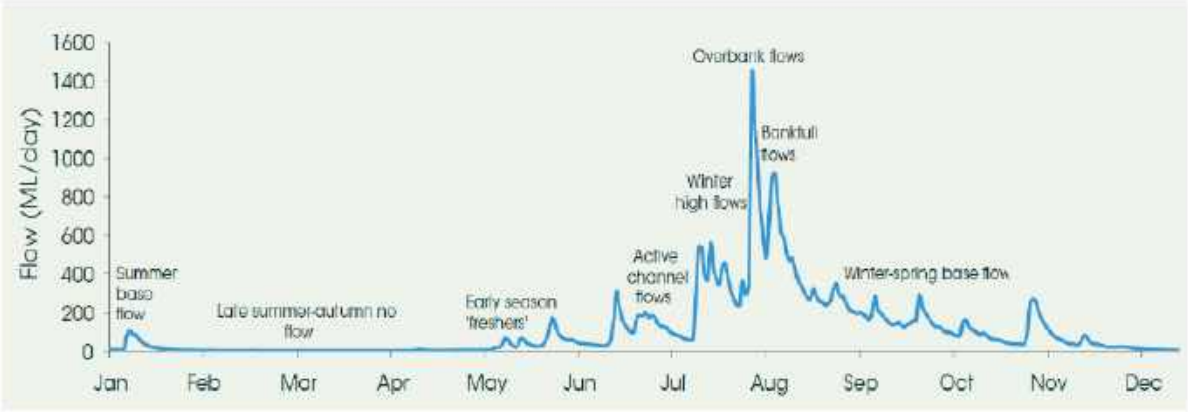

Plate 2: Representative Hydrograph of Margaret River (DWER 2011)

A feature of Margaret River relevant to the management of treated wastewater within the site is the seasonal nature of discharge, in that flow within the River is sometime reduced due to low catchment runoff and sand blocking the River mouth. For the purposes of this NMP it is assumed that these conditions may occur for up to three months at a time.

2.4.1.2 Margaret River water quality

There is no long-term surface water quality data available for the Margaret River in proximity to the site, however Emerge Associates conducted surface water monitoring at immediately adjacent upstream and downstream locations of Margaret River on a quarterly basis between August 2022 and May 2023. The surface water sampling locations are shown in **Figure 2** and results summarised

in Table 2. The NWQMS (ANZECC and ARMCANZ 2000) guideline for slightly disturbed lowland rivers in Southwest Australian is provided for reference (however note that given Margaret River is the downstream end of a rural catchment and these trigger values may not be appropriate).

Table 2: Surface water quality summary

Sampling Location	Sampling Time	pH	EC (mS/cm)	TN (mg/L)	TP (mg/L)
NWQMS		6.5-8.0	0.12-0.3	1.2	0.065
Upstream	August 2022	7.61	506	0.4	0.02
	November 2022	8.04	24,467	0.2	0.2
	February 2023	7.74	28,377	0.7	0.09
	May 2023	7.46	26,133	0.6	0.04
	Average	7.71	19,871	0.5	0.09
Downstream	August 2022	7.67	586	0.5	0.02
	November 2022	8	35,114	0.1	0.1
	February 2023	7.5	28,352	0.4	0.07
	May 2023	7.31	26,250	0.5	0.01
	Average	7.62	22,576	0.4	0.05

The results indicate that nearby Margaret River is considered neutral to slightly alkaline with pH ranging from 7.31 to 8.04. Electrical conductivity (EC) levels vary from 506 to 35,114 mS/cm and are elevated as compared to NWQMS guidelines at both upstream and downstream surface water sampling locations between November 2022 and May 2023. The high EC values in summer and autumn are likely attributed to the high evaporation and non-flow period at the Margaret River. The low EC values are likely associated with the heavy rainfall in winter months.

Total nitrogen (TN) concentrations range from 0.1 to 0.7 mg/L and are low in comparison to NWQMS guidelines at both upstream and downstream locations. Total phosphorus (TP) concentrations range from 0.01 to 0.2 mg/L and are elevated in comparison to NWQMS guidelines at upstream (in November 2022 and February 2023) and downstream (in November 2022) sampling locations. The highest nutrient concentrations occur at the upstream sampling location in summer (November 2022 and February 2023).

2.4.2 Groundwater

2.4.2.1 Groundwater levels

The site is within the Busselton-Capel Groundwater Area and the Cape to Cape North subarea.

Groundwater levels have been measured at the site since 2021, with the installation of eight monitoring bores by Emerge Associates. The locations of the bores (bores MW01 to MW08) are shown on **Figure 2**. Data loggers were installed in MW01, MW02, MW03 and MW04 in 2021.

A summary of the peak groundwater levels is provided in **Table 3**.

The measurement of groundwater levels combined with the extensive geotechnical and geophysical investigations undertaken facilitated a hydrogeological investigation. This was documented in the *Hydrogeological Assessment* (Emerge Associates 2022a), which concluded that a surficial aquifer exists beneath the northwestern portion of the site. This is further discussed in **Section 2.4.2.3.**

Table 3: Groundwater measurement summary

Monitoring well ID	Date of peak GWL	Minimum GWL (mAHD)	Peak GWL (mAHD)	Range in GWL (m)
MW01	11/06/2022	0.43	2.43	2
MW02	07/06/2022	0.90	2.48	1.58
MW03	02/02/2022	1.48	2.73	1.25
MW04	20/09/2021	2.62	3.78	1.16

Based on the measured groundwater levels it can be inferred that the groundwater resource has a strong connection to the River, however given the reduced extent of variation at MW04 (furthest from the River) it can be inferred that that the influence of the River diminishes with increasing distance.

2.4.2.2 Groundwater quality

There is no long-term groundwater quality monitoring data available for the site, however shallow groundwater has historically been utilised to irrigate landscaped portions of the site, and the condition of irrigated vegetation is excellent (from a plant health perspective). Based on this, it is inferred that the quality of groundwater is appropriate for long term irrigation of vegetation and landscaped areas.

Groundwater quality monitoring was conducted by Emerge Associates at eight bores (MW01-MW04, PB02, MW04D, MW07 and MW08) between August 2022 and May 2023. **Table 4** summarises the measured nutrient concentrations at the site, with the bore locations shown in **Figure 2.** Whilst not intended for groundwater, to provide some context the measured groundwater characteristics are compared with NWQMS guidelines (ANZECC and ARMCANZ 2000) for slightly disturbed lowland rivers in Southwest Australia and long-term trigger values (LTVs) in irrigation water.

Table 4: Measured groundwater quality

Bore ID		pH	EC (mS/cm)	TN (mg/L)	TP (mg/L)
NWQMS – Lowland River		6.5-8.0	0.12-0.3	1.2	0.065
NWQMS – LTV in irrigation water		-	-	5	0.05
MW01	Average	7.18	1,872	8.1	2.33

Table 4: Measured groundwater quality (continued)

MW02	Average	7.37	1,622	3.9	2.99
MW03	Average	7.18	1,777	0.6	0.45
MW04	Average	7.43	1,317	3.9	2.04
PB02	Average	7.57	1,458	3.2	0.01
MW04D	May 2023	7.81	1,293	3	0.01
MW07	May 2023	7.71	2,527	1.2	0.44
MW08	May 2023	7.54	1,848	3.8	0.14

The results show that the groundwater beneath the site presents a neutral pH condition and EC values range from 1,301 to 2,527 mS/cm. TN concentrations range from 0.4 to 9.6 mg/L and are elevated in comparison to NWQMS guidelines for lowland rivers and LTV irrigation water in six of the eight bores (MW01, MW02, MW04, PB02, MW04D and MW08). TP concentrations range from 0.01 to 4.97 mg/L and also exceed NWQMS guidelines in six of the eight bores (MW01, MW02, MW03, MW04, MW07 and MW08). The highest nutrient concentrations occur in the northern and central region of the site at MW01, MW02 and MW04, however it is noted that TP is not reflected in the deeper parts of the groundwater resource (at PB02, MW04D).

Whilst nutrients were recorded in the shallow portion of the aquifer, these do not appear to have negatively affected water quality in Margaret River, where nutrient concentrations remain generally low.

2.4.2.3 Wallcliffe Surficial aquifer

The site is located within the Leeuwin Complex which is classified as surficial and fractured rock aquifers. During the *Hydrogeological Assessment* (Emerge Associates 2022a), a thin weathered zone and overlying surficial deposits were identified beneath the site that holds a groundwater resource. This resource, referred to as the Wallcliffe Surficial Aquifer relies on the infiltration of rainfall from the contributing recharge catchment area.

The Wallcliffe Surficial aquifer beneath the site was assessed in the *Hydrogeological Assessment* (Emerge Associates 2022a) to determine the volume of the groundwater resource available to support irrigation. The Wallcliffe aquifer is recharged by a 58 ha catchment uphill to approximately Wilderness Road by rainfall and is recharged between 5,500 kL/year to 44,100 kL/year, depending on the assumptions used (% recharge of rainfall, size of catchment, etc.). The median calculated recharge has been adopted as the sustainable recharge of the Wallcliffe Aquifer at approximately 22,000 kL/year; this considers potential impacts of climate change and rainfall variation.

Based on this assessment and adopting a conservative approach to maintain a sustainable yield, the sustainable yield available beneath the site is estimated to be 22,000 kL per annum.

2.5 Summary of existing environment

In summary, the environmental investigations conducted to date indicate that:

- Long term climatic averages indicate that the site receives 951.7 mm on average annually with the majority of rainfall received in May to August.
- The site slopes towards Margaret River with an average grade between 10-15%. Existing ground levels range from 2 m AHD to 64 mAHD.
- The site soils include limestone outcrops/pinnacles at various locations, surficial layers of sandy topsoil/fill overlying sand or limestone. In the lower portion of the site adjacent to Margaret River, the surficial layer is underlain by a layer of clayey sand, sandy silt, silty sand, and clay, overlying granitic bedrock.
- Soil permeability of shallow soils at the location proposed for infiltrating treated wastewater is 17 m/day adjacent to the proposed WWTP and 4.9 m/day in the arrivals paddock.
- There are no waterways or surface flow channels present on site, and frequent and minor event runoff is likely to infiltrate within the site at or close to source. Major event runoff would likely result in some sheet flow over both impermeable and permeable surfaces given the steep slope of the site.
- The site is immediately adjacent to the Margaret River and associated riparian vegetation.
- Groundwater levels beneath the site vary from 0.43 mAHD to 3.78 mAHD.
- The site is underlain by the Wallcliffe Surficial aquifer, which provides a sustainable groundwater resource of approximately 22,000 kL per annum.

3 Proposed Development

GHD have prepared a concept plan to detail the proposed redevelopment of the site, which is provided in **Appendix A**.

The site is intended to be developed as a boutique hotel that will accommodate up to 25 keys (62 guests) and is intended to respect and acknowledge the cultural heritage and history of the site, its location as well as the existing landscape values. The principles being adopted will see new buildings located within the footprint of the existing fire damaged buildings (which could not be restored), as well being constructed throughout the site including new guest cottages and suites, an operations building and wastewater treatment plant, guest and staff parking, an estate management office, a guest spa and supporting utility infrastructure.

The existing mature cultivated gardens and areas of remnant vegetation within the site are proposed to be retained, although some modification to this vegetation may be required as part of development.

The development of the site necessitates upgrades to the capacity of existing services. In particular, the management of wastewater will be upgraded from the former domestic-scale system to one that is suitable for the proposed development and that will minimise the potential for nutrients to enter the surrounding environment.

4 Wastewater Management Strategy

Development of the site will generate demand for wastewater collection and disposal. Wastewater will be collected from each new building by means of gravity property sewers to one master pump station which in turn will pump to the WWTP.

4.1 Expected wastewater demand

The anticipated wastewater volumes have been based on an annual water demand assessment that has accounted for the following uses/services:

- Hotel guests (at full capacity) – 62 guests
- Staff (during peak times) – 67 per day (which accounts for permanent and potential ad hoc staff)
- Main kitchen/restaurant – 180 sittings per day
- Tea room and bar
- Guest spa facility – 25 uses per day
- Incidental laundry and ancillary uses (bin washdown, car wash, etc.)

4.2 Onsite wastewater treatment plant

The proposed treatment system at the site will include a membrane bioreactor (MBR). The MBR combines a bioreactor, membrane system and sludge handling unit all in one system that outputs treated wastewater. Treated wastewater refers to an advanced level of secondary treatment. This includes activated sludge treatment, coagulation and membrane filtration to significantly reduce contaminants beyond what is achieved with secondary treatment alone, achieving a quality that is significantly higher than that of conventional septic tank type systems.

4.2.1 System summary

The proposed wastewater treatment system will treat a maximum of 38.4 kL/d of wastewater generated from the various buildings associated with the proposed Wallcliffe House development. With attenuation of diurnal flow variations in the feed/equalisation tank, wastewater will be treated at a peak instantaneous flow rate of 0.44 L/s over 24 hours, using biological and chemical treatment processes, and final membrane filtration all within the MBR. Treated wastewater will be disposed via a below-ground infiltration system (modular storage-type system supplied by TunnelWell). The wastewater flow design basis is shown in Table 5.

Table 5: Wastewater flow design basis

Parameter	Units	Requirement
Seasonal occupancy range	%	57-79
Peak-Peak capacity (inc. full capacity with special one-day event once or twice a year)	kL/D	38.4
Full capacity (100% occupancy)	kL/D	34.1

Table 5: Wastewater flow design basis (continued)

Parameter	Units	Requirement
Average capacity	kL/D	27.4
Off-peak period (57% occupancy)	kL/D	21.9
Peak instantaneous flow rate for peak-peak capacity	L/s	0.44
Minimum instantaneous flow rate for peak-peak capacity	L/s	0.25

The proposed design includes the following components:

- Raw wastewater is pumped via a raw wastewater pump station into the WWTP Feed / Equalisation Tank and then via gravity to a wet well. The wet well serves as the feed pumping station into the MBR package plant.
- The MBR initially provides treatment including denitrification, nitrification and reduction in BOD and solids within an activated sludge-type setup.
- The treated wastewater is dosed with coagulant (for P removal) before entering the membrane tank which will house the submerged membranes.
- Membrane filtration is the final part of the MBR treatment system which will remove the remaining suspended solids (TSS) and precipitate associated with phosphorus removal from the treated wastewater.
- The treated wastewater is stored within the treated wastewater storage tank before it is pumped into the duty TunnelWell infiltration structure.
- Sludge is stored in a tank internal to the MBR and will be removed periodically offsite.

4.2.2 WWTP feed tank

A 23 kL feed tank will receive, store and transfer raw sewage to the WWTP package.

4.2.3 Wet well

A 1800 mm wet well will be used as the feed pump station prior to the MBR inlet.

4.2.4 WWTP package

The WWTP package provides wastewater treatment, using MBR technology including reduction in total nitrogen, biological oxygen demand and suspended solids. Followed by coagulant dosing for total phosphate removal. Continuous effluent monitoring of DO, MLSS and pH within the MBR and continuous online monitoring of turbidity and pH on the effluent for process monitoring.

4.2.5 Treated water buffer tank

The treated wastewater storage and delivery system will consist of one 7 kL treated water tank, two duty/standby treated water pumps sending water to the TunnelWell infiltration structure.

4.2.6 Chemical storage and dosing

Liquid chemical storage and dosing units will provide sufficient chemical storage for 28 days of peak operation and be stored in suitably bunded areas. Each storage and dosing unit shall be compliant with *AS3780* and include:

- Primary storage tank
- Secondary containment sump
- Dosing cabinet
- Dose pump
- Valves, fittings, and instruments.

4.2.7 Liquid sludge waste

Sludge to be periodically removed from equalisation tank and MBR sludge chamber using vacuum tankers (onsite thickening and/or dewatering of this sludge not proposed). Removal of MBR sludge by tanker estimated to be every 6 to 12 months and will be delivered off site to an appropriately licensed disposal facility.

4.2.8 Treated wastewater disposal requirements

Land application systems typically discharge wastewater via soil absorption systems (e.g., flatbed leach drains) or irrigation systems (e.g., subsurface irrigation or surface irrigation). The method by which wastewater is dispersed to the land influences the amount of land required for application.

Based on the expected daily generation of wastewater, a maximum system demand has been estimated to be 34.1 kL/day (based on 100% occupancy), though this could be as low as 21.9 kL/day during off peak times. Occupancy is expected to vary from approximately 57 % during off peak to 79 % during peak times, and therefore the assessment using 100 % occupancy is conservative. Further, 100% occupancy in conjunction with a special one-day event has been used as the design flow and estimated to be up to 38.4 kL/day.

The suitability of the land to accept the anticipated wastewater stream is assessed in Section 4.4 as well as the disposal method through subsurface infiltration.

4.3 Soil amendments

Earlier water servicing planning had considered the adoption of engineered soil media being placed beneath infiltration structures to facilitate nutrient removal. However, the wastewater treatment plant is now proposed to reduce TP typically to <1mg/L. The location of the proposed infiltration is at the entrance to the site, near Wallcliffe Road, placing it approximately 375 m from Margaret River and approximately 240 m from the Wallcliffe Surficial Aquifer. For contingency a second location for infiltration is proposed at the southern end of the arrivals paddock, placing it approximately 200 m from Margaret River and approximately 70 m from the Wallcliffe Surficial Aquifer. There is therefore a long pathway that the water will need to filter through before it reaches the downstream

environment. It has therefore been determined that an engineered soil media is not warranted or required.

Based on recent investigations (Douglas Partners 2024), it is anticipated that some limestone (likely isolated limestone pinnacles) may be encountered in the area where the infiltration structures are proposed to be constructed. The following investigation and ground improvement measures will be implemented, if required, to determine that the infiltration system is not adversely affected by any underlying limestone:

- The Contractor will over-excavate the site where the infiltration structures are proposed to be built, to a depth of 2 m below the proposed invert level of the structures.
- Any limestone encountered in the excavation will be removed and either used elsewhere on the site, or disposed of off-site, and sand free of topsoil or limestone (>100 mm in size) from the excavation will be stockpiled. The excavated base of the infiltration structures shall be deep ripped and presented for inspection.
- A geotechnical engineer will inspect the base of the excavation and the excavation batters, to confirm that the limestone has been removed, and the infiltration structures will perform as designed.
- When the geotechnical engineer determines that any limestone present will not impact the performance of the infiltration structures, the excavation will be backfilled with sand and compacted during placement to achieve a strong foundation for the infiltration structures without altering the highly permeable ground available at this site) up to the design invert level of the structures.
- Sand shall not be over-compacted to maintain the infiltration capacity of the soil profile. The permeability of this sand will also be considered, with a target permeability of 5 m/day.

4.4 Site and soil evaluation

4.4.1 Summary of relevant site conditions

The characteristics of the site that are relevant to the disposal of treated wastewater within the site are discussed in **Section 2**, and summarised in **Table 6**, which is based on AS1547:2012 Table K1 potential site limitations.

Table 6: Site and soil evaluation summary

Site characteristic	Summary	Disposal implications
Topography/slope	Site ranges from 2 mAHD to 64 mAHD with a slope of 15% generally steep slope towards the River .	The site is too steep for treated wastewater disposal methods that rely on shallow/flat infiltration areas or surface irrigation.
Soil depth	Sand soil depth to limestone beneath the potential infiltration area ranges from 1.5 m to greater than 4.2 m.	Where required the site of the proposed infiltration structures will be over-excavated and replaced with suitable sand backfill to meet the permeability requirements.

Table 6: Site and soil evaluation summary (continued)

Site characteristic	Summary	Disposal implications
Soil category and permeability	Shallow soils are sand and limestone, increasing with depth, overlying strongly to weakly weathered granite with decreasing permeability. Permeability in shallow sand soils is 4.9 to 17 m/day.	Site soils are considered as Category 1, permeability suitable for onsite infiltration of treated wastewater.
Depth to groundwater	Portions of the site next to the River have >2 m separation, however portions of the site >100 m from the river have >20 m clearance above groundwater.	Depth to groundwater at locations >100 m from the river is >20 m, providing a deep soil profile and long pathway for effluent .
Duration of continuous soil saturation	Soils are moderate to highly permeable and not seasonally saturated.	No impediment imposed by duration of soil saturation.
Dispersive soil	Soils have high measured permeability and are not sodic.	No impediment imposed by soil sodicity.
Site area	5.2 ha, mostly vegetated/landscaped.	The site has a large enough spatial extent to facilitate infiltration of treated wastewater.
Proximity to environmental assets	Margaret River immediately adjacent to the site.	Approximately 30% of the site >100 m from the River, and the proposed infiltration areas are >100 m from the River.
Other nearby resource users	No other users of the Wallcliffe Aquifer.	No impediment imposed by other land users.

Given the site conditions described in Table 6, which include high soil permeability and that the location of the TunnelWell infiltration structures will be>100 m from Margaret River, onsite infiltration of treated wastewater is an acceptable approach.

AS1547:2012 indicates that where slope is a design constraint consideration should be provided to risk of erosion, buildability, and seepage. These factors will be appropriately managed in the design of subsurface infiltration cells.

4.4.2 Design loading rate and land application area

Substantive guidance is provided to onsite effluent disposal system design and effluent disposal by the Health (Treatment of Sewage and Disposal of Effluent and Liquid Waste) Regulations 1974 and AS 1547:2012. *AS 1547* provides guidance for design of systems used to dispose of effluent from primary and secondary treatment systems. It is however noteworthy that the MBR system proposed for use (as described in Section 4.2) is significantly more sophisticated than a typical residential septic or secondary treatment system and warrants additional consideration.

When considering the sizing of the land application area for the site AS1547:2012 recommends selecting an appropriate design loading rate (DLR) from the values presented in Table L1. When selecting an appropriate DLR (based on the site soils and permeability) it is recommended to use a conservative value if there is uncertainty regarding the capacity of the site to accommodate on-site wastewater disposal. Based on the site soil investigations (see Section 2.3) and the recommended treatment system a DLR of 50 mm/day would be appropriate. However, given the steep slope of the

site (> 15 %) towards Margaret River a more conservative approach to DLR selection has been made resulting in a DLR of 30 mm/day based on Table L1.

Using the selected DLR, the maximum trench width of 2.53 m and a peak daily design flow rate the required length of leach drains can be determined using the formula given in Section L4.2 of AS1547:2012. Based on this information the required length of leach drains to effectively treat the peak daily flow rate would be 330 lineal metres and have a spatial footprint of 575 m^2 for the infiltration of treated effluent.

Due to the steep topography of the site, a traditional (e.g., infiltration trench, flatbed leach drains or other similar) approach is not possible, and therefore the treated wastewater will be infiltrated within subsurface infiltration cells. A modular TunnelWell arch-storage system each 20 m in length and with a volume of 20 kL, approximately 30.4 m^2 of infiltration area with each providing a storage and infiltration capacity of at least 38 kL/d (maximum daily wastewater generation plus allowance for special functions/day use). Measured infiltration rates at the proposed cell locations (see **Section 2.3.2**) indicate that this volume would readily infiltrate into the underlying soils within 24 hours. This is based on a design permeability of 2 m/day, which is less than the measured permeability of 4.9-17 m/day in the shallow soil profile, and therefore the assessment is extremely conservative.

The land area required for these cells would be 30.4 m^2 each, significantly less than that calculated by AS1547:2012 methodology, however, the easternmost portion of the site that the proposed infiltration cells will be located and which is >100 m from the River is approximately 16,000 m^2, which is approximately 28 times the surface area indicated as required by AS1547:2012, and therefore the site has sufficient land area to achieve the intent/objectives of AS1547:2012, as shown in **Figure 3**.

Given the soil profile underlying the infiltration cells (permeable sandy/limestone soils) and the large area of the site, the approach proposed is consistent with the stated intent of AS1547:2012, which is to meet the performance objectives for the on-site system of providing sufficient capacity to receive, treat and absorb all treated wastewater flows within the site boundary in an effective and sustainable manner which protects public health and the environment.

4.4.3 Contingency in design

To provide additional standby capacity, and also redundant service capacity, two groups of two by 20 kL storage cells are proposed (i.e., four times the maximum daily capacity will be provided). The use of these will be rotated as required to suit operational and maintenance needs.

4.4.4 Risk reduction measures

A summary of relevant risk reduction measures applicable to the site and the selected wastewater treatment solution are provided in **Table 7**, which is based on AS1547:2012 Tables A1 and A2, and presents the measures taken to reduce the risks associated with the development.

Table 7: Design risk reduction measures for the site

Potential Risk	Potential cause	Risk mitigation measure
Wastewater system hydraulic failure	Inadequately sized wastewater treatment system and undersized land application area	• Designing for maximum daily wastewater generation not likely peak wastewater volumes • Use of a conservative approach for land application area sizing • Buffer storage provided at the WWTP inlet and outlet for accumulation of wastewater • Infrastructure included to allow accumulated raw wastewater to be stored and later treated
Biological failure from power outage causing cessation of pumps and aerators	Loss of power which stops the operation of the treatment system. This can cause a backup of wastewater and reduce the effectiveness of the system	• Backup generators are provided for the treatment system • Additional storage provided within buffer tanks • Contingency/management plans are in place in case of loss of power • Staff are made aware of contingency planning in case of loss of power
High rainfall or torrential downpours	Excessive surface runoff can hydraulically overload the land application areas	• There is no connection of surface runoff into any part of the wastewater system • If unable to discharge to the TunnelWell infiltration structures treated wastewater will be tankered and disposed offsite.
Wastewater biological failure from washout of bacteria	Inadequate hydraulic design of the wastewater system (i.e. undersized, inappropriate treatment system, etc.)	• Designing for a larger hydraulic loading than anticipated • Additional storage provided with WWTP feed buffer tank, which accumulates excessive instantaneous inflows • Use of a conservative approach to the sizing of land application area • Provide multiple disposal areas to provide contingency within the system
Site constraints	Steep slopes located within proposed land application area	• Conservative approach taken for selection of DLR • Appropriate selection of disposal system for the steep slopes (i.e. subsurface disposal) • Install disposal systems perpendicular to the fall of the slope
Clogged outlet filters	Inadequate servicing of wastewater system	• Implementation of a regular monitoring and maintenance program • Conservative estimate of maximum wastewater flows within system
Sludge and scum solids fill tank	Irregular pump/maintenance schedule, undersized wastewater treatment system	• Implementation of a regular monitoring and maintenance program • Follow maintenance schedule as per manufacturers specifications

Table 7: Design risk reduction measures for the site (continued)

Potential Risk	Potential cause	Risk mitigation measure
Build-up of excessive solids to land application area	High organic loading and insufficient settling of solids within wastewater treatment system	• Selection of robust membrane filters reduce solids content of effluent to essentially zero • Provision of a contingency land application area for additional disposal area • Implementation of a regular monitoring and maintenance program • A full set of spare parts components will be stored on site, including replacement membranes
Uneven distribution system/broken/damaged distribution lines	Traffic over land application area	• Minimise compaction during installation • Ensure land application area is protected by fences/barriers • Ensure 'no-go' areas area are specified in the monitoring and maintenance program

4.5 Nutrient balance

4.5.1 Treated wastewater nutrient assessment

In order to assess the potential nutrient load that may be directed to the downstream environment, and to determine if this will provide an acceptable outcome, a nutrient mass balance analysis has been undertaken. The mass balance assesses a worst-case outcome, combining the following circumstances and assumptions:

- 100% occupancy for a three-month period – the anticipated daily loading as a result of this was 34.1 kL/day. The Nutrient Balance has tested the full design loading of 38kL/day, to account for occasional special day use. This loading occurs if the Hotel is fully occupied and there are 115-day visitors (but which is 150% of the typical expected load and in reality may only occur on one or two days each year)
- No flow within Margaret River for a three-month period
- Flow from wastewater treatment system directly enters the Wallcliffe Aquifer and River as a combined system
- No additional attenuation provided by natural processes that could be expected to occur within the soil profile
- Nutrient concentrations in the River are consistent with those measured and constant throughout the assessment period (TN 0.425 mg/L TP 0.069 mg/L)
- Adjacent portion of the River that water could interact with is 9 ha at an average 3 m depth providing 270,000 kL of potential storage
- The Wallcliffe Aquifer is 69,300 kL of potential storage
- Varied nutrients measured in the Wallcliffe Aquifer are temporary as the source of these (historical agricultural land use) has been removed.
- Wastewater treatment system outputs (to the TunellWell strucures) are TN 20 mg/L and TP 1 mg/L

Based on the nutrient mass balance undertaken, the following results are noted:

- Existing (static) nutrient mass in the River: TN 115 kg and TP 19kg.
- Nutrient mass in treated wastewater: TN 68.4 kg and TP 3.42 kg.
- Resulting nutrient concentration in Wallcliffe Aquifer/Margaret River over 3 month no flow period: TN 1.275 mg/L and TP 0.339 mg/L.
- When anticipated occupancy rates are adopted the nutrient concentrations in Wallcliffe Aquifer/Margaret River over 3 month no flow period reduces to TN 1.22 mg/L and TP 0.339 mg/L.
- For context, if there are no inputs provided by the WWTP over a 3 month period the River water quality will be TN 1.09 mg/L and TP 0.33 mg/L.

4.5.2 Irrigation nutrient assessment

In order to provide a holistic project assessment, the nutrient application that may be expected to maintain the high standard of landscaping evident at the site has also been considered. Whilst native vegetation and unfertilised garden beds will be the typical approach adopted, based on the maintenance of the approximate extents of traditional style landscaping the following nutrient inputs can be determined:

- Landscaped area requiring fertiliser input: 1.2 ha.
- Fertiliser rate 60.6 kg/ha/year and TP 10.2 kg/ha/year (based on UNDO Tool combined 'non-native gardens', 'sport', 'native vegetation').
- Assume 75% plant uptake of applied nutrients and 25% of nutrients applied are leached.
- Nutrient output from the site is consistent throughout the year.
- No further attenuation is provided by movement through soil and the aquifer.
- Nutrient mass leached from fertiliser use over three-month period: TN 4.545 kg and TP 0.765 kg
- Resulting nutrient concentration in Wallcliffe Aquifer/Margaret River over 3 month no flow period when combined with wastewater outputs: TN 1.288 mg/L and TP 0.341 mg/L.

4.5.3 Nutrient balance conclusion

The nutrient mass balance for both treated wastewater and other anticipated uses (fertiliser) shows that the potential nutrient concentrations that might be experienced in the Wallcliffe Aquifer and Margaret River are marginally above the existing nutrient concentrations. It is noted that the potential nutrient concentrations that might occur as a result of developing the site are well below the maximum levels that have already been recorded in Margaret River adjacent to the site (see **Section 2.4**).

In summary:

- The key driver for change in nutrient concentrations within the River under all scenarios is the conservative assumption that the Wallcliffe Aquifer and Margaret River are fully connected, and that full mixing of these occurs over the three month duration.
- No attenuation has been assumed as a result of natural physical or biological processes, and these can be expected to reduce nutrient concentrations in the River. This is exemplified by

the low nutrient concentrations within the River despite the existing agricultural uses upstream and existing connection to the Wallcliffe Aquifer.

- The nutrient (mass) outputs from the WWTP are many orders of magnitude less than the existing nutrients recorded in the Wallcliffe Aquifer and in Margaret River.
- The additional nutrients resulting from activities proposed for the site will be barely detectable, and this is largely due to the very large volume of the combine River/Aquifer (349,000kL) versus the very small contribution from treated wastewater (2,466 kL for average operations over a 3 month period).
- Combined nutrients from treated wastewater and potentially leached fertiliser will cause a very slight increase in nutrient concentrations. However, this will be within the recorded natural variability of nutrients within the Wallcliffe Aquifer and in Margaret River.

5 Management and Maintenance Plan

5.1 Management objectives

5.1.1 WWTP operation

The WWTP will be operated to ensure that treated wastewater is within the design limits of <20 mg/L of TN and <1 mg/L of TP and TSS.

Treated effluent determined to be outside the WWTP design limits will cause a high priority alarm (TSS or pH leaving the MBR). The MBR will stop and flows will collect in the feed/equalization tank until the issue is resolved.

5.1.2 Infiltration operation

The infiltration structures are the final element of the wastewater treatment system and have been designed to infiltrate the maximum daily flow in each structure. The infiltration structures will require ongoing management to ensure that they continue to provide the intended function. The management objectives will be achieved through the implementation of the maintenance and monitoring described in the following sections.

5.2 Maintenance plan

The site maintenance and management will remain the responsibility of the proponent. A summary of the schedule of management actions and the responsibility for carrying out each action is provided in **Table 8.**

Table 8: Maintenance schedule and responsibility for management actions.

Management Action	Timing	Location	Responsibility
Physical attendance at WWTP to visually check site for signs of abnormal operation and check site readings and chemical levels	Twice a week	On site	Wallcliffe House staff
Cleaning and calibration of in-line analysers	As per manufacturers recommendations	On site	Wallcliffe House staff
Lab sampling of treated effluent (to confirm proxy readings provided by online instrumentation)	Quarterly	On site, analysis delivered offsite	Wallcliffe House staff, NATA accredited laboratory
Desludging of equalisation tank and sludge compartment of the MBR unit	6- 12 months	On-site	Contractor

5.3 WWTP monitoring

The monitoring within the WWTP will include the following:

- Continuous online monitoring of turbidity (TSS< 1 mg/L), and pH at the MBR outlet
- Continuous online monitoring within the MBR for pH, mixed liquor suspended solids (MLSS) and dissolved oxygen (DO)
- For treated wastewater monthly monitoring of:
  - TSS
  - TN
  - NO_x-N
  - TKN-N
  - TP
  - BOD
  - TDS
  - pH
- Weekly monitoring of sludge levels
- Periodic inspections and review of operational data by consultant.

5.4 Infiltration monitoring

Monitoring for the infiltration structure will include:

- Two access/inspection points at each end of the Tunnelwell and single vent for visual inspections
- Inlet pipework will include an automated control valve to direct effluent to one or both structures as required
- A pressure transducer (or similar) will be installed in each structure to monitor water levels.

5.5 Environmental monitoring

Monitoring of groundwater quality concentrations is proposed to occur at the pre-development bore locations (PB 1 and PB2) if these locations can be retained. Where they cannot be retained, they will be reinstalled downstream of the infiltration cells.

Monitoring of surface water quality will be undertaken to provide an indication of the overall performance of the development and to demonstrate whether surface water has been appropriately managed or if contingency actions are required. Surface water quality is proposed to be monitored in Margaret River upstream and downstream of the site.

Surface water quality trigger values were taken from the pre-development surface water quality measured at monitoring locations applicable to the site. Groundwater quality trigger values are based on the pre-development groundwater quality at all bores located within the site. Breach of a trigger value is a prompt for further investigation into operation of the WWTP system to ensure it is functioning as intended. There is some amount of variability in nutrient concentrations experienced

across the development area and the trigger values may need to be modified following additional monitoring.

A summary of the schedule of management actions and the responsibility for carrying out each action is provided in **Table 9.**

Table 9: Water quality monitoring trigger values

Analyte	Surface water quality trigger values	Groundwater trigger values
TN as N (mg/L)	0.42	3.77
TP as P (mg/L)	0.07	1.39

A summary of the monitoring program is provided in **Table 10.**

Table 10: Monitoring program summary

Monitoring type	Locations	Frequency	Parameters
Groundwater	Pre-development bore locations or downstream of infiltration cells.	Quarterly (typically Jan, April. July and Oct)	In situ physicochemical parameters (pH, DO, EC, Temperature)
Surface water	In Margaret River, upstream and downstream of the site	Quarterly (typically Jan, April. July and Oct)	Laboratory analytes (TSS, NOx, NH_4, TKN, TN, TP)

5.6 Contingency actions

Table 11 summarises elements of the proposed design and contingencies that address various operational events.

Table 11: Operational summary

Event	Contingency action
High wastewater generation	WWTP feed buffer tank provides buffering/storage capacity. Treated water buffer tank provides buffering/storage capacity.
Low wastewater generation	MBR unit incorporates recirculation mechanism.
High wastewater strength/load	MBR process automatically increases aeration to provide improved biological treatment.
High treated effluent TSS	Transfer to infiltration inhibited, critical alarm raised for immediate operator attention.
Treatment fault	Fault with the MBR will stop effluent passing to the effluent storage tank. Critical alarm raised for immediate operator attention.

Table 11: Operational summary (continued)

Event	Contingency action
Prolonged high-wastewater generation and/or treatment outage and/or power failure or generator failure	Tankering of stored raw wastewater for offsite treatment and disposal
Prolonged outage to effluent disposal mechanism	Tankering of stored treated effluent for offsite treatment and disposal
High water level in infiltration structure	Automated opening of the inlet valve to the resting structure (parallel operation)
High-High water level (or TSS) in infiltration structure	Switch to one of the standby TunnWell infiltration structures. If all four infiltration structures are high, then shutdown treated wastewater pumps
Planned special event on site	Flow will be switched to the rested infiltration structure
Groundwater quality exceeds the trigger values	Repeat monitoring to eliminate sampling error
Groundwater quality exceeds the trigger values in the repeated monitoring	Identify cause by comparing values with the WWTP monitoring system, groundwater levels, rainfall data, soil moisture, nutrient application practices and water quality in Margaret River. Remove source if possible (e.g. fertiliser input, review of WWTP operation)
Groundwater quality exceeds the trigger values for consecutive months	Monitoring data should then be used as a management tool to determine if the trigger values should be revised, and the proponent will seek to work with DWER to determine if the results are representative of a broader catchment management issue, and whether any additional contingency actions need to be implemented on site

6 Implementation Plan

6.1 Delivery of works phase

The delivery phase will include the design construction and commissioning of the infrastructure and will include:

- An initial operation and maintenance period which will include training of permanent on-site staff
- A two-year defects liability period with servicing support.

6.2 Operations phase

The proponent will retain ownership and operate the infrastructure utilising the following:

- On-site engineering team
- Maintenance service providers based in the south-west
- Technical support from manufacturer with 24/7 support
- Extensive set of spare parts kept on-site

The responsibility for working within the framework established within the NMP rests with the proponent and their contractors. The schedule of management actions and the responsibility for carrying out each action is summarised in **Table 8**.

7 References

7.1 General references

Australian and New Zealand Environment and Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand (ANZECC and ARMCANZ) 2000, Australian and New Zealand Guidelines for Fresh and Marine Water Quality, National Water Quality Management Strategy, Commonwealth of Australia, Canberra.

CMW Geosciences 2018, Geotechnical Investigation Report - Proposed Building Development Wallcliffe House, Prevelly, WA.

Douglas Partners 2020, Geophysical Investigation for Subsurface Geological Mapping - Wallcliffe House, 752 Wallcliffe Road, Margaret River Western Australia, 70585, 0.

Douglas Partners 2021, On-site Sweage Disposal Assessment, 96717.01.

Douglas Partners 2022, Geotechnical Investigation - Proposed Wallcliffe House Redevelopment, 752 Wallcliffe Road Margaret River WA, R.001, 0.

Douglas Partners 2023, Potential Treated Water Infiltration Areas - 752 Wallcliffe Road, Margaret River, WA, R.001.Rev0.

Douglas Partners 2024, Report on Geotechnical Investigation Wallcliffe House Water Infiltration Areas 752 Wallcliffe Road, Margaret River WA, Version 0.

Department of Water (DoW) 2010, Water Quality Protection Note 33: Nutrient and Irrigation Management Plans, Perth.

Department of Planning, Lands and Heritage (DPLH) 2021, Draft State Planning Policy 2.9 Planning for Water Guidelines, Perth, Western Australia.

Department of Water and Environmental Regulation (DWER) 2011, Ecological Water Requirements of the Margaret River, Perth.

Emerge Associates 2022a, Hydrogeological Assessment, EP18-128(09)--026 AJI, 1.

Emerge Associates 2022b, Hydrogeological Assessment, Lot 101 Wallcliffe Road, Prevelly, EP18-128(09)-026 AJI, 1.

7.2 Online references

Bureau of Meteorology (BOM) 2023, Weather and Climate Statistics, viewed 9 October 2023 <http://www.bom.gov.au/climate/data/>.

Department of Water and Environmental Regulation (DWER) 2023, Water Register, viewed 9 October 2023, <http:// https://maps.water.wa.gov.au/#/webmap/register>.

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Figures

Figure 1: Site Locality

Project:	Nutrient Irrigation Management Plan Lot 101 Wallcliffe Road, Prevelly
Client:	Wallcliffe House Pty Ltd

Plan Number: EP18-128(19)--F90

Drawn:	WJC
Date:	11/03/2025
Checked:	DRL
Approved:	DPC
Date:	28/03/2025

N

0 100 200
Metres

Scale: 1:5,000@A4

GDA 1994 MGA Zone 50

emerge ASSOCIATES

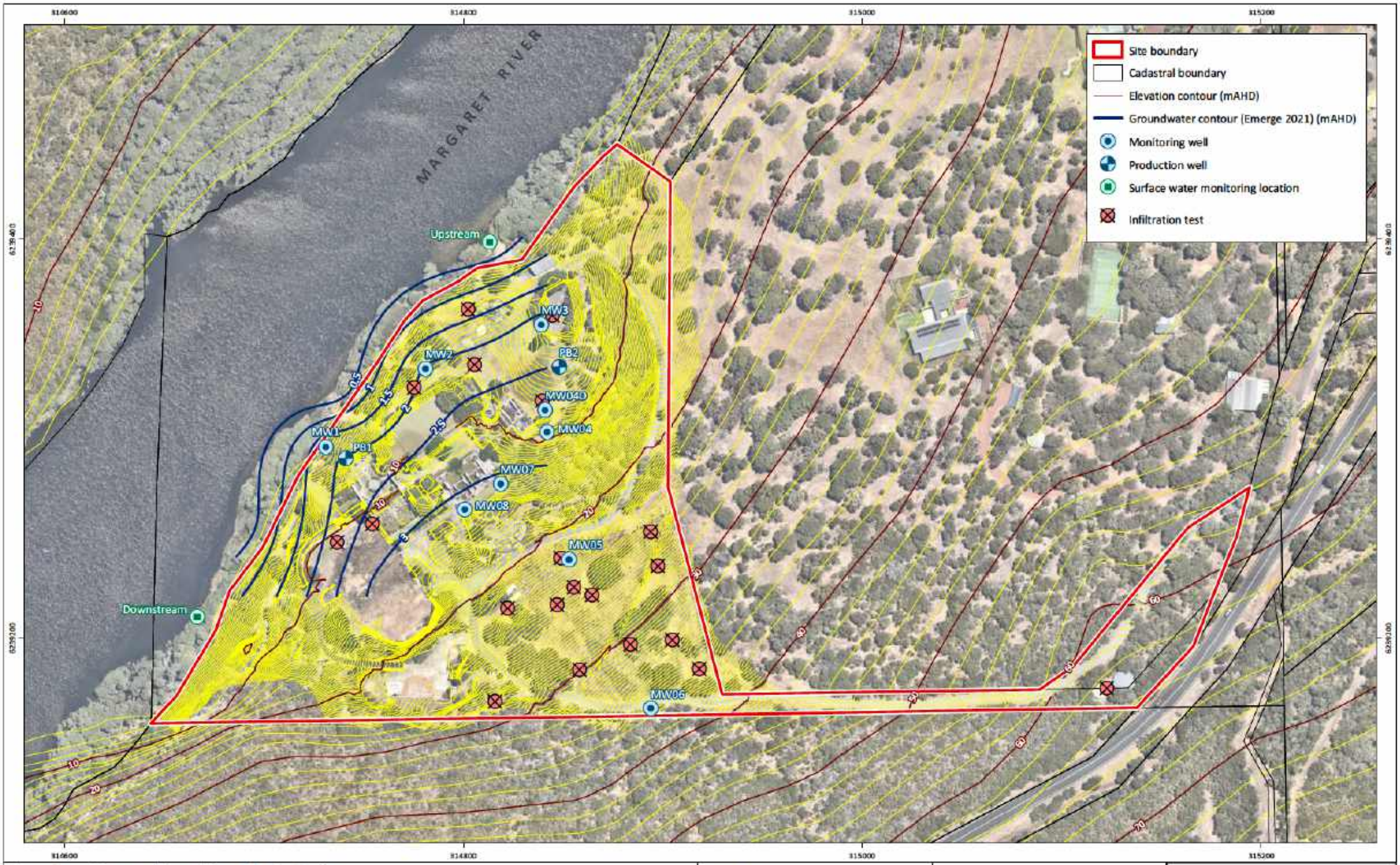

Figure 2: Topographic and Groundwater Contours

Project:	Nutrition Irrigation Management Plan Lot 101 Wallcliffe Road, Prevelly
Client:	Wallcliffe House Pty Ltd

Plan Number: EP18-128(19)--F91a

Drawn:	WJC
Date:	28/04/2025
Checked:	DRL
Approved:	DPC
Date:	28/04/2025

N

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Metres

Scale: 1:2,500@A4

GDA 1994 MGA Zone 50

emerge ASSOCIATES

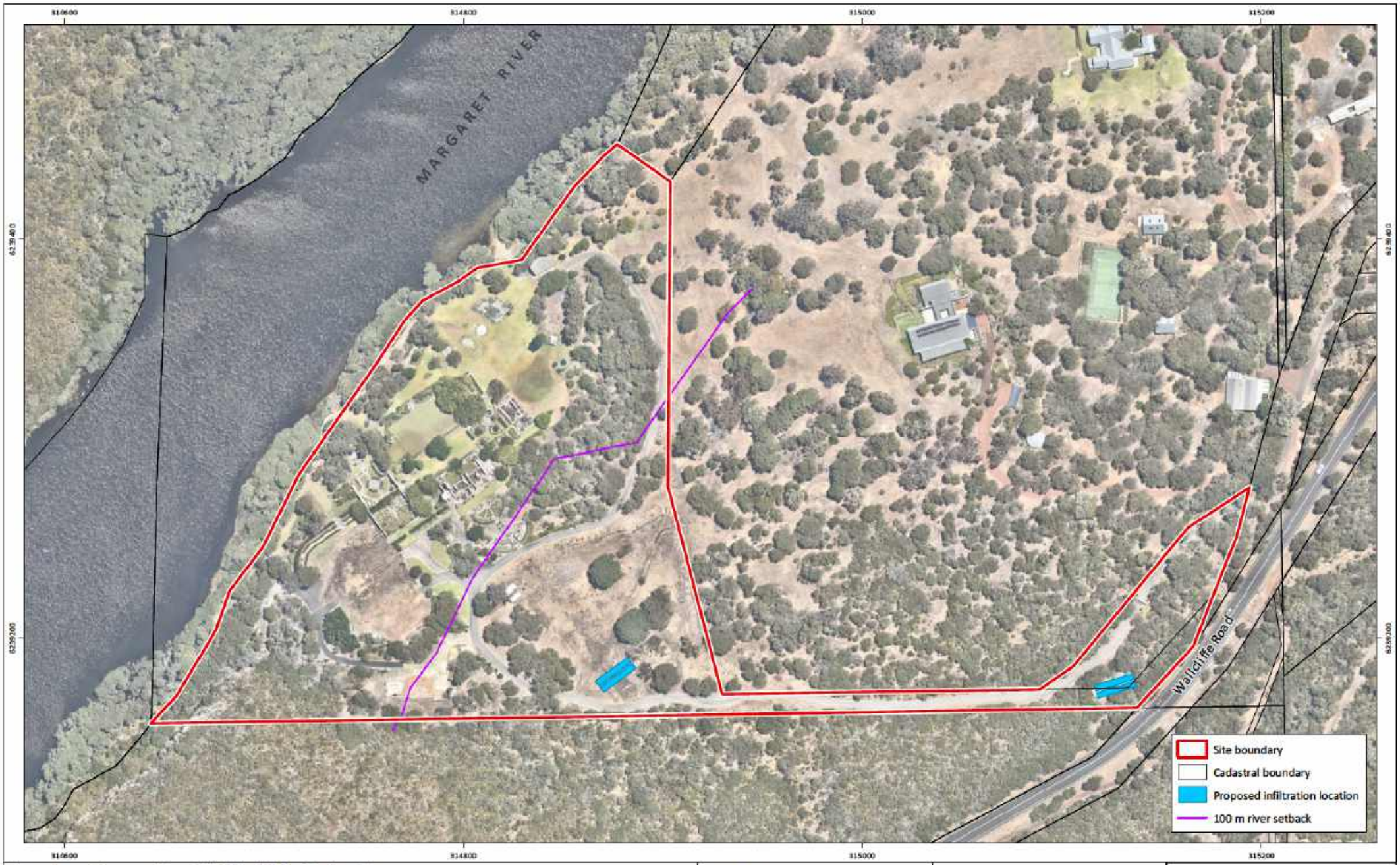


Figure 3: Proposed Treated Water Infiltration Locations

Project:	Nutrition Irrigation Management Plan Lot 101 Wallcliffe Road, Prevelly
Client:	Wallcliffe House Pty Ltd

Plan Number:	**EP18-128(19)--F93b**
Drawn:	WJC
Date:	01/05/2025
Checked:	DRL
Approved:	DPC
Date:	01/05/2025

N

0 50 100
Metres

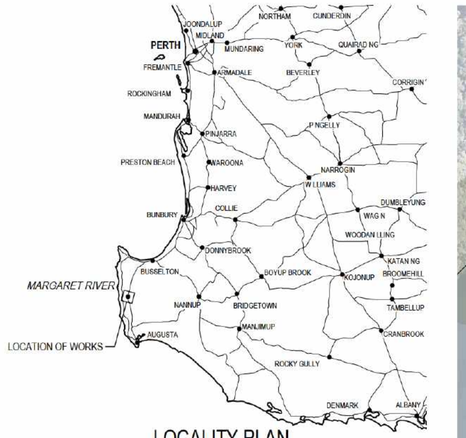
Scale: 1:2,500@A4

GDA 1994 MGA Zone 50

emerge ASSOCIATES

Appendix A

Wallcliffe House concept plan



LOCALITY PLAN

SCALE: DIAGRAMMATIC

SITE PLAN

SCALE 1:1000

NOTE

1. REFER TO DOUGLAS PARTNERS INFILTRATION AREAS GEOTECHNICAL INVESTIGATION REPORT 96717.05.R.001

LEGEND

- DEVELOPMENT EXTENTS (BY OTHERS)
- CADASTRAL BOUNDARY
- MARGARET RIVER
- 100m MARGARET RIVER BUFFER
- TUNNELWELL LEACH DRAIN
- EXISTING RESIDENCES
- ACCESS ROAD
- GEOTECH TEST LOCATION (NOTE 1)

DRAWING LIST

Rev	Description	Drawn	Date
C04	DESIGN REVISED	[redacted]	14/05/2025
C03	GEOTECH NOTE ADDED		16/3/2025
C02	GEOTECH TEST PITS OVERLAYED		16/3/2025
C01	BUILDING PERMIT ISSUE		14/3/2025
P04	REISSUED FOR TENDER EVALUATION		8/11/2024
P03	ISSUED FOR TENDER EVALUATION		6/11/24

Author [redacted] Drafting Check [redacted]
Designer Design Check

0 10 20 30 40 50m
SCALE 1:1000 AT ORIGINAL SIZE

N

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E permail@ghd.com W www.ghd.com

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Project No. 12635805

Client WALLCLIFFE HOUSE PTY LTD

Project WALLCLIFFE HOUSE

Status

Drawing Title

Size A1

Drawing No. Rev

Plot Date: 15 May 2025 - 2:26 PM Plotted by [redacted]

File Name: N:\AU\Perth\Projects\61\12635805\CADD\Drawings\12635805-DC-WWTP-C001_C04.dwg

FORWARD WORKS INCLUDES INSTALLATION OF UNDERGROUND TANKS AND CONNECTIONS, BY THE CONTRACTOR, PRIOR TO THE INSTALLATION OF ROADS AND STRUCTURES, BY OTHERS.

NOTES

1. INSTALLATION OF INFILTRATION AREA REQUIRES PRIOR APPROVAL FROM THE DEPARTMENT OF HEALTH. THE CONTRACTOR SHALL NOT UNDERTAKE WORKS IN THIS AREA WITHOUT WRITTEN APPROVAL FROM THE PRINCIPAL.
2. CONTRACTOR TO INSTALL APPROPRIATE LV ELECTRICAL, INSTRUMENTATION AND CONTROL CONDUITS FOR THE OPERATION AND CONTROL MANAGEMENT OF TANKS. ALIGNMENTS SHOWN ARE INDICATIVE ONLY.
3. CONTRATOR TO SIZE SUBMERSIBLE PUMPS AND PIPEWORK TO ACCOMODATE A NOMINAL 7L/s FLOW RATE, TBC BY CONTRACTOR. CONTRACTOR SHALL INSTALL ALL PIPEWORK AND VALVING NECESSARY FOR OPERATION AND CONTROL MANAGEMENT OF EFFLUENT. ALIGNMENTS SHOWN ARE INDICATIVE ONLY.
4. INFLUENT MANIFOLD (UPSTREAM OF WWTP FEED TANK) DESIGNED AND INSTALLED BY OTHERS, NOMINALLY DN150.

CADASTRAL BOUNDARY

APPROXIMATE LOCATION OF TREATED WASTEWATER RISING MAIN TO ARRIVAL PADDOCK INFILTRATION. REFER TO HYDRAULIC DRAWINGS.

APPROXIMATE LOCATION OF SEWER RISING MAINS (ONE SPARE) CONNECTED TO WWTP FEED TANK

INDICATIVE CONDUIT FOR LEACH DRAIN INSTRUMENTATION AND ACTUATED VALVE CONTROL

GATE HOUSE

FUTURE BIN STORAGE BUILDING

A C004

B C004

WWTP EQUALISATION/ FEED TANK
NOTE 4

MBR FEED PUMP STATION WET WELL

NOTE 2

NOTE 3

1.4m 1.0m 7.6m 20.0m 1.0m 1.0m

62.00 60.00 59.00 60.00 62.00 60.00

TUNNELWELL LEACH DRAINS

HOLD:
PENDING DoH APPROVAL

TREATED WASTEWATER STORAGE TANK
NOTE 1

WWTP SUPPORT SHED

WASTEWATER TREATMENT TANKS
(KUBOTA MEMBRANE BIOREACTOR)

CADASTRAL BOUNDARY

LEGEND

- WWTP PIPEWORK
- WWTP ELECTRICAL I&C CONDUITS
- CADASTRAL BOUNDARY
- TUNNELWELL LEACH DRAIN
- ACCESS ROAD

SITE PLAN

SCALE 1:100

Rev	Description	d	Date
C02	DESIGN REVISED	[redacted]	14/05/2025
C01	BUILDING PERMIT ISSUE		14/3/2025
P02	REISSUED FOR TENDER EVALUATION		8/11/2024
P01	ISSUED FOR TENDER EVALUATION		6/11/2024

Author [redacted] Drafting Check [redacted]
Designer Design Check

0 1 2 3 4 5m
SCALE 1:100 AT ORIGINAL SIZE

N

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Project No. 12635805

Client WALLCLIFFE HOUSE PTY LTD

Project WALLCLIFFE HOUSE

Status

Drawing Title

Drawing No.

Size A1

Rev

Plot Date: 15 May 2025 - 4:17 PM Plotted by: [redacted]

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