Government of Western Australia
Department of Water and Environmental Regulation

Amendment Report

Application for Licence Amendment

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

Licence Number L9273/2020/2

Licence Holder Water Corporation

File Number APP-0026949

Premises Mount Barker Water Resource Recovery Facility and Mount Barker Woodlot
Bunker Street and 47 Omrah Road
MOUNT BARKER WA 6324

Legal description –

Lot number	Plan/Diagram Number	Volume	Folio
Mount Barker Water Resource Recovery Facility			
Lot 610	Deposited Plan 187856	LR3142	962
Lot 575	Deposited Plan 175884	LR3142	961
Mount Barker Woodlot			
Lot B 21	Diagram 111	1886	142
Lot 1367	Deposited Plan 114634		
Lot 1611	Deposited Plan 122001		
Lot 5262	Deposited Plan 163872		
Lot 2063	Deposited Plan 131157	1809	472

As defined by the premises maps in Schedule 1 of the revised licence

Date of Report 26/05/2026

Proposed Decision Revised licence granted

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1. Decision summary

Licence L9273/2020/2 is held by Water Corporation (licence holder) for the Mount Barker Water Resource Recovery Facility (WRRF) (the premises), located at Lot 610 on Plan 187856 and Lot 575 on Plan 175884 Crown Reserve 26367 Mount Barker, WA, 6324.

This Amendment Report documents the assessment of potential risks to the environment and public health from proposed changes to the emissions and discharges during operation of the premises. As a result of this assessment, revised licence L9273/2020/2 has been granted.

The revised licence issued as a result of this amendment consolidates and supersedes the existing licence previously granted in relation to the premises.

2. Scope of assessment

2.1 Regulatory framework

In completing the assessment documented in this Amendment Report, the department has considered and given due regard to its Regulatory Framework and relevant policy documents which are available at https://dwer.wa.gov.au/regulatory-documents.

2.2 Application summary

On 23/12/2024, the licence holder submitted an application to the department to amend licence L9273/2020/2 under section 59 and 59B of the *Environmental Protection Act 1986* (EP Act). The application relates to updating infrastructure details and the inclusion in the licence of an approximately 140-hectare blue gum (*Eucalyptus globulus*) woodlot for the irrigation of treated wastewater.

The woodlot has received treated wastewater from the Mount Barker WRRF since 1999, and the irrigation of blue gums has occurred since 2011. The woodlot was previously operated by Penris Pty Ltd under agreement with Water Corporation until 2018. Water Corporation purchased the woodlot in 2018 for continued long term use as a treated wastewater disposal option. However, the woodlot has not been included in licence L9273/2020/2.

The size of the current plots used for irrigation is 88 hectares. The application includes an Irrigation Management Plan for the woodlot, which has provided recent site-specific data for the assessment (Water Corporation 2024a).

The existing prescribed premises boundary is proposed to change, due to the inclusion of the woodlot, as depicted in Figure 1 below. Water Corporation is the registered proprietor for the lots on which the woodlot is located, summarised in

Table 1 below:

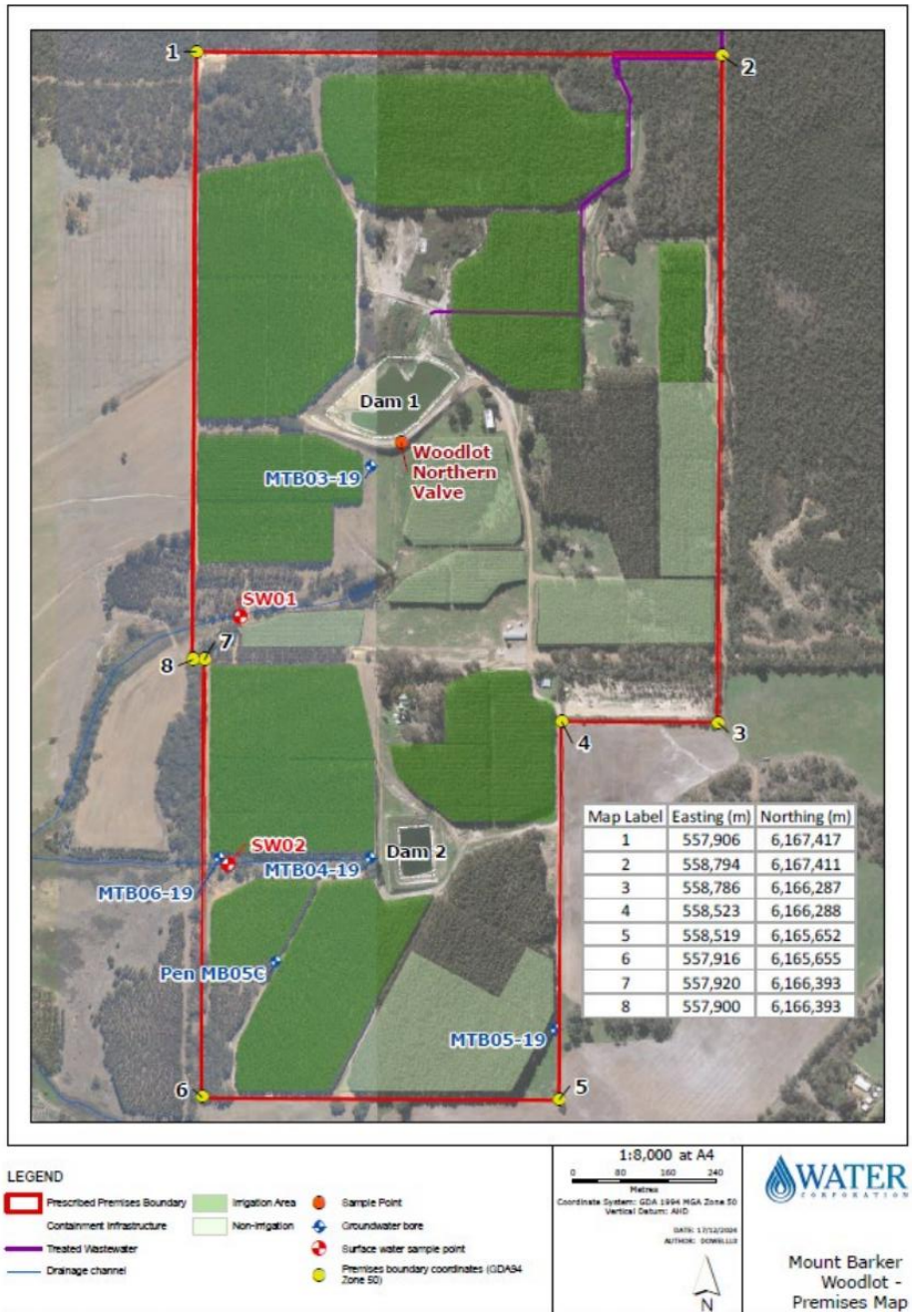

Figure 1: Mount Barker woodlot

Table 1: Lots within the woodlot

Lot number	Plan/Diagram number	Volume	Folio
Lot B 21	Diagram 111	1886	142
Lot 1367	Deposited Plan 114634		
Lot 1611	Deposited Plan 122001		
Lot 5262	Deposited Plan 163872		
Lot 2063	Deposited Plan 131157	1809	472

In addition to including the woodlot for irrigation of treated wastewater, the following amendments are being sought by the licence holder as part of the application:

- Condition 1, Table 1: Infrastructure and equipment
  - Update to descriptions of infrastructure
  - Inclusion of the woodlot, dams, irrigation equipment and groundwater monitoring bores
- Condition 2: Emissions and discharges
  - Inclusion of the woodlot discharge points and nutrient application rates
- Condition 6, Table 2: Monitoring
  - Amendment to reduced sampling frequency at the final effluent sample point at the WRRF from monthly to quarterly
  - Inclusion of monitoring at the Dam 1 outflow meter and northern valve at the woodlot
  - Inclusion of groundwater and surface water monitoring
- Condition 9, Table 3: Monitoring
  - Update to the sampling location name
- Condition 13: Records and reporting
  - Inclusion of monthly contaminant loading in tabular format in environmental reporting
- Schedule 1: Maps, Figure 1:
  - Update to Figure 1: Map of the boundary of the WRRF, to include monitoring points and boundary coordinates
  - Replacement of Figure 2: Layout map and sample points at the WRRF with a map of the woodlot and woodlot monitoring points
- Schedule 2: Premises boundary
  - Removal of the coordinates table as boundary coordinates have been provided in the revised figures 1 and 2.

2.3 Overview of the premises

The WRRF operates to treat sewage from the local area, with an assessed design capacity of 1,280 cubic metres per day. The facility consists of several treatment ponds, and is depicted in Figure 2. Treated wastewater is pumped from the WRRF to the woodlot via a 5 km long main. The treated wastewater is stored in Dam 1 at the woodlot prior to irrigation via a surface drip irrigation system. Dam 1 has a storage capacity of 51.9 ML. Dam 2 at the woodlot is used for contingency storage, with a capacity of 34.7 ML. The dams were existing when Water Corporation purchased the woodlot, however Water Corporation have refurbished the dams, diverted the external catchments and upgraded the spillway for Dam 1. The dams are depicted in Figure 1. The location of the woodlot relative to the WRRF is depicted in Figure 3. Figure 3 depicts an unlined open channel, however the licence holder advised during assessment of works approval W6771/2023/1 that this channel is no longer in use, and treated wastewater is pumped directly from the WRRF to Dam 1 via a pressure main.

Figure 2: Current premises boundary of the WRRF

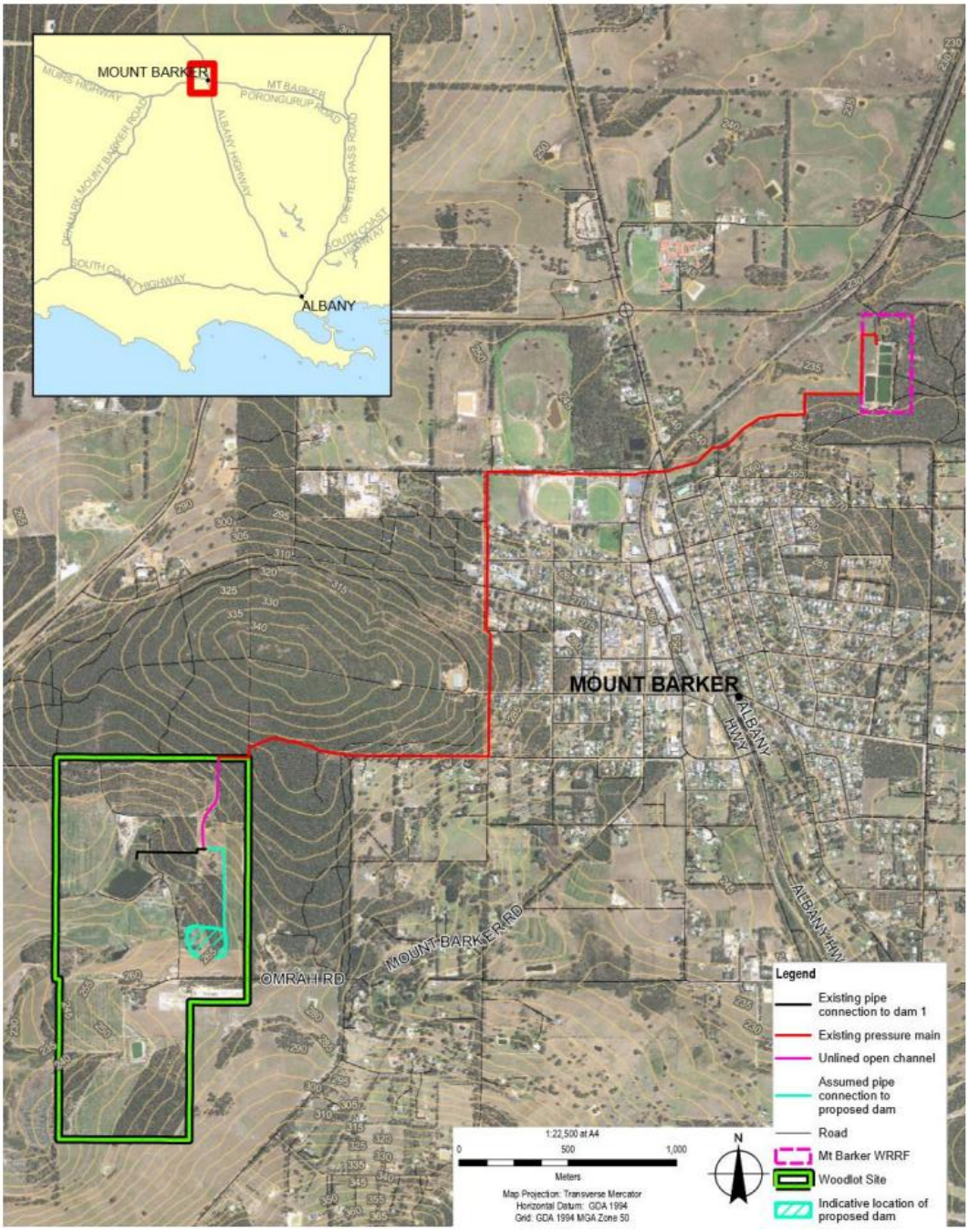

Figure 3: Location of the WRRF (pink) and the woodlot (green)

2.4 Works approval W6771/2023/1

Water Corporation currently holds works approval W6771/2023/1 for the woodlot, which was granted by the department on 13 February 2025. The works approval is for the construction and operation of a treated sewage storage dam and associated pumping infrastructure for irrigating at the woodlot. The two current storage dams at the woodlot (Dam 1 and Dam 2) are proposed to be decommissioned following construction of the new storage dam.

Following construction of the new infrastructure, the intent was for the woodlot premises to be included in licence L9273/2020/2, however this application is to assess the inclusion of the woodlot in the licence while construction under the works approval is underway. Infrastructure constructed under the works approval is intended to be included in the licence through a separate licence amendment following construction.

Licence: L9273/2020/2

The works approval also authorises irrigation of treated wastewater during environmental commissioning and time limited operations. The Nutrient Irrigation Management Plan (GHD 2023) submitted with the works approval application was assessed, and yearly nutrient loading limits were specified on the works approval. The limits are specified as 132 kg/ha/y for total nitrogen and 32 kg/ha/y for total phosphorus.

The updated Irrigation Management Plan submitted with this amendment application was assessed to determine updated nutrient loading limits to be included in the licence as part of this amendment.

Works approval W6771/2023/1 permits irrigation during environmental commissioning and time limited operations. These conditions are in effect until such time as a licence for the items of infrastructure is granted in accordance with Part V of the *Environmental Protection Act 1986,* if a licence is granted before the end of the period specified in condition 15(a) of the works approval. Therefore, upon the issue of this licence amendment to authorise irrigation of treated wastewater, irrigation conditions in the works approval will be superseded, and conditions in the amended licence will take effect.

2.5 Environmental siting

2.5.1 Climate

Mount Barker experiences warm, dry summers and cool, wet winters. Average annual rainfall is about 720 mm, with the wettest months being June to August. The driest months are January and February (BoM n.d.).

Average monthly maximum and minimum temperatures, as well as average rainfall for Mount Barker are shown below, and average monthly evaporation rates in Figure 5, using data from the Bureau of Meteorology's website (BoM n.d.).

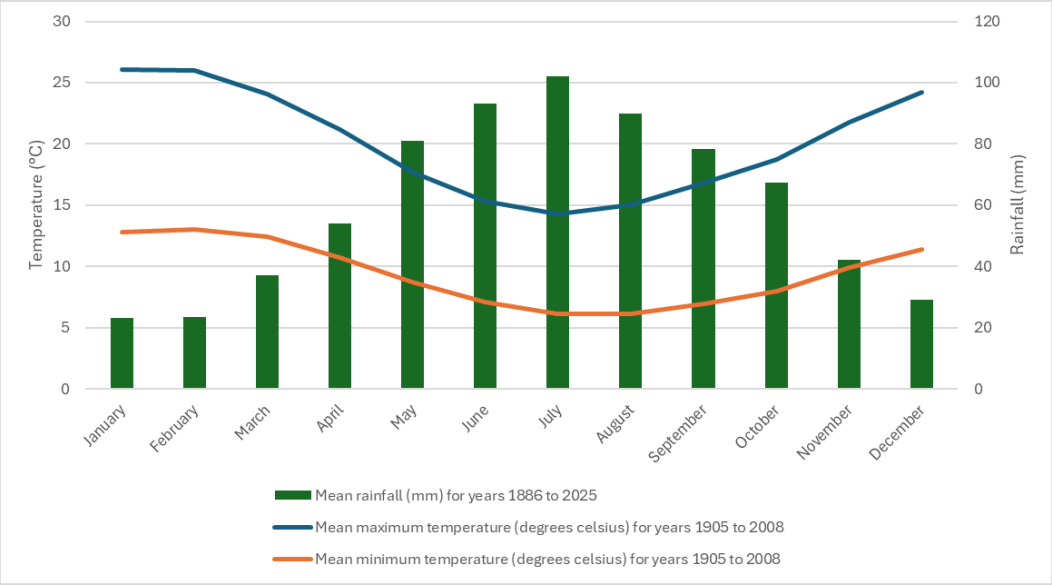

Figure 4: Average rainfall, minimum and maximum temperatures at Mount Barker (from data from the Bureau of Meteorology)

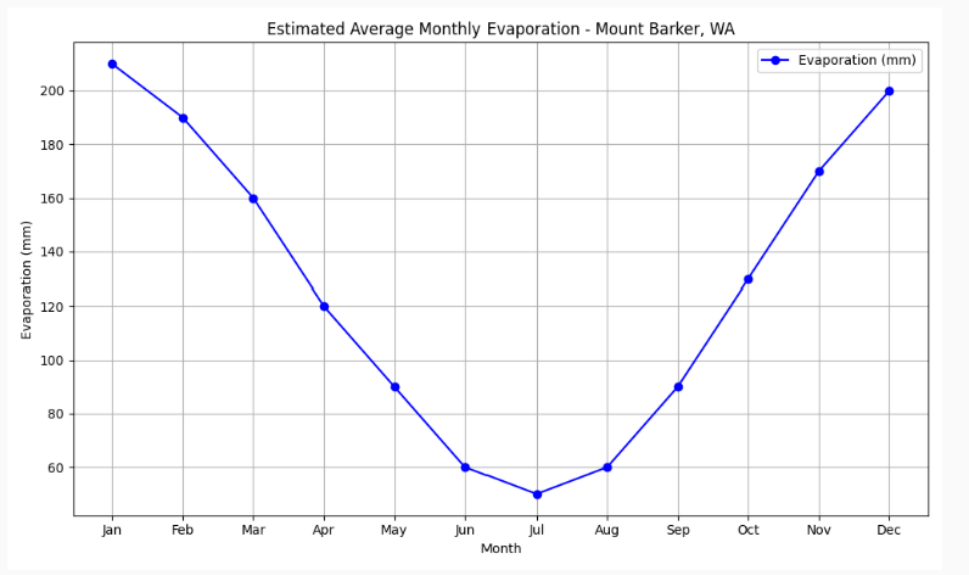

Figure 5: Average evaporation rates for Mount Barker (from data from the Bureau of Meteorology)

2.5.2 Soil characteristics at the WRRF

The land the WRRF is located on is part of the Kent soil landscape system, which consists of an undulating lateritic plain with lakes and poorly drained flats. Duplex sandy gravels, loamy gravels, grey deep sandy duplexes, semi-wet soils and wet soils are also present.

2.5.3 Soil characteristics at the woodlot

The northern half of the woodlot is part of the Kent soil landscape system. The southern half of the woodlot is part of the Porongorup Range soil landscape system, which consists of granitic hills and fringing siltstone slopes in the Albany Sandplain Zone. Sandy gravel, loamy gravel, loamy duplex and stony soil are present. Jarrah-marri-karri forest, jarrah woodland and shrublands are typical vegetation types.

The department's internal mapping system indicates parts of the woodlot have a high to extreme phosphorus export risk. Some areas of the woodlot have a moderate to high salinity risk or are presently saline. Some areas of the woodlot have a moderate to high flood risk, and water erosion risk. 10-30% of the southern half of the woodlot has a moderate to very high waterlogging risk.

Site-specific investigation work was undertaken in 2017, and three characteristic soil profiles were identified (Water Corporation 2024a). The licence holder has indicated soils one and two are the predominant soil types at the site, and soil three is limited to a small section of the site that is not proposed for irrigation. A map of the soil types at the woodlot is provided in Figure 6. The composition of each soil type is shown in Figure 7.

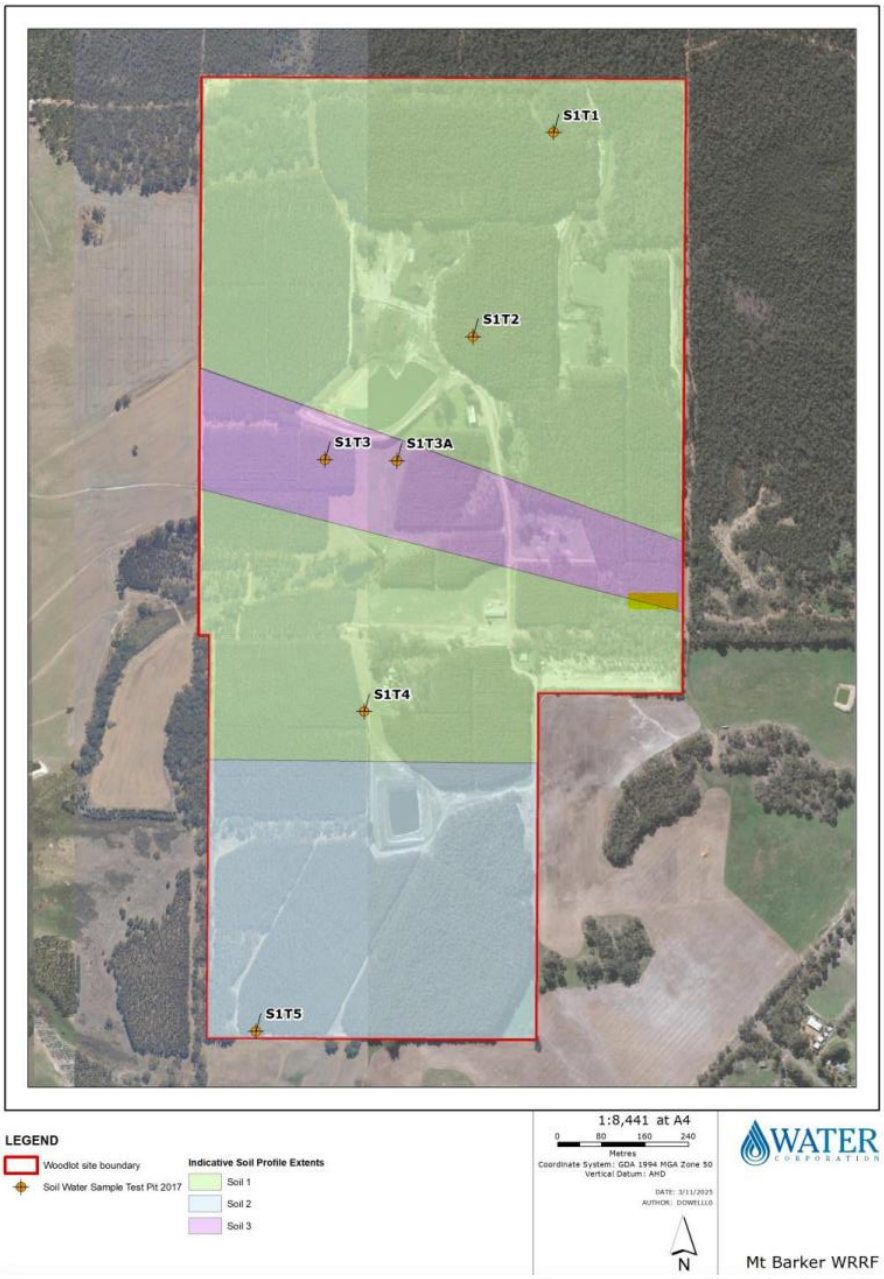

Figure 6: Soil types at the woodlot (Water Corporation 2025)

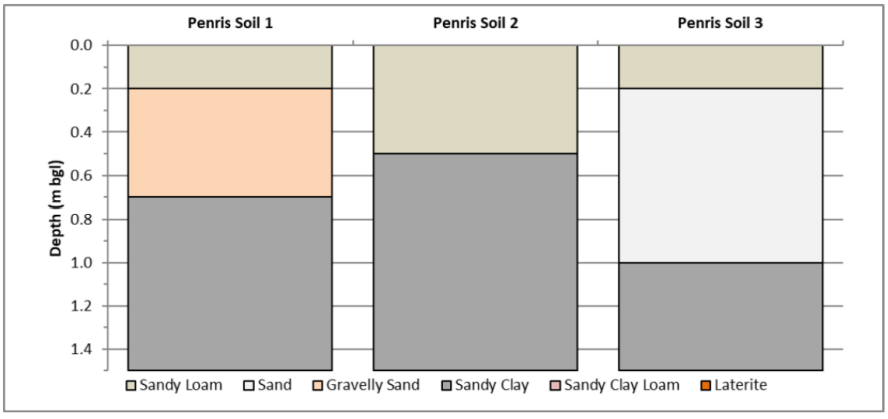

Figure 7: Soil profiles of the woodlot, provided by the licence holder

Soil infiltration testing was also undertaken as part of the site investigation. General findings of the tests were summarised as:

- *"Saturated hydraulic conductivity generally exhibited a rating of rapid to very rapid in the upper sandy material and tended to be slower in the clay subsoil."*
- *"Surface infiltration ranged from about 20 to 60 cm/hr across sampling locations, and these values are consistent with that reported for sandy soils."*
- *"The underlying clay subsoils have appreciably lower saturated permeability, and thus perching of infiltrating rainfall and waterlogging of the basal portion of the surface sands occurs."*

Hydraulic conductivity results of the soil infiltration testing are presented in

Table 2.

Table 2: Hydraulic conductivity results, provided by the licence holder

Soil and depth	Hydraulic conductivity (cm/hr)
Soil 1, 0.0 to 0.5m	4.2 – 26.0
Soil 1, >0.5m	0.3 – 17.7
Soil 2, 0.0 to 0.5m	10.9 – 12.1
Soil 2, >0.5m	6.3×10^{-5}
Soil 3, 0.0 to 0.5m	1.3 – 12.8
Soil 3, >0.5m	0.4

The Phosphorus Retention Index (PRI) and Phosphorus Buffer Index (PBI) in the soil was analysed by consultants in 2018 and 2022. The licence holder has stated the results ranged significantly, and there is potential for phosphorus attenuation in the soil.

2.5.4 Topography

Elevation at the WRRF ranges from approximately 242 to 234 m AHD, sloping down to the north. Elevation at the woodlot ranges from approximately 310 m AHD in the northeast of the premises to 235 m AHD in the west of the premises, with slopes running from the north east to the south west, and from east to west, as depicted in Figure 8.

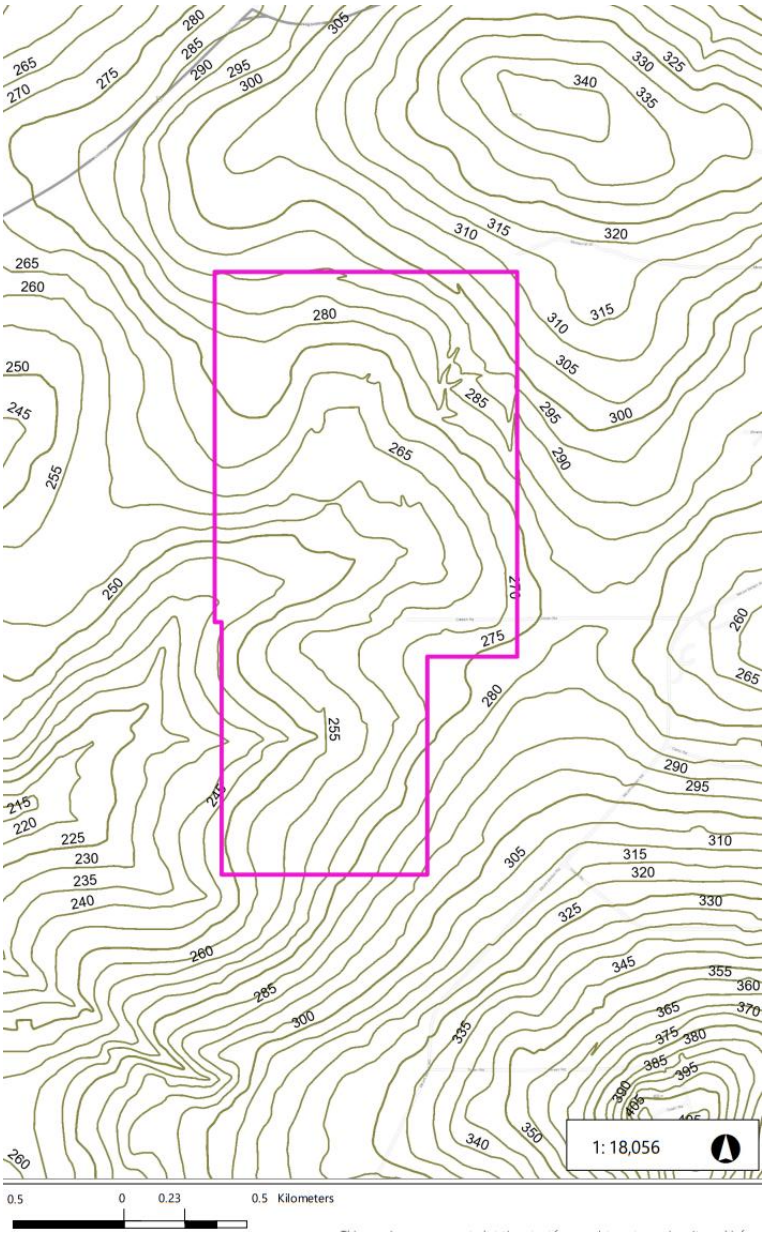

Figure 8: Topography of land at the woodlot

2.5.5 Hydrology

There are two drainage channels that run through the woodlot. These converge approximately 280 m to the west of the woodlot boundary to form a non-perennial creek, which discharges to the Hay River approximately 3.5 km southwest of the woodlot.

2.5.6 Hydrogeology

It is inferred from wider groundwater investigations undertaken across the premises that groundwater levels decrease down the hillside. A seasonal perched groundwater layer is likely to be present when infiltrating rainfall and waterlogging of the basal portion of surface soils occurs.

Groundwater is inferred to generally flow from east to west, towards Hay River and may discharge into water courses at the lower portions of the premises, particularly in winter months when the groundwater table is elevated.

2.5.7 Surrounding Land Use

There is significant agricultural activity in the Mount Barker area. The licence holder has stated the land to the south and west of the woodlot is used for cropping and animal production. The area to the north and east of the woodlot is bushland. The Mount Barker townsite begins approximately 900 m northeast of the woodlot. Information on nearby receptors is detailed further in section 6.1.2.

2.6 Water quality monitoring

The licence holder has undertaken monitoring of treated wastewater, groundwater and surface water at the woodlot in recent years and provided the results as part of this application. Results have been interpreted considering nearby receptors and relevant guidelines, as outlined in the following sections.

2.6.1 Investigation levels

The licence holder considered potential down-gradient groundwater abstraction bores (used for non-potable use or livestock watering), the ecology of a nearby creek, and potential recreational users of that creek as potential receptors of surface water and groundwater. The licence holder used investigation levels from the following guidelines to consider potential impacts to these receptors:

- Non-potable use guideline (NPUG) values in the DWER Guideline: Assessment and management of contaminated sites 2021 (DWER 2021)
- NPUG values in the NHMRC Guidelines for Managing Risks in Recreational Water (NHMRC 2008)
- Australian Drinking Water Guidelines (NHMRC 2024) – used where no published values were available for parameters. NPUG was derived by applying a factor of 10x
- Australian and New Zealand Guidelines for fresh and marine water quality (ARMCANZ and ANZECC 2000)
- Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG 2018)

2.6.2 Treated wastewater

The licence holder has monitored treated wastewater quality from three sampling points including treated wastewater discharged to Dam 1 and treated wastewater delivered to the woodlot. The average concentrations of parameters sampled between 1 July 2022 and 30 June 2024 are provided in Table 3 below:

Table 3: Summary of treated wastewater quality (2022-2024), provided by the licence holder

Parameter	Final effluent	SP Northern Valve Woodlot	SP Southern Valve Woodlot
Ammonium as N (mg/L)	5.4	1.9	0.7
Nitrite + nitrate as N (mg/L)	3.5	1.0	0.3
Total nitrogen (mg/L)	21.4	6.8	4.0
Total phosphorus (mg/L)	6.0	4.6	4.0
Filterable reactive phosphorus (mg/L)	-	4.0	3.6

pH	8.3	8.2	8.2
Biochemical oxygen demand (mg/L)	24	6	10
Escherichia coli (*E.coli*) (CFU/100mL)	1,254	171	151
Suspended solids (mg/L)	83	15	18
Total dissolved solids (mg/L)	758	707	625

Delegated Officer summary:

Reported concentrations of nitrogen and phosphorus delivered to the woodlot are below levels used in the MEDLI modelling as discussed in section 2.8 (21 mg/L and 5 mg/L respectively). The Delegated Officer has determined to include loading limits in the licence for water discharged to the woodlot for nitrogen and phosphorus as outlined is section 2.8 below.

Reported concentrations for pH and *E.Coli* are compliant with limits specified in the Department of Health (DoH) approval as outlined in section 3.1. Relevant concentration limits have been included in the licence. The *E.Coli* limit of <10,000 cfu/100mL also aligns with the *E.Coli* limits for woodlots (DoH 2011). pH levels are also within recommended limits in the Technical Guideline for Disposal of Effluent via Irrigation (Queensland Government 2020).

The Delegated Officer has also determined to include a discharge concentration limit for biochemical oxygen demand (BOD). The limit aligns with the limit for sites with a low/medium exposure risk level in accordance with the Guidelines for the non-potable uses of recycled water in Western Australia (DoH 2011).

2.6.3 Groundwater

There are 11 groundwater monitoring bores at the woodlot, however only five are currently operational (MtB03-19, MtB04-19, MtB05-19, MtB06-19 and PenMB05C). Three additional monitoring bores are proposed to be constructed under works approval W6771/2023/1. The locations of the current monitoring bores are shown in Figure 9 below.

Figure 9: Groundwater monitoring bore and surface water monitoring locations at the woodlot

Groundwater elevation and flow at the woodlot was monitored by a consultant between November 2019 and August 2020 (Water Corporation 2024a). The key findings provided by the licence holder are summarised as:

- *"Groundwater elevations vary significantly across the site, with the highest groundwater elevations generally being associated with the site's topographic high. The lowest groundwater elevations are recorded on the western boundary of the woodlot and coincide with the sites topographical low."*
- *"In general groundwater elevations beneath the site exhibited negligible seasonal fluctuations. This is considered to be reflective of the varying degrees of groundwater recharge that occur across the site."*
- *"The inferred site-specific groundwater flow direction is dominated by the site's topographical features, which is based upon understanding of groundwater flow in*

saprolite aquifer in these hydrogeological settings where groundwater data is limited and in consideration of the catchment areas within the site."

- *"General groundwater flow is inferred in a west to south-west direction towards the two main drainage channels located in the northern and southern portions of the site. The direction of groundwater flow, as calculated from the wells, does not vary significantly during the monitoring period."*
- *"Groundwater elevations at Pen MB03 displayed a potentiometric head of groundwater above ground surface. However, the construction log indicates the presence of a confining clay layer which resulted in artesian flow following drilling."*

Groundwater quality data was collected between November 2019 and August 2020 from six monitoring bores that were operational at the time (MtB03-19, MtB04-19, MtB05-19, MtB06-19, Pen MB03 and Pen MB05C). The licence holder has stated the samples were analysed for the following contaminants of potential concern:

- Nutrients (total phosphorus, reactive phosphorus, total nitrogen, total Kjeldahl nitrogen, total ammonia, nitrate + nitrite)
- Dissolved metals (arsenic, cadmium, chromium, copper, nickel, lead, zinc, manganese, iron and mercury)
- Pathogens (*E.coli*).

The results for total ammonia and nitrate + nitrite as N are provided in Table 4.

Table 4: Groundwater monitoring data – NHx (total ammonia) and NOx-N (nitrate + nitrite as N), provided by the licence holder

Sample ID	Location	Date	NHx-N (mg/L)	NO_x-N (mg/L)
NPUG/ recreational use			0.41	122
Stock watering			-	99.1
Freshwater toxicant 95%			**0.9**	**5.9**
MtB05-19	Up-hydraulic gradient	Nov 2019	0.01	1.59
		Feb 2020	<0.01	1.62
		May 2020	<0.01	1.6
		Sep 2020	<0.01	1.64
Pen MB03	On-site irrigation area	Nov 2019	0.17	<0.01
		Feb 2020	0.13	0.02
		May 2020	0.12	<0.01
		Sep 2020	0.12	<0.01
Pen MB05C	On-site irrigation area	Nov 2019	0.02	0.87
		Feb 2020	0.01	0.64
		May 2020	<0.01	0.28
		Sep 2020	<0.01	0.38
MtB02-19	On-site irrigation area	Sep 2020	0.13	0.11
MtB03-19	Down-hydraulic gradient of Dam 1	Nov 2019	0.48	<0.01
		Feb 2020	**1.11**	0.04
		May 2020	**1.14**	<0.01
		Sep 2020	**1.29**	0.49
MtB04-19	Down-hydraulic gradient of Dam 2	Nov 2019	0.01	<0.01
		Feb 2020	0.02	<0.01
		May 2020	<0.01	<0.01
		Sep 2020	<0.01	<0.01
MtB06-19	Down-hydraulic gradient western boundary	Nov 2019	0.17	0.04
		Feb 2020	0.22	0.02
		May 2020	0.21	<0.01
		Sep 2020	0.21	0.12

The licence holder has provided the following observations of the nutrient levels recorded in groundwater samples:

- *"NHx (total ammonia) exceeded the NPUG/ recreational use IL for all sampling events at MtB03-19. These impacts were localised immediately down-hydraulic gradient of Dam 1 and do not reflect broader groundwater quality beneath the woodlot.*

Furthermore, the water quality results for Dam 1 and Dam 2 demonstrate total ammonia was lower in the dams than in down-hydraulic gradient groundwater quality. Regardless, groundwater quality leaving the site (MtB06-19) was below the NPUG/ recreational use ILs indicating a low risk to off-site potential human health receptors (bore users for non-potable purposes and recreational users of Ooranggatup Creek)."

- NHx-N *"exceeded the freshwater (toxicant) value for three sampling events at MtB03-19. These impacts were localised immediately down-hydraulic gradient of Dam 1 and do not reflect broader groundwater quality beneath the woodlot. Furthermore, field observations suggest that Ooranggatup Creek is ephemeral and only flows during or immediately following rainfall. This means that any localised groundwater impacts are unlikely to interact with surface water quality in the creek."*

Delegated Officer summary:

It is noted that reported levels for total ammonia exceeded guideline values at MtB03-19.

It is also noted that results for total phosphorus, reactive phosphorus, total nitrogen, and total Kjeldahl nitrogen have not been provided.

The Delegated Officer has determined that the monitoring of groundwater will be added to the licence to monitor potential impacts from the irrigation of treated wastewater, and to determine if any leakage is occurring from the storage ponds. The parameters included for monitoring are those included in the department's standard suite for groundwater monitoring at sites discharging treated wastewater.

It is also noted that Dam 1 and Dam 2 are proposed to be used only until they are decommissioned following the construction of a new storage dam under works approval W6771/2023/1.

Results for dissolved metal concentrations in the groundwater sampling are provided in Table 5.

Table 5: Groundwater monitoring data - metals, provided by the licence holder

Sample ID	Date	Cadmium (mg/L)	Chromium (mg/L)	Nickel (mg/L)	Zinc (mg/L)	Manganese (mg/L)	Iron (mg/L)
NPUG/ recreational use		0.02	0.5	0.2	3*	5	0.3*
Stock watering		0.01	1	1	20	-	-
Freshwater toxicant 95%		**0.0002**	**0.001**	**0.011**	**0.008**	**1.9**	**-**
Pen MB03	Nov 2019	<0.0001	<0.001	**0.178**	**0.019**	0.36	<0.05
	Feb 2020	<0.0001	<0.001	**0.176**	**0.013**	0.327	<0.05
	May 2020	<0.0001	<0.001	**0.163**	**0.013**	0.3	<0.05
	Sep 2020	<0.0001	<0.001	**0.159**	**0.013**	0.283	<0.05
Pen MB05C	Nov 2019	<0.0001	<0.001	0.002	**0.01**	0.068	<0.05
	Feb 2020	<0.0001	<0.001	0.002	**0.021**	0.043	<0.05
	May 2020	<0.0001	<0.001	0.001	**0.014**	0.057	<0.05
	Sep 2020	<0.0001	<0.001	<0.001	0.005	0.055	<0.05
MtB02-19	Sep 2020	**0.0012**	**0.006**	**0.034**	**0.046**	0.712	0.08
MtB03-19	Nov 2019	<0.0001	**0.005**	0.006	**0.011**	0.902	6.66
	Feb 2020	<0.0001	**0.007**	0.009	**0.022**	0.8	15.3
	May 2020	<0.0001	**0.005**	0.006	**0.026**	0.412	12
	Sep 2020	<0.0001	0.003	0.005	**0.03**	0.09	5.7
MtB04-19	Nov 2019	<0.0001	<0.001	0.004	**0.012**	0.057	0.15
	Feb 2020	<0.0001	<0.001	0.002	**0.014**	0.038	0.07
	May 2020	<0.0001	**0.002**	0.001	**0.011**	0.034	0.11
	Sep 2020	<0.0001	<0.001	0.001	0.007	0.029	0.09
MtB05-19	Nov 2019	<0.0001	<0.001	0.006	**0.02**	0.079	<0.05
	Feb 2020	<0.0001	<0.001	0.003	**0.015**	0.02	<0.05
	May 2020	<0.0001	<0.001	0.002	**0.023**	0.012	<0.05
	Sep 2020	<0.0001	<0.001	0.002	0.008	0.011	<0.05
MtB06-19	Nov 2019	<0.0001	<0.001	**0.016**	**0.035**	1.48	76.5
	Feb 2020	**0.001**	<0.001	**0.015**	**0.023**	0.242	10.6
	May 2020	<0.0001	<0.001	0.01	**0.058**	0.161	3.9
	Sep 2020	0.0001	<0.001	**0.014**	**0.036**	0.147	0.84

**ADWG aesthetic value (not health-based)*

The licence holder has provided the following observations of the dissolved metal levels recorded in groundwater samples:

- *"Arsenic, lead and mercury were at or below the limit of reporting and investigation levels during all sampling events. Copper was below the investigation levels during all sampling events."*
- *"Iron exceeded the aesthetic non-potable/ recreational investigation level at MtB03-19 and MtB06-19 only. These exceedances are not health-based and given the absence of iron in water quality at Dam 1 and Dam 2 are not considered site related."*
- *"Cadmium, chromium, nickel, zinc and manganese variable exceeded the freshwater toxicant investigation levels at all groundwater monitoring bores. These variations are largely considered to reflect background groundwater quality. Furthermore, field observations suggest that Ooranggatup Creek is ephemeral and only flows during or immediately following rainfall. This means that any localised groundwater impacts are unlikely to interact with surface water quality in the creek."*

Delegated Officer summary:

The Delegated Officer notes that iron levels recorded at MtB03-19 and MtB06-19 exceeded guideline levels. The licence holder has reported there was no iron recorded in the treated wastewater, however the Delegated Officer has determined to include monitoring of iron in groundwater in the licence.

The Delegated Officer also notes the exceedances in levels of other metals against freshwater toxicant investigation levels. Monitoring for a range of metals in groundwater has been added to the licence. The parameters included for monitoring are those included in the department's standard suite for groundwater monitoring at sites discharging treated wastewater.

The licence holder has provided the following observations of the pathogen concentration levels recorded in groundwater samples:

> *"E.coli concentrations were typically recorded at the limit of reporting of <1 CFU/100mL, with three samples recording concentrations <10 CFU/100mL and a single sample recording a concentration of 3,100 CFU/100mL (MtB04-19 in Nov 2019). Given that concentrations were between <1 and 3 CFU/100mL at MtB04-19 for the following three monitoring events, the spike is not considered representative of groundwater quality at this location. Therefore, all concentrations were below the recreational (1000 CFU/100mL) and stock watering (100 CFU/100mL) guidelines."*

Delegated Officer summary:

The Delegated Officer considers that a single report of elevated *E.Coli* levels is not likely to indicate sustained elevated *E.Coli* levels in the groundwater. However, the data for *E.Coli* levels in groundwater has not been provided as part of the application.

The Delegated Officer is satisfied that *E.Coli* levels in water discharged to the woodlot as reported in Table 3 are well below the value of <10,000 cfu/100 mL required by DoH. The level of <10,000 cfu/100mL also aligns with the *E.Coli* limits for woodlots (DoH 2011).

The Delegated Officer has determined to include monitoring of *E.Coli* levels in groundwater on the licence to monitor potential impacts from the irrigation of treated wastewater, and potential leakage from the storage ponds.

2.6.4 Surface water

Surface water monitoring was conducted between November 2019 and August 2020 at eight locations at the woodlot. These were mostly locations that contain treated wastewater such as Dam 1 and Dam 2. A treated wastewater effluent channel and a pond north of Dam 1 were also sampled, however these are no longer in operation. The licence holder has excluded results for these locations as they are not representative of surface water quality leaving the site. The remaining surface water sampling points are SW-6 and SW-8. Locations of surface water monitoring points are shown in Figure 9. Samples were analysed for the following contaminants of potential concern:

- Nutrients (total phosphorus, reactive phosphorus, total nitrogen, total Kjeldahl nitrogen, total ammonia, nitrate + nitrite)
- Dissolved metals (arsenic, cadmium, chromium, copper, nickel, lead, zinc, manganese, iron and mercury)
- Pathogens (*E.coli*).

The results for total ammonia and nitrate + nitrite as N at SW-6 and SW-8 are presented in Table 6.

Table 6: Surface water monitoring data – NHx (total ammonia) and NOx-N (nitrate + nitrite as N), provided by the licence holder

Sample ID	Location	Date	NHx-N (mg/L)	NO_x-N (mg/L)
NPUG/ recreational use			0.41	122
Stock watering			-	99.1
Freshwater toxicant 95%			**0.9**	**5.9**
SW-6	Northern drainage channel-western site boundary	Nov 2019	<0.01	<0.01
		Feb 2020	0.01	<0.01
		May 2020	<0.01	<0.01
		Sep 2020	<0.01	<0.01
SW-8	Southern drainage channel – western site boundary	Nov 2019	<0.01	<0.01
		Feb 2020	<0.01	0.04
		May 2020	0.14	0.04
		Sep 2020	<0.01	<0.01

Delegated Officer summary:

Levels of NHx and NOx-N appear to be below guideline levels for the relevant investigation levels.

The Delegated Officer notes that results for total phosphorus, reactive phosphorus, total nitrogen and total Kjeldahl nitrogen have not been provided.

The Delegated Officer has determined that the monitoring of surface water will be added to the licence to monitor potential impacts from the irrigation of treated wastewater. The parameters included for monitoring are those included in the department's standard suite for surface water monitoring at sites discharging treated wastewater, and include nutrients.

Results for metal concentrations in surface water sampling are provided in Table 7.

Table 7: Surface water monitoring data – metals, provided by the licence holder

Sample ID	Date	Arsenic	Copper (mg/L)	Nickel (mg/L)	Zinc (mg/L)	Manganese (mg/L)	Iron (mg/L)
NPUG/ recreational use		0.1	1*	0.2	3*	5	0.3*
Stock watering		0.5	0.4	1	20	-	-
Freshwater toxicant 95%		**0.013**	**0.0014**	**0.011**	**0.008**	**1.9**	**-**
SW-6	Nov 2019	<0.001	<0.001	**0.049**	**0.017**	0.32	0.42
	Feb 2020	<0.001	<0.001	**0.013**	<0.005	0.267	0.08
	May 2020	<0.001	<0.001	**0.013**	**0.01**	0.006	<0.05
	Sep 2020	<0.001	<0.001	**0.054**	**0.009**	0.054	<0.05
SW-8	Nov 2019	<0.001	<0.001	<0.001	0.005	0.078	0.33
	Feb 2020	<0.001	<0.001	<0.001	0.007	0.611	0.19
	May 2020	<0.001	<0.001	<0.001	**0.012**	0.056	0.18
	Sep 2020	<0.001	<0.001	<0.001	**0.01**	0.078	0.36

**ADWG aesthetic value (not health-based)*

The licence holder has provided the following observations of the metal concentrations recorded in surface water samples:

- *"Arsenic, copper and manganese were below the limit of reporting for investigation levels in surface water quality leaving the site in the northern drainage channel (SW-6) and southern drainage channel (SW-8)."*

- *"Zinc and nickel were variably above the freshwater (toxicant) investigation level in surface water quality leaving the site in the northern drainage channel (SW-6) and southern drainage channel (SW-8). However, given zinc and nickel were largely below the limits of reporting or investigation levels in Dams 1 and 2, they are not considered to be contaminants of potential concern related to TWW and woodlot operations."*

- *"Iron variably exceeded the aesthetic non-potable/ recreational investigation level in surface water quality leaving the site in the northern drainage channel (SW-6) and southern drainage channel (SW-8). These exceedances are not health-based and are not related to site operations given low or absent concentrations in Dams 1 and 2."*

Delegated Officer summary:

The licence holder has indicated that levels of zinc, nickel and iron were largely below levels in Dams 1 and 2, however data on zinc, nickel and iron levels in the dams has not been provided.

The Delegated Officer has determined to add monitoring for a range of metals in surface water to the licence. The parameters included for monitoring are those included in the department's standard suite for monitoring at sites discharging treated wastewater.

The licence holder has provided the following observations of the pathogen concentration levels recorded in surface water samples:

- *"A single E.Coli outlier result from the northern drainage channel (SW-6) was recorded at 100,000 cfu/100 mL (November 2019) which was three orders of magnitude higher than all the other results."*

- *"Excluding the outlier, a median concentration of 59 cfu/100 mL was recorded from the northern drainage channel (SW-6) and southern drainage channel (SW-8). Therefore,*

the risk is considered low as the median concentration was below the recreational (1000 cfu/100 mL) and stock watering (100 cfu/100 mL) guidelines."

Delegated Officer summary:

The Delegated Officer has determined to include monitoring of *E.Coli* levels in surface water on the licence to monitor potential impacts from the irrigation of treated wastewater.

E.Coli levels in water discharged to the woodlot as reported in Table 3 are below the value of <10,000 cfu/100 mL required by DoH. The level of <10,000 cfu/100mL also aligns with the *E.Coli* limits for woodlots (DoH 2011).

2.7 Irrigation of treated wastewater – Soil-water balance

The licence holder has advised that the current planting density of the blue gum woodlot is variable, with densities of up to 1,800 stems per hectare, and the woodlot may be thinned mid-rotation. Soil testing indicated that root depth was between 50 to 80 cm (Water Corporation 2024a).

The licence holder undertook a soil-water balance to determine the minimum irrigation area required, and an irrigation schedule to manage the hydraulic load that supports woodlot growth, while limiting transport of treated wastewater to surface water and groundwater. The soil-water balance was calculated considering soil storage, rainfall, irrigation volume applied, evapotranspiration, runoff and deep infiltration into the soil.

The key inputs used in the soil-water balance are in Table 8.

Table 8: Soil-water balance inputs, provided by the licence holder

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
TWW Available *(Current State)* (ML)[a]	3.38	4.09	6.06	6.78	8.13	9.99	9.92	10.97	8.66	9.36	8.57	6.02
TWW Available *(2048 Flow Forecast)* (ML)[b]	5.27	6.38	9.46	10.57	12.69	15.59	15.47	17.11	13.50	14.59	13.36	9.39
Rainfall (mm)[c]	23.4	24.2	36.8	53.7	81.3	92.9	102.3	90.2	79.1	67.9	42.2	29.5
Crop Factor[d]	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Evapotranspiration (mm)[e]	199.4	163.6	137.3	84.8	56.9	43.5	45.2	57.5	76.4	108.3	139.5	182.2

[a] Average outflow to woodlot measured from Mt Barker WWRF Inlet Magflow Meter S4013751 (September 22 – March 24)
[b] Representative monthly flow forecast for 2048 (Annual average daily flow of 393 kL/day, monthly flow variation based on existing TWW availability)
[c] As per rainfall data provided by the licence holder
[d] As reported in a study into land treatment of Albany wastewater by the Water Authority of Western Australia, 1992 for conservative water loss in the woodlot.
[e] Calculated by multiplying the crop factor by the pan evaporation

Data reported in Table 8 indicates current flows to the woodlot are approximately 91.93 ML per year, which equates to approximately 252 m^3/day. As stated in note b of Table 8, flows are expected to increase to 393 kL/day (or 393 m^3/day).

The licence holder has reported the results indicate the woodlot can sufficiently manage current and future hydraulic loads of the WRRF.

The licence holder has determined that an operating woodlot irrigation area of 14.4 hectares is sufficient to maintain an appropriate soil-water balance to ensure uptake of water by the plantation trees, while minimising leaching beyond the root zone. The predicted root zone soil-water content of a 14.4-hectare irrigation area at current WRRF flows is shown in Figure 10 below.

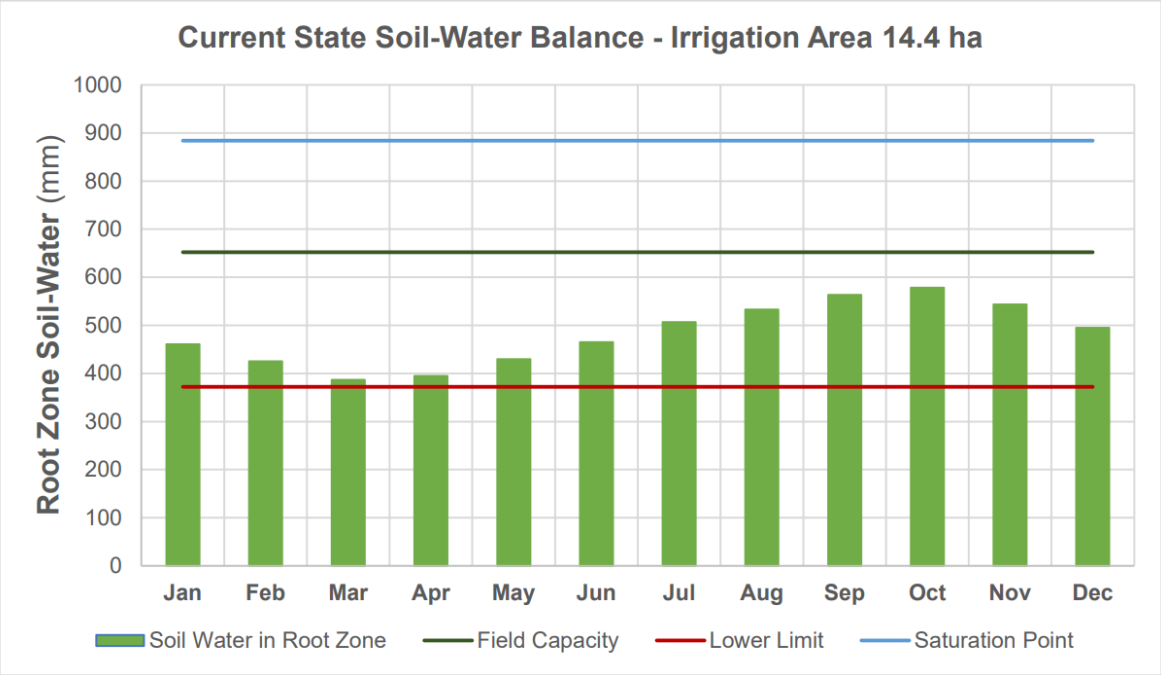

Figure 10: Predicted root zone soil-water of a 14.4-ha irrigation area at current flows

The irrigation schedule recommended by the licence holder is summarised in Table 9. This schedule is based on average treated wastewater availability and long-term climate data. The licence holder acknowledges that irrigation should be varied based on actual daily conditions.

Table 9: Recommended irrigation schedule for current state in 'average' climate year, provided by the licence holder

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Irrigation (ML/month)	20.3	15.5	9.72	6.78	3.28	-	-	0.97	5.76	9.36	9.94	16.5

Flows to the WRRF are expected to increase to 393 m^3 per day by 2048. The licence holder has advised increased flows would result in Dam 1 not having sufficient storage capacity in winter, and consequently irrigation would have to occur. An expanded irrigation area of at least 22 hectares is proposed to manage the increased flows and reduce risk of infiltration beyond the root zone. The predicted root zone soil-water content of a 22-hectare irrigation area at future flows at the WRRF is shown in Figure 11. It is not expected that the soil-water deficit in March and April would impact woodlot health.

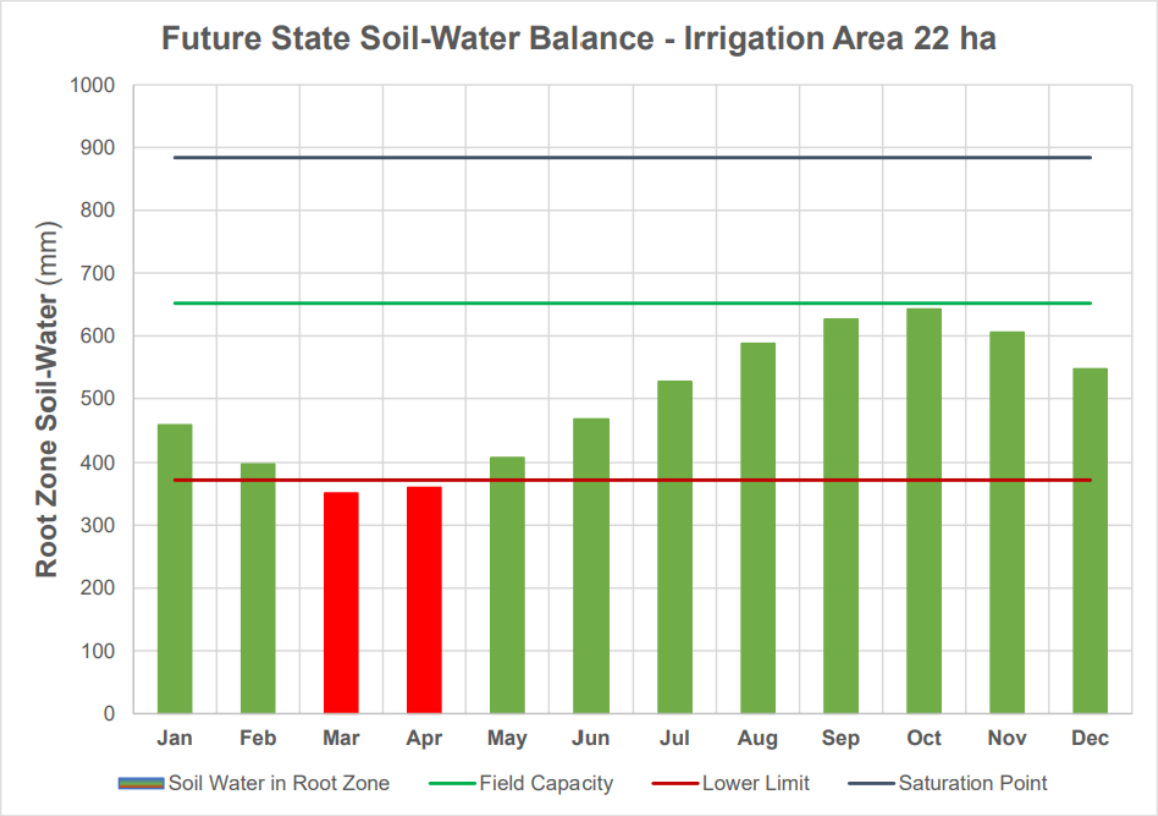

Figure 11: Predicted root zone soil-water of a 22-ha irrigation area at future flows

The irrigation schedule proposed by the licence holder to manage future increased flows is summarised in Table 10. Similar to the irrigation schedule in Table 9, the schedule is based on average treated wastewater availability and long-term climate data, and the licence holder acknowledges that irrigation should be varied based on actual daily conditions. The licence holder has also noted the future model is conservative and does not account for a future drying climate in the region.

Table 10: Recommended irrigation schedule for future state in 'average' climate year, provided by the licence holder

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Irrigation[1] (ML/month)	22.2	17.8	13.1	10.6	7.84	5.67	3.55	9.11	10.6	14.6	14.7	21.7

Delegated Officer summary:

It is acknowledged the woodlot is expected to have sufficient area to manage current and future treated wastewater volumes. The proposed irrigation area sizes and irrigation schedules are proposed to prevent deep drainage and leaching of contaminants to groundwater and surface water.

The Delegated Officer notes that irrigation during winter has the potential to cause irrigation runoff during rainfall. Consequently, conditions relating to irrigation have been include in the licence, including a minimum irrigation area, the requirement for irrigation to not occur on land that is waterlogged, and the requirement for irrigation to not occur when rainfall is imminent, during, or immediately after rainfall.

2.8 Nutrient assessment

The licence holder engaged a consultant to assess the nutrient capacity of the woodlot using the Model for Effluent Disposal using Land Irrigation (MEDLI) modelling program (GHD 2023). The parameters used to model nutrient removal of the blue gum plantation are listed in Table 11.

Table 11: Blue gum parameters used in MEDLI modelling, provided by the licence holder

Parameter	Units	Assumed Value
Maximum Crop Coefficient	mm/mm	0.9
Maximum Root Depth	mm	1200
Radiation Use Efficiency	kg/ha/MJ/m^2	7
Maximum Shoot Nitrogen	Fraction dwt	0.01
Maximum Shoot Phosphorus	Fraction dwt	0.0012
Maximum Yield at Full Cover	kg/ha	10,000
Harvest Trigger Yield	kg/ha	250,000
Residual Green Cover	Fraction	0.15
Residual Dead Cover	Fraction	0.1
Residual Shoot Biomass	kg/ha	3,000

Several scenarios were modelled using the MEDLI program. The licence holder determined the most applicable scenario for the Irrigation Management Plan submitted with this application was the Plant Available Water Content (PAWC) scenario, as it considered woodlot demand and soil water deficit to determine irrigation rates. The three soil types identified at the site as shown in Figure 7 were modelled.

2.8.1 Nitrogen

As nitrogen removal occurs in Dam 1, the modelling used nitrogen levels in treated wastewater prior to storage in Dam 1 as a more conservative input. Each soil type modelled had different water demands to maintain vegetation in the PAWC zone, and so nitrogen levels applied varied. Results of nitrogen uptake in the three soil types are shown in Table 12.

Table 12: Vegetation nitrogen uptake results from MEDLI modelling (GHD 2023)

Irrigation Rate (Model Run)	Soil Modelled	Nitrogen Applied (kg/ha/y)	Nitrogen Removed by Crop (kg/ha/y)
PAWC (203)	Soil 1	138.3	216.2
PAWC (210)	Soil 2	158.5	192.7
PAWC (515)	Soil 3	155.9	245.3

The results indicate nitrogen uptake is expected to exceed nitrogen applied. The MEDLI modelling also indicated that nitrate was reported to leach beyond the root zone, however the licence holder has justified this is not likely to occur in the woodlot for the following reasons:

- The model predicted that the highest level of leaching would occur during the first year of plant growth. However, this does not align with actual practices at the woodlot, where irrigation is typically minimal or absent during the planting year.
- The MEDLI modelling predicted no nitrate removal via denitrification within the simulated root zone. However, this does not accurately represent the conditions at the woodlot, where the top 0.2 meters of soil contain high levels of organic carbon and experience periods of saturation before water drains to deeper layers - conditions that are conducive to denitrification.
- Other sources of nitrogen removal such as anaerobic ammonium oxidation are not factored into MEDLI modelling.
- There is limited ability for contaminants to be transported beyond the 2-metre root zone, as described in the soil water balance in section 2.7.

Due to uncertainty about actual nitrogen removal at the woodlot, the licence holder has taken a conservative approach and excluded other potential nitrogen removal pathways when determining a nitrogen application rate. Continuing the conservative approach, the licence holder has also used the lowest modelled nitrogen uptake rate in Table 12 (192 kg/ha/y in soil 2), and reduced that number by 20%, to propose a maximum nitrogen application rate of 154 kg/ha/y.

Delegated Officer summary:

The Delegated Officer considers the licence holder has used a conservative approach and the proposed nitrogen application rate is appropriate to help prevent nutrient leaching beyond the soil root zone.

A total nitrogen loading limit of 154 kg/ha/y will be included in the licence.

2.8.2 Phosphorus

The MEDLI modelling demonstrated that uptake by the blue gums accounted for almost all phosphorus applied. Results of phosphorus uptake in the three soil types are shown in Table 13.

Table 13: Vegetation phosphorus uptake results from MEDLI modelling (GHD 2023)

Irrigation Rate (Model Run)	Soil Modelled	Phosphorus Applied (kg/ha/y)	Phosphorus Removed by Crop (kg/ha/y)	Phosphate Leached (kg/ha/y)
PAWC (203)	Soil 1	33.3	32.9	< 0.1
PAWC (210)	Soil 2	38.1	37.2	< 0.1
PAWC (515)	Soil 3	37.5	40.5	< 0.1

A comprehensive soil assessment was undertaken by a consultant in 2017. Soil samples were reported to have high phosphorous retention ability. Predicted phosphorus retention was calculated for a 22-hectare area. Figure 12 demonstrates that an irrigation area of 22 hectares is anticipated to retain phosphorus continuously applied at a rate of 15 kg P/ha/y for approximately 70 years before there will be meaningful transport beyond the two-metre root zone of the woodlot.

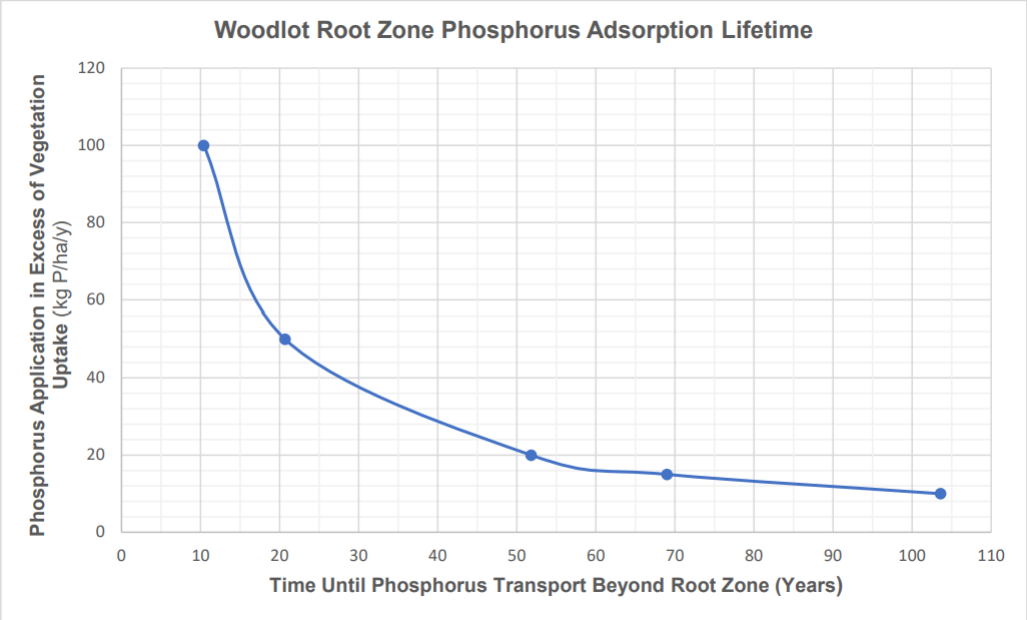

Figure 12: Indicative phosphorous adsorption lifetime for phosphorus applied in excess of vegetation uptake

The licence holder has proposed that since the woodlot area is 88 hectares and the blue gum plots will not be continuously irrigated, a phosphorus application rate of 15 kg P/ha/y above the vegetation uptake rate should limit phosphorus leaching. Using the lowest vegetation phosphorus uptake rate of ~33 kg P/ha/y from the MEDLI results in Table 13, the licence holder has added 15 kg P/ha/y to propose a maximum phosphorus application rate of 48 kg P/ha/y.

Delegated Officer summary:

The Delegated Officer considers the proposed phosphorus application rate of 48 kg P/ha/y is appropriate to help prevent nutrient leaching beyond the soil root zone.

A total phosphorus loading limit of 48 kg/ha/y will be included in the licence.

3. Legislative context and other approvals

3.1 Department of Health (DoH) approval

The licence holder holds approval from the DoH for the use of recycled water for woodlot irrigation. The approval was granted on 12 August 1996 and last amended on 19 August 2019. Ownership of the approval was transferred to Water Corporation on 29 November 2018. The approval requires monthly sampling of recycled wastewater for bacteriological analysis and reporting of results to DoH. The licence holder has advised the DoH approval requires recycled water quality to comply with the limits in Table 14.

Table 14: Recycled water quality limits under DoH approval, provided by the licence holder

Parameter	Compliance value	Operational monitoring frequency
E.coli	< 10,000 cfu/100 mL	Monthly

pH	6.5-8.5	Monthly

3.2 Planning approval

Planning approval is not required as there is no change to the existing operation. The local government authority (Shire of Plantagenet) advised the development of a new or replacement timber plantation would require development approval from the Shire.

4. Incidents and complaints

At the time of writing this report, there are two records in the department's incidents and complaints system of wastewater overflow incidents from the WRRF since 2020. One occurred in May 2021 and one in August 2020. Since May 2021 there are no records of any other incidents or complaints from the premises.

5. Contaminated Sites Branch advice

The application was referred to the department's internal Contaminated Sites Branch (CSB) to seek expert advice on the following matters:

- Guidelines for assessing irrigation of treated wastewater and risks to receptors
- Reported concentrations of parameters in treated wastewater
- Reported concentrations of parameters in surface water and ground water
- The proposed nitrogen and phosphorus application rates and loading limits
- Proposed discharge concentration limits for other parameters
- Proposed surface water and ground water monitoring suites
- Depth to groundwater in the irrigation area
- Distances between irrigation areas and waterways
- Proposed future irrigation during all months, including winter
- Potential accumulation of nutrients in the soil
- Potential leaching of nutrients beyond the root zone

CSB undertook an independent assessment of the MEDLI modelling, calculations and conclusions drawn by the applicant. The assessment took into consideration the current proposed irrigation area of 14.4 hectares and current average flows of treated wastewater to the woodlot of 252 m^3/day, as per Table 8, while considering the projected increases in flows and subsequent irrigation area. CSB's advice is summarised below.

- Guidelines used by the licence holder in the application are appropriate.
- The proposed irrigation area of 14.4 hectares is likely sufficient to remove all nitrogen applied, when viewed over an entire crop-cycle (this is assumed to be 12 years). However, the MEDLI modelling incorrectly assumes the rate of nitrogen uptake would remain constant throughout the year. In fact, the transpiration rate of blue gums in winter can be around 40% lower than in warmer months (Froend et al. 1995). This means there is a risk that some nitrogen would leach beyond the root zone during winter. There are also duplex soils at this site, where permeable topsoil overlays regolith with much lower hydraulic conductivity. This means that in shallow

soil interflow during heavy rainfall, some nitrogen will likely be exported and possibly discharged to nearby creeks.

- Current monitoring bores at the woodlot are constructed fairly deep within the regolith. Consequently, these bores are unlikely to detect periodic interflow events. However, it may be possible to detect the effects of interflow discharges by detecting 'first flush' runoff after heavy rainfall through installing passive siphon-samplers at the surface water monitoring locations.
- Phosphorus applied to soil is adsorbed and not immediately available for plant uptake. Consequently, phosphorus will build up in the soil faster than plants can uptake it. Eventually, there will be soil saturated by phosphorus that slowly moves down through the soil profile below the root zone. CSB agrees with the MEDLI modelling that indicates this is likely to occur after about 70 years. Irrigation should cease once soils in the root zone become saturated with phosphorus.
- Even though there is high phosphorus adsorption capacity, there is significant risk that colloidal particles containing adsorbed phosphorus could be transported in soil interflow during heavy rainfall and discharged into streams. Samples taken from passive siphon-samplers mentioned above could detect colloidal phosphorus being exported from the irrigation area, and samples should be unfiltered. If sampling indicates a progressive increase in colloidal phosphorus export, it is recommended that the level of treatment of wastewater is increased to reduce phosphorus being applied to the woodlot.
- Due to the depth at which monitoring bores are installed, and the potential for seepage from irrigation to be transported in shallow interflow, it is unclear whether elevated metal concentrations reported in groundwater are due to seepage from irrigation, or represent natural background levels.
- CSB advised the construction of one or more interflow interception trenches downgradient of the woodlot would be the most effective method to measure contaminant concentrations in seepage.
- It is difficult to determine whether reported elevated metal concentrations in surface water reflect natural background levels, or are from a contamination source, as metal concentrations in water can vary significantly. CSB recommended that metal concentrations in other waterways in the area be assessed to determine whether reported concentrations reflect background levels. CSB also recommended concentration trends over a period of time would need to be analysed to determine whether there is a likely source of contamination.
- Some transport of nutrients from the woodlot is likely during winter when rainfall exceeds the rate of evapotranspiration.
- It is acknowledged that construction of an additional pond to hold wastewater during winter instead of irrigating is not feasible, as a pond that large could create odour issues, and a much larger irrigation area would be required to irrigate the stored wastewater during warmer months. Instead, it is recommended that a short-rotation coppicing cultivation system is used to manage the plantation (cutting the trees every 3-4 years at the base), which is likely to remove more nutrients (Rutz and Dimitriou 2015).
- Difficulty managing wastewater irrigation without some transport of nutrients is acknowledged. It is also acknowledged that the premises are located in an area where existing agricultural activities are likely releasing nutrients. Regardless, releases should be minimised where possible.
- It is recommended that additional monitoring infrastructure is installed in the

irrigation area to measure periodic soil interflow that is likely to transport contaminants to receptors.

- It is recommended that selenium, mercury, molybdenum and vanadium are included in surface water and groundwater monitoring suites (ANZG 2023).
- Victorian Environmental Protection Authority (EPA) guidance recommends a water quality objective of <1,000 *E.Coli* organisms/100mL for class C recycled water (EPA Victoria 2021).
- US Environmental Protection Agency (EPA) guidance suggests the depth to the water table should be at least 1.2 m in areas where wastewater irrigation occurs (US EPA 2006). However, the thickness of the uppermost permeable soil horizon is more relevant. This is where most of the biological and chemical treatment of contaminants occurs. US EPA guidance recommends this horizon should be at least approximately 0.6 m. Given the soil profile at the woodlot, which has a permeable top sandy layer of at least 0.5 m, the woodlot should be suitable for irrigation.
- Due to the potential for shallow interflow during heavy rainfall events, and potential transport of contaminants to areas where interflow emerges (such as creeks), a buffer zone should be maintained between irrigation areas and nearby seasonal creeks.
- To reduce the risk of interflow transporting nutrients from the woodlot, the following measures were proposed:
  - Growing blue gums on the steepest slopes of the woodlot should be avoided. US EPA guidance (US EPA 2006) suggests plantations irrigated with treated wastewater should not be grown on slopes greater than 30°, and interflow can be caused by slopes greater than 20°.
  - Capturing interflow water in cross-slope interception drains may be possible. This water could then be diverted to a storage pond for reirrigation during dry periods. However, before drains such as these are considered, further investigation would be necessary to determine the significance of nutrient export in interflow events.
  - To reduce the amount of nitrogen and phosphorus in the irrigation water that could be exported in interflow, the level of treatment of the wastewater could be increased to reduce nitrogen and phosphorus concentrations.

5.1 Licence holder comments on CSB advice

The licence holder was requested to provide comment on the following issues:

- The potential for interflow at the site
- The adequacy of current deep monitoring bores to detect interflow events
- The recommendation to install passive siphon-samplers to detect ‘first-flush’ runoff
- The potential for phosphorus export in interflow during heavy rainfall
- The possibility of constructing interflow interception trenches

5.1.1 Potential for interflow

The licence holder responded commenting that site-specific data indicates interflow is not

likely to occur at the site. It is theoretically possible for interflow to occur in some areas of the woodlot during 10% Annual Exceedance Probability (AEP) rainfall events of less than 24 hours duration. However, this would only be likely if the upper soil horizon was saturated, but modelling indicates that there is sufficient soil-water storage capacity prior to heavy rainfall events to prevent interflow occurring. Figure 10 indicates soil-water content is between field capacity and the lower limit during the year. As a conservative calculation, it was assumed the upper soil horizon was at field capacity (approximately 650 mm), which would mean there is approximately 235 mm water/m soil storage volume available before saturation was reached (Water Corporation 2025).

The licence holder provided saturated hydraulic conductivity (infiltration rate) results for soils 1 and 2, which are the predominant soil types at the woodlot (Table 15). The results indicate moderately rapid to very rapid infiltration rates in the top 0.5 m of soil. Figure 7 in section 2.5.3 showed 0.5 m is the approximate depth of the upper permeable sandy layer for soils 1 and 2. Using the conservative estimate of 235 mm water/m soil available before saturation, multiplied by 0.5 m of soil which water could infiltrate through before reaching a permeable restricting layer, gives 117.5 mm of water that could infiltrate the soil before saturation is reached (Water Corporation 2025).

Table 15: K_{sat} values for samples of characteristic profile soil 1 and soil 2, provided by the licence holder

Soil Bore ID*	Soil Profile	Depth (m bgl)	Field K_{sat} (mm/hr)	Lab K_{sat} (mm/hr)	K_{sat} Rating	Dominant Texture
S1T1	Soil 1	0-0.2	187	119	Very rapid	Sandy loam
		0.3-0.6	ND^	90.2	Very rapid	Sand
		1.0-1.3	ND^	3	Slow	Sandy clay loam
S1T2	Soil 1	0-0.2	150	ND^	Very rapid	Sandy loam
		0.3-0.5	ND^	260	Very rapid	Sand
		1.0-1.5	ND^	23	Moderately rapid	Sandy clay
S1T4	Soil 1	0-0.2	126	ND^	Very rapid	Sandy clay
		0.2-0.5	ND^	42	Moderately rapid	Sandy loam
		0.6-1	ND^	177	Very rapid	Clay
S1T5	Soil 2	0-0.2	109	ND^	Very rapid	Sandy loam
		0.2-0.5	ND^	121	Very rapid	Sandy clay
		0.5-0.8	ND^	6.3×10^{-4}	Very slow	Clay

The licence holder also provided data on rainfall volumes for 10% Annual Exceedance Probability (AEP) events, sourced from the Bureau of Meteorology's Intensity-Frequency-Duration dataset. This data is shown in Table 16.

Table 16: Rainfall volumes by event duration during a 10% AEP event

Event Duration	Total Rainfall (mm) – AEP 10%	Rainfall per hour (mm/hr)
30 mins	18.3 mm	36.6 mm/hr
1 hour	23 mm	23 mm/hr
24 hours	80.3 mm	3.34 mm/hr
72 hours	114 mm	1.58 mm/hr

In view of the upper soil horizon storage capacity of 117.5 mm, this would indicate that the soil is capable of storing excess volume applied during short duration events, up to a 72-hour AEP 10% rainfall event. Therefore, the probability of lateral interflow occurring and transporting contaminants is low.

5.1.2 Adequacy of current monitoring bores

The licence holder advised there are no perched groundwater layers beneath the woodlot, only a single aquifer, and shallow and deep bores intercept the same aquifer. Groundwater

flow is down hydraulic gradient, westward towards the drainage lines. The licence holder has proposed to install an additional shallow sentinel groundwater monitoring bore near surface water monitoring point SW-01, replacing current monitoring bore Pen MB-03. The new bore is proposed to be screened across the water table in the shallow sandy horizon. Existing monitoring bores MtB03-19 and MtB06-19 in the western portion of the woodlot are also shallow, and together with the new proposed bore, these are expected to provide sufficient ability to monitor groundwater quality at the down-hydraulic gradient boundary of the woodlot.

5.1.3 Passive siphon-samplers

Passive siphon samplers are not recommended by the licence holder, due to the potential for collection bias and high failure/maintenance risk. The licence holder believes the current method of targeted grab sampling is more reliable, however has proposed that an additional sample be collected in August, which will mean samples are collected during all three winter months.

5.1.4 Potential for phosphorus export

As detailed in section 5.1.1, the licence holder believes an interflow pathway for the transport of contaminants is not likely, therefore the transport of phosphorus to receptors is unlikely. Furthermore, the licence holder has stated groundwater and surface water results have shown low levels of phosphorus, and there have been no rainfall-related spikes.

5.1.5 Interflow interception trenches

The licence holder believes the construction of interflow interception trenches is unjustified, as the proposed groundwater and surface water monitoring provides sufficient coverage to monitor water quality. Erosion and safety risks were also raised as concerns if trenches were constructed.

Delegated Officer summary of CSB advice and licence holder's comments:

- Appropriate CSB recommendations have been incorporated into the licence as regulatory conditions, such as ceasing irrigation on phosphorus-saturated soil in the root zone, monitoring concentration trends over time, vegetation management, maintaining a buffer zone near waterways, and not irrigating on steep slopes.
- The Delegated Officer has considered the licence holder's site-specific data on soil profiles and soil characteristics, and rationale for not installing passive siphon-samplers and interflow interception trenches. The Delegated Officer considers the licence holder's proposal to instead install an additional shallow monitoring bore and to conduct additional surface water monitoring as acceptable controls to monitor potential impacts. These have been added as licence conditions. Additional groundwater monitoring bores are proposed to be installed under works approval W6771/2023/1.
- Conditions on nutrient loading limits and irrigation methods have been included in the licence. Additionally, monitoring conditions have been included to monitor if irrigation has an impact on surface water and groundwater.
- A condition prohibiting irrigation of treated wastewater when rainfall is imminent, during rainfall, or immediately after rainfall has been added to the licence. This is intended to ensure there is sufficient soil-water storage capacity prior to any heavy rainfall events.

6. Risk assessment

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

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

6.1 Source-pathways and receptors

6.1.1 Emissions and controls

The key emissions and associated actual or likely pathway during premises operation which have been considered in this Amendment Report are detailed in Table 17 below. Table 17 also details the proposed control measures the licence holder has proposed to assist in controlling these emissions, where necessary.

Table 17: Licence holder controls

Sources	Emission	Potential pathways	Proposed controls
Aerators and pumps operated during treatment of sewage.	Noise	Air/windborne pathway	None proposed.
Acceptance, treatment and discharge of sewage. Desludging of ponds.	Odour		• Licence holder has stated residences beyond the site boundary are considered well beyond the zone of influence for potential odour issues. • Lessees of the homestead within the woodlot boundary are made aware of the premises operation and associated risks. • Woodlot is drip irrigated so no spray drift issues are expected. • For sludge removal, temporary or permanent infrastructure consisting of a bunded hardstand or lined area (lined to achieve a permeability of less than 10^{-9} m/s or equivalent), capable of preventing surface run-off of leachate and sludge and which includes a leachate collection system will be used.
	Disease vectors	Attraction and harbouring of pests	None proposed.
Spills, leaks and overflows during acceptance and treatment of sewage. Emergency discharge to drain. Desludging of ponds.	Contaminants associated with sewage (nutrients, metals, pathogens, PoPs). Treatment chemicals (chlorine).	Overland runoff. Seepage through dam lining to soil. Infiltration through soil to groundwater. Downgradient groundwater discharge. Direct contact.	• Increased irrigation area can be brought online to manage dam storage levels to avoid overflow in the event of storm events or unexpected flows. The soil-water of the woodlot soil root zone is expected to be maintained below the saturation point throughout the year, enabling irrigation to occur in winter if required without significant increased risk of ponding and/or surface run off. • The dam water level is lowered prior to the onset of winter to maximise storage capacity while limited irrigation is occurring. • Dams have been refurbished to ensure interim safety while the new storage dam is

Sources	Emission	Potential pathways	Proposed controls
	Odour	Air/windborne pathway	built under W6771/2023/1, which included diverting of external catchments and upgrading the spillway for Dam 1. • In the event of an emergency overflow of the TWW storage Dam 1 via the spillway, water would flow into the non-perennial watercourse located onsite, downslope of the dam. The DoH and DWER would be notified of all spills of TWW greater than 1,000 L. • The minimum recommended operating woodlot irrigation area considering the current TWW hydraulic loads is 14.4 ha. The total woodlot area is approximately 88 ha. • The licence holder considers that the nearby downstream creek *"is within potential influencing distance of irrigation activities occurring at the site, however, Hay River (3.8 km from the site) is of sufficient distance from the site that it would not be impacted by woodlot operations."* • No chemicals are permanently stored on site. Chemicals that require short-term storage on site will be stored in accordance with the manufacturer's instructions and relevant government regulations. • For sludge removal, temporary or permanent infrastructure consisting of a bunded hardstand or lined area (lined to achieve a permeability of less than 10^{-9} m/s or equivalent), capable of preventing surface run-off of leachate and sludge and which includes a leachate collection system will be used.
Storage and discharge of treated sewage via woodlot irrigation.	Contaminants associated with treated sewage (nutrients, metals, pathogens, PoPs).	Runoff from irrigation. Infiltration through soil to groundwater. Downgradient groundwater discharge.	• The soil-water of the woodlot soil root zone is expected to be maintained below the saturation point throughout the year, enabling irrigation to occur in winter if required without significant increased risk of ponding and/or surface run off. • The minimum recommended operating woodlot irrigation area considering the current TWW hydraulic loads is 14.4 ha. The total woodlot area is approximately 88 ha. • The licence holder has undertaken soil-water balance modelling to determine the minimum irrigation area to manage the hydraulic load and associated irrigation for current and future inflows. The licence holder has determined the modelling

Sources	Emission	Potential pathways	Proposed controls
			demonstrated the woodlot size can manage the current and future hydraulic load of the WRRF. • The licence holder has developed a recommended irrigation schedule, which will be based on treated wastewater supply available and weather conditions. • The licence holder has stated Dam 1 has sufficient capacity to store the majority of the current treated wastewater supply (and direct rainfall) during winter. • The licence holder is proposing to manage risks associated with leaching through nutrient application limits for nitrogen and phosphorus. • The licence holder considers that the nearby downstream creek *"is within potential influencing distance of irrigation activities occurring at the site, however, Hay River (3.8 km from the site) is of sufficient distance from the site that it would not be impacted by woodlot operations."*
		Direct contact	• Chlorination of treated wastewater. • Drip irrigation.
	Sediment	Loss of soil structure and erosion	• Use of drip irrigation to limit erosion. • Nutrient loading limits. • Monitoring of flows and surface water quality.

6.1.2 Receptors

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

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

Table 18: Sensitive human and environmental receptors and distance from prescribed activity

Human receptors	Distance from prescribed activity
Rural residential homesteads and residential premises	<u>WRRF</u> Closest to the WRRF is a rural residential homestead located approximately 240 m southeast of the WRRF boundary. Multiple rural residential homesteads and residential premises are

	located to the west, south and southeast within 1 km of the WRRF boundary.
	Woodlot Closest to the woodlot is a residential homestead, which is located within the woodlot boundary. The licence holder has advised the homestead is leased for residence and the lease agreement only gives the residents access to the house, immediate garden and access road. The lessee is made aware irrigation of treated wastewater occurs on site and made aware of the associated risks. Other properties in close proximity to the woodlot are approximately 415 m southeast, 1.5 km west, 850 m north, and 480 m east of the woodlot boundary.
Mount Barker Community College	Approximately 770 m northwest of the WRRF boundary.
Potential recreational users of nearby streams/creeks	As detailed in surface water section below.
Potential downstream groundwater bore users for non-potable use/stock watering	As detailed in underlying groundwater section below.
Environmental receptors	**Distance from prescribed activity**
Underlying groundwater – Ecological and non-potable purposes	WRRF There is limited information relating to groundwater at the WRRF location. The licence holder has indicated depth to groundwater measured at a number of bores registered to the Department of Agriculture and Food approximately 480 m north of the WRRF boundary was within 2 m of the ground surface (Water Corporation 2024b). These are the closest registered down-gradient bores to the WRRF. Groundwater flow is expected to generally follow topographical contours and flow in a northeasterly direction. Groundwater salinity in the area is 1,000 – 3,000 mg/L.
	Woodlot Groundwater depth measurements recorded in monitoring bores at the woodlot by GHD ranged from 1.5 mbgl (west and south) to 18.81 mbgl (east and north) depending on location (GHD 2023). These measurements were taken in November 2017, and between November 2019 to August 2020. However, exact dates of measurement are not provided, so it is unclear whether measurements were taken when groundwater levels may be highest, such as June to August. The depth to groundwater of 1.5 mbgl was recorded at MtB06/19. This bore is located on the western boundary of the woodlot, near the southern minor non-perennial watercourse that flows through the woodlot (Figure 1, Figure 9). A minimum depth of -1.16 mbgl was recorded at PEN_MB03, however this bore is located very close to the northern minor non-perennial watercourse (Figure 1, Figure 9). A reading such as this indicates there was surface water present at the time. It is inferred from wider groundwater investigations undertaken

	across the premises that groundwater levels decrease down the hillside. A seasonal perched groundwater layer is likely to be present when infiltrating rainfall and waterlogging of the basal portion of surface soils occurs. Groundwater is inferred to generally flow from east to west, towards Hay River and may discharge into water courses at the lower portions of the premises, particularly in winter months when the groundwater table is elevated. Groundwater salinity is above 2,000 mg/L (GHD 2023). The closest registered down-gradient bores are approximately 1.5 km south, 2 km southwest and 2.3 km southwest of the woodlot boundary. They are listed as privately-owned sampling bores. The statuses are unknown. There are two registered bores approximately 3 km and 3.4 km west of the woodlot boundary. The use/status of the bores is unknown. A rural residence approximately 1.5 km to the west of the woodlot may use unregistered bores for non-potable use, irrigation or livestock watering.
Surface water – Minor non-perennial watercourses	<u>WRRF</u> There are two minor non-perennial watercourses approximately 70 m north and 1 km east of the WRRF boundary.
	<u>Woodlot</u> Two minor non-perennial watercourses that are tributaries of the Hay River are located in the west of the woodlot area. The watercourses converge and run in an inferred southwesterly direction to connect to the Hay River, approximately 3.5 km downstream from the woodlot.
Soil	Immediately below the WRRF and woodlot. Information on soil types is explained in section 2.5.2 and 2.5.3.
Surface water – Farm dams	<u>WRRF</u> Farm dams in close proximity to the WRRF are located approximately 200 m west, 700 m west, 690 m northwest, 580 m north, 580 m east and 630 m southeast.
	<u>Woodlot</u> A farm dam is located approximately 300 m west of the woodlot boundary. This dam is in very close proximity to the non-perennial waterway and may experience groundwater interaction. The dam is likely used for livestock watering and/or irrigation use. Other farm dams in close proximity to the woodlot are located approximately 480 m west, 280 m east, 130 m south.
Western Australian Herbarium specimens	<u>WRRF</u> Seven records within 2 km of the WRRF boundary.
	<u>Woodlot</u> 55 records within 2 km of the woodlot boundary. Two specimens are within 70 m of the woodlot boundary.

Threatened and priority flora	WRRF One within 50 m of the WRRF boundary.
	Woodlot Three within 2 km of the woodlot boundary.
Threatened fauna	WRRF Records of nine species within 2 km of the WRRF boundary.
	Woodlot Records of three species within 2 km of the woodlot boundary.
Cultural receptors	**Distance from prescribed activity**
Aboriginal Cultural Heritage site **Place ID:** 39044 **Name:** Pwakkenbak. Tower Hill. Mount Barker. **Place type:** Artefacts / Scatter; Ritual / Ceremonial; Meeting Place; Landscape / Seascape Feature	Approximately 600 m southeast of the woodlot.

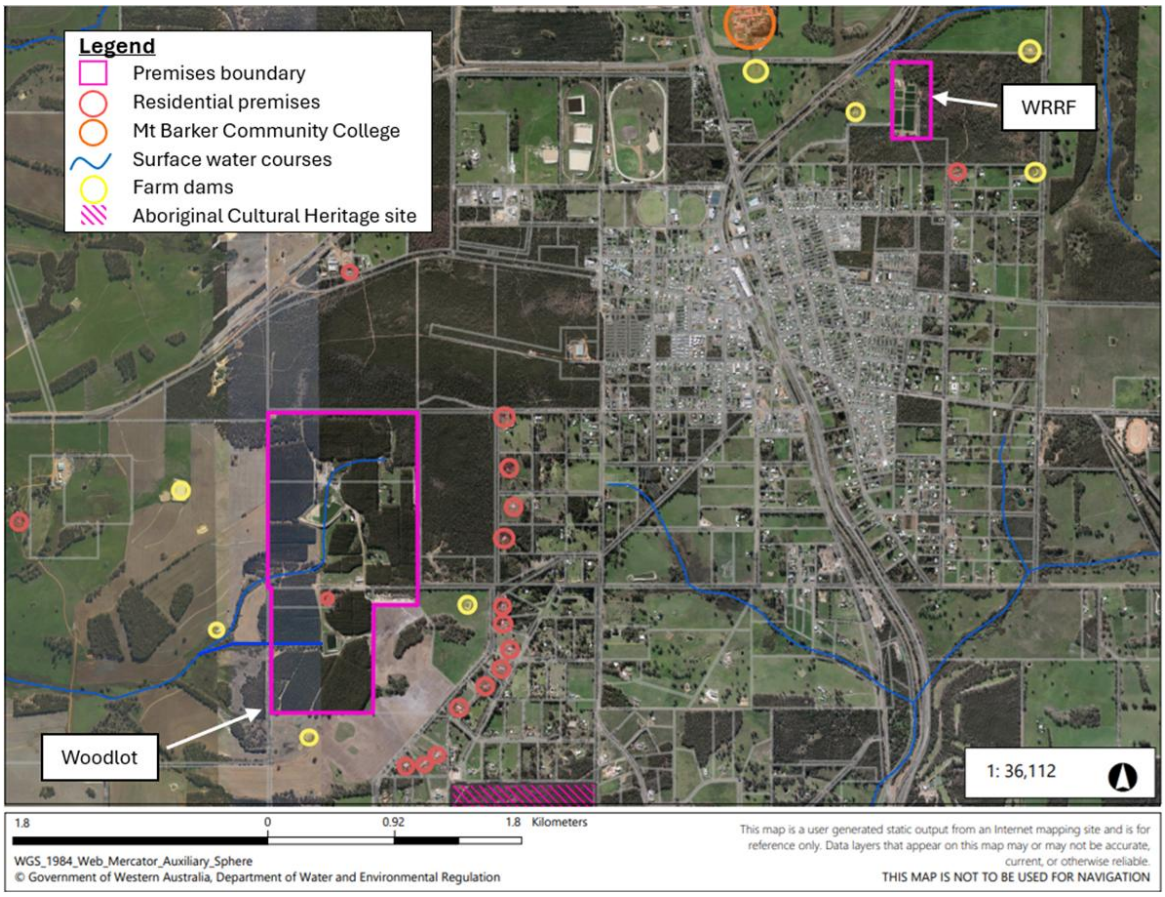

Figure 13: Distance to sensitive receptors

6.2 Risk ratings

Risk ratings have been assessed in accordance with the *Guideline: Risk Assessments* (DWER 2020) for those emission sources which are proposed to change and takes into account potential source-pathway and receptor linkages as identified in Section 6.1. Where linkages are incomplete they have not been considered further in the risk assessment.

Where the licence holder has proposed mitigation measures/controls (as detailed in Section 6.1), these have been considered when determining the final risk rating. Where the Delegated Officer considers the licence holder's proposed controls to be critical to maintaining an acceptable level of risk, these will be incorporated into the licence as regulatory controls.

Additional regulatory controls may be imposed where the licence holder's controls are not deemed sufficient. Where this is the case the need for additional controls will be documented and justified in Table 19.

The revised licence L9273/2020/2 that accompanies this Amendment Report authorises emissions associated with the operation of the premises i.e. sewage treatment and irrigation of treated wastewater.

The conditions in the revised licence have been determined in accordance with *Guidance Statement: Setting Conditions* (DER 2015).

Table 19. Risk assessment of potential emissions and discharges from the premises during operation

Risk Event					Risk rating[1] C = consequence L = likelihood	Licence holder's controls sufficient?	Conditions[2] of licence	Justification for additional regulatory controls
Source/Activities	**Potential emission**	**Potential pathways and impact**	**Receptors**	**Licence holder's controls**				
Operation								
Aerators and pumps operated during treatment of sewage	Noise	**Pathway:** Air/windborne pathway **Impact:** Amenity	Residential homesteads and premises Mount Barker Community College Fauna	Refer to section 6.1.1	C = Minor L = Possible **Medium Risk**	N/A	N/A	The Delegated Officer has considered that there are no recorded recent noise complaints, and any noise emissions can be managed under the *Environmental Protection (Noise) Regulations 1997*. Therefore, no additional regulatory controls are required.
Acceptance, treatment and discharge of sewage Desludging of ponds	Odour				C = Minor L = Possible **Medium Risk**	Yes	3, 4, **5**, **7**, **8**, 24	The Delegated Officer has considered that there have been no recent recorded odour complaints. In addition to existing licence controls, conditions relating to treatment standards and sludge management have been added to the licence.
	Disease vectors	**Pathway:** Attraction and harbouring of pests **Impact:** Health and amenity			C = Minor L = Unlikely **Medium Risk**	N/A	**3**, **5**, **6**, **7**, 13, 24	The Delegated Officer has considered that there have been no recent recorded complaints of pests. In addition to existing licence controls, conditions relating to treatment standards and sludge management have been added to the licence.
Spills, leaks and overflows during acceptance and treatment of sewage Emergency discharge to drain	Contaminants associated with sewage (nutrients, metals, pathogens, PoPs) Treatment	**Pathway:** Overland runoff **Impact:** Ecosystem disturbance and impact to surface water quality	Minor non-perennial watercourses (within the premises), and downstream creek Users of surface water for recreation	Refer to section 6.1.1	C = Moderate L = Unlikely **Medium Risk**	Yes	**3**, **4**, **5**, **7**, **8**, 11, 13, **14**, 15, 24, 28, 29, 30, 31	The Delegated Officer considers the licence holder's controls adequate to manage wastewater levels, sludge and chemicals at the WRRF. The key proposed controls identified in the application have been included in the licence as regulatory controls, including

Risk Event					Risk rating[1] C = consequence L = likelihood	Licence holder's controls sufficient?	Conditions[2] of licence	Justification for additional regulatory controls
Source/Activities	**Potential emission**	**Potential pathways and impact**	**Receptors**	**Licence holder's controls**				
Desludging of ponds	chemicals (chlorine)		/ non-potable uses Farm dams Rural residence 1.5 km west Flora Fauna					sludge management controls. It is noted the existing licence does not include conditions on freeboard requirements for ponds at the WRRF. Freeboard heights have been added as part of this amendment. A condition relating to maintenance of fencing and site security at the WRRF has also been included as a measure to prevent public access.
		Pathway: Seepage through soil to groundwater and migration in groundwater **Impact:** Soil contamination, ecosystem disturbance and impact to water quality	Underlying soil Ecological users of groundwater Users of groundwater for non-potable purposes Flora Fauna	Refer to section 6.1.1	C = Moderate L = Unlikely **Medium Risk**	Yes		
		Pathway: Direct contact **Impact:** Health	Residential homestead within the premises	Refer to section 6.1.1	C = Moderate L = Rare **Medium Risk**	Yes		
	Odour	**Pathway:** Air/windborne pathway **Impact:** Amenity	Residential homesteads and premises Mount Barker Community College Threatened fauna	Refer to section 6.1.1	C = Moderate L = Rare **Medium Risk**	Yes	**3**, **4**, **5**, **7**, **8**, 11, 13, **14**, 15, 24, 28, 29, 30, 31	The Delegated Officer considers the licence holder's controls adequate to manage wastewater levels and potential overflows that may cause odour. The key proposed controls identified in the application have been included in the licence as regulatory controls. The Delegated Officer has also considered that there have been no recent recorded odour complaints.

Risk Event					Risk rating[1] C = consequence L = likelihood	Licence holder's controls sufficient?	Conditions[2] of licence	Justification for additional regulatory controls
Source/Activities	**Potential emission**	**Potential pathways and impact**	**Receptors**	**Licence holder's controls**				
								In addition to existing licence controls, conditions relating to treatment standards and sludge management have been added to the licence.
Storage and discharge of treated sewage via woodlot irrigation	Contaminants associated with treated sewage (nutrients, metals, pathogens, PoPs)	**Pathway:** Overland runoff / downgradient migration **Impact:** Ecosystem disturbance and impact to surface water quality	Minor non-perennial watercourses (within the premises), and downstream creek Users of surface water for recreation / non-potable purposes Farm dams Rural residence 1.5 km west Flora Fauna	Refer to section 6.1.1	C = Moderate L = Possible **Medium Risk**	No	1, **3**, **5**, **6**, **7**, 9, **10**, **14**, 15, 18, **19**, **20**, **21**, 25, 26, 28, 29, 30, 31	The key proposed controls identified in the application and Irrigation Management Plan have been included in the licence as regulatory controls. Additional irrigation conditions have been included. These are standard conditions required for premises irrigating treated wastewater. Further conditions have been added based on internal expert advice. The Delegated Officer has also included yearly nutrient loading limits for irrigation to the woodlot as a regulatory control. The loading limits are 154 kg/ha/y for total nitrogen and 48 kg/ha/y for total phosphorus. The Delegated Officer considers the nutrient application rates proposed by the licence holder using site-specific data appropriate to minimise nutrient leaching. The Delegated Officer has included discharge concentration limits for key parameters in the licence. Groundwater and surface water monitoring conditions have been included in the licence to monitor any potential dam seepage and
		Pathway: Seepage through soil to groundwater and migration in groundwater **Impact:** Soil contamination, ecosystem disturbance and impact to water quality	Underlying soil Ecological users of groundwater Users of groundwater for non-potable purposes Flora Fauna	Refer to section 6.1.1	C = Moderate L = Possible **Medium Risk**	No		
		Pathway: Direct contact	Residential homestead within the premises	Refer to section	C = Moderate	No		

Risk Event					Risk rating[1] C = consequence L = likelihood	Licence holder's controls sufficient?	Conditions[2] of licence	Justification for additional regulatory controls
Source/Activities	**Potential emission**	**Potential pathways and impact**	**Receptors**	**Licence holder's controls**				
		Impact: Human health		6.1.1	L = Rare **Medium Risk**			effects of irrigation. Additional groundwater monitoring bores are proposed to be constructed under W6771/2023/1 and added to the licence. The Delegated Officer has also determined to include additional controls in the licence based on internal expert advice.
	Sediment	**Pathway:** Loss of soil structure and erosion **Impact:** Ecosystem disturbance and impact to water quality	Minor non-perennial watercourses (within the premises), and downstream creek Users of surface water for recreation / non-potable purposes Farm dams	Refer to section 6.1.1	C = Minor L = Unlikely **Medium Risk**	Yes	**<u>3</u>**, **<u>5</u>**, **<u>6</u>**, 9, **<u>20</u>**, 28, 29, 30, 31	The key proposed controls identified in the application and Irrigation Management Plan have been included in the licence as regulatory controls.

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

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

7. Consultation

Table 20 provides a summary of the consultation undertaken by the department.

Table 20: Consultation

Consultation method	Comments received	Department response
Local Government Authority (Shire of Plantagenet) advised of the proposal on 17 February 2025.	The Shire of Plantagenet responded on 27 February 2025 advising they have no objections to the proposed amendment. The Shire noted DoH and DWER will advise on the recycled water scheme and irrigation management plan and the ability to manage risk to health and the environment. The Shire advised the premises is within Special Control Area #4 in Shire of Plantagenet Local Planning Scheme No.5. The development of a new or replacement timber plantation would require development approval from the Shire. It would also require regard for Part 5 of the Scheme, Town Planning Policy #15 and consideration of bushfire mitigation due to the close proximity of the premises to Mount Barker townsite.	The department notes the Shire of Plantagenet's comments, and this information is provided to the licence holder in this decision report.
Department of Health (DoH) was advised of the proposal on 17 February 2025.	DoH responded on 13 March 2025 advising they have no objection to the proposed amendment. DoH advised they have issued approval for the use of recycled water for woodlot irrigation. The approval was granted on 12 August 1996 and was last amended on 19 August 2019. DoH advised the licence holder will be required to update their Recycled Water Quality Management Plan (RWQMP) to reflect boundary changes to the woodlot.	The department notes the DOH's comments, and this information is provided to the licence holder in this decision report.
Licence holder was provided with draft amendment on 24 November 2025.	Refer to Appendix 1	Refer to Appendix 1

8. Conclusion

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

8.1 Summary of amendments

Table 21 provides a summary of the proposed amendments and will act as record of implemented changes. All proposed changes have been incorporated into the revised licence as part of the amendment process.

Table 21: Summary of licence amendments

Condition no.	Proposed amendments
All	• The word “shall” replaced with “must”.
Cover page	• ACN removed – the licence holder does not have an ACN. • DWER file number INS-0002148 added. • Date of amendment added. • Name and location of the Mount Barker Woodlot added. • Lot numbers amended to table format
Licence history	• Details of current amendment added.
New condition 1	• Condition added for the construction/installation of a new shallow groundwater monitoring bore.
New condition 2	• Condition added for the submission of a well construction report.
Condition 1 (now condition 3)	• Infrastructure location column added. • Site infrastructure at the WRRF updated from *Wastewater treatment ponds* to *Pond 1A primary facultative, Pond 1B primary facultative, Pond 2 secondary facultative, Pond 3 tertiary maturation, Pond 4A storage* and *Pond 4B contingency.* • Freeboard height added as an operational requirement for treatment ponds and treated wastewater storage dams. • Reuse offtake point removed. • Geobag drying area, final effluent pump station and fencing and site security added to infrastructure table with operational requirements • Mount Barker Woodlot and associated infrastructure (storage dams, irrigation area and irrigation system, groundwater monitoring bores, and fencing and site security) added to infrastructure table with operational requirements.
New condition 4	• Waste acceptance condition added. This is a standard condition on licences for premises where waste is accepted.
New condition 5	• Waste processing condition added for sewage, sewage sludge and treated wastewater, including conditions for the irrigation of treated wastewater to the woodlot.
New condition 6	• Condition on vegetation management added.
New condition 7	• Standard conditions on spill recovery added.
New condition 8	• Standard condition on contaminated stormwater prevention added.
New condition 9	• Authorised discharge points table added for the irrigation area.
New condition 10	• Emission and discharge limits table added for discharges at the irrigation area.

Condition 2	• *"The licence holder shall make available treated wastewater for reuse"* – deleted. Irrigation of treated wastewater has been added to the licence.
Condition 3 (now condition 11)	• Updated to specify the discharge point referred to is at the WRRF.
Condition 4 (now condition 12)	• Storage dams added to locations where vegetation and floating debris may be collected from.
Condition 5 (now condition 13)	• Condition (c) on the storage of sewage sludge removed – this is now covered in condition 3.
New condition 14	• Condition on waste inputs and outputs added.
Condition 6 (now condition 15)	• Updated to current licence format wording.
Condition 8 (now condition 17)	• Updated to current licence format wording. • Unit column added. • *Reuse Offtake Point flow meter* updated to *Mount Barker Woodlot offtake point flow meter.* • Final effluent sampling point updated to specify S2 • Sampling frequency for final effluent sample point (S2) reduced from monthly to quarterly as requested by the licence holder. • Monitoring locations *Dam 1 outflow meter* and *Northern valve* at the woodlot added with corresponding parameters.
Condition 9 (now condition 18)	• Updated to current licence format wording. • Reference to "Reuse offtake point" updated to "Mount Barker Woodlot offtake point".
New condition 19	• Condition on groundwater monitoring added with monitoring locations, parameters and corresponding units, frequencies and methods.
New condition 20	• Condition on surface water monitoring added with monitoring locations, parameters and corresponding units, frequencies and methods.
New condition 21	• Condition on soil monitoring added. These are similar to monitoring requirements under works approval W6771/2023/1.
New condition 22	• Condition added on ceasing irrigation once soils in the root zone become saturated with phosphorus.
Condition 10 (now condition 23)	• Condition numbers for additional monitoring added. • Requirement to report "Reportable Events" removed, as the requirement is not specified. The requirement to report events in accordance with condition 15 (now condition 28) remains.
Condition 12 (now condition 25)	• Updated to specify the report is an Annual Audit Compliance Report.
Condition 13 (now condition 26)	• (b)(i) amended from *"in comparison with past monitoring data collected for the previous three years"* to *"in comparison with past monitoring data collected for the previous three years, except for soil monitoring data which must be compared with past monitoring data collected for all previous years"* • Calculation of quarterly contaminant loads (in tabular format) added to biennial Environmental Reporting condition as requested by the licence holder.

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Definitions	• Definitions added – *AS 1726, AS 4482.1, AS/NZS 5667.6, AS/NZS 5667.11, ASTM D5092/D5092M-16, biannually, biennially, BOD_5, cfu, electrical conductivity$_{1:5}$, MPN, $pH_{1:5}$, quarterly* • Definitions updated – *Discernible seepage, Final Effluent Sample Point, Reuse Offtake Point, Wastewater Discharge Point* • Definitions removed – *Reportable Event, Serious Environmental Harm, Unreasonable Emission.* These definitions are considered redundant.
Schedule 1: Maps	• Figure 1 replaced with an updated map of the WRRF. • Figure 2 layout map of the WRRF replaced with a map of the woodlot. • Figure 3 map of soil monitoring locations added.
Schedule 2: Premises boundary	• Coordinates table removed as coordinates are on the updated figures 1 and 2.

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Appendix 1: Summary of licence holder's comments on risk assessment and draft conditions

Condition	Summary of licence holder's comments	Department's response
Condition 1, Table 1 Groundwater monitoring well construction / installation	Requested to amend the timeframe for installation from three months to six months.	Accepted. The timeframe has been extended to six months.
Condition 3, Table 2, Column 2 - Mount Barker WRRF Treatment ponds	Requested to amend Pond 1B from primary advanced facultative to primary facultative. This pond is not advanced facultative.	Pond 1B has been renamed.
	Condition b) - Requested to amend the pond freeboard height from ≥500 mm to ≥300 mm - *"The WRRF pond infrastructure was designed and constructed to operate with a freeboard of 300 mm, which is adequate to protect overtopping from wave action. The ponds have been operating in accordance with this design without incident, overtopping, or environmental harm".*	Accepted. The Delegated Officer considers the designed freeboard height adequate to prevent overtopping.
	Condition d) – Requested to reinstate the word discernible – *"WRRF ponds are not designed to have zero seepage, therefore wording the condition as having no seepage loss is a condition that cannot be complied with".*	Accepted. The intention of the condition is for seepage from a pond to not be visually observed or measured to be beyond that expected based on the lining specifications of the pond and environmental factors such as evaporation.
	Condition e) – Requested to amend the wording from: *Vegetation and floating debris (emergent or otherwise) is prevented from encroaching onto in pond surfaces or inner pond embankments* to *Manage vegetation and floating debris (emergent or otherwise) in pond surfaces or inner pond embankments to maintain performance.* *"Mount Barker WRRF is in an area that receives rainfall during summer months, meaning vegetation will always require management and weather may limit herbicide spraying conditions. Moreover, there is no screening of the influent prior to the primary ponds, so there will always be debris as part of the normal process".*	This is an existing condition in the licence, and the amendment of this condition is out of scope of this amendment. The current wording will remain.

Condition	Summary of licence holder's comments	Department's response
Condition 3, Table 2, Column 3 - Mount Barker WRRF Geobag drying area	Condition (a) – *"Remove permeability. There may be situations in which the site will need to conduct a drain and dry desludging method, for which the pond will be acting as the infrastructure for desludging. Ponds have not been designed with a permeability of ≤ 1x10-9 m/s".*	The condition has been amended to allow for ponds to be used as containment during desludging.
Condition 3, Table 2, Column 2 – Mount Barker WRRF Fencing and site security	Condition (a) – Requested to amend the wording from: *Suitable fencing must be erected and maintained to prevent unauthorised access to the premises* to *Implement security measures at the premises to prevent unauthorised access.* This update to wording was requested to achieve consistency with other Water Corporation licences.	The Delegated Officer has determined to remove the requirement for fencing to be erected, as the WRRF is already fenced. However, the requirement for suitable fencing to be maintained to prevent unauthorised access will remain. As described in Table 19, a condition relating to maintenance of fencing has been added to prevent public access. This is considered necessary to maintain a medium risk rating for potential contact with disease vectors, contaminants and treatment chemicals at the WRRF.
	Condition (c) – Requested to amend wording from: *Regular inspections must be undertaken of all security measures and damage repaired within 10 working days of identification* to *Undertake regular inspections of all security measures and repair damage as soon as practicable.* This update to wording was requested to achieve consistency with other Water Corporation licences.	To repair damage "as soon as practicable" is not enforceable. The Delegated Officer has determined to retain the original wording as it specifies actions with defined timeframes.
Condition 3, Table 2, Column 3 – Mount Barker Woodlot Dam 1 and Dam 2	Condition (d) – Requested to reinstate the word discernible – *"WRRF ponds are not designed to have zero seepage, therefore wording the condition as having no seepage loss is a condition that cannot be complied with".*	Accepted. The intention of the condition is for seepage from a pond to not be visually observed or measured to be beyond that expected based on the lining specifications of the pond and environmental factors such as evaporation.
	Condition (e) - Requested to amend the wording from: *Vegetation and floating debris (emergent or otherwise) is prevented from encroaching onto in pond surfaces or inner pond embankments*	The Delegated Officer has determined to keep the original wording to remain consistent with the same condition for the WRRF ponds.

Condition	Summary of licence holder's comments	Department's response
	to *Manage vegetation and floating debris (emergent or otherwise) in dam surfaces or inner dam embankments to maintain performance.* *"Mount Barker WRRF is in an area that receives rainfall during summer months, meaning vegetation will always require management and weather may limit herbicide spraying conditions".*	
Condition 3, Table 2, Column 3 – Mount Barker Woodlot Irrigation area and irrigation system	Condition (c) – Requested to amend wording from: *Drip irrigators must be maintained to ensure no blockages to allow even and effective drip production* to *Drip irrigation plots must be monitored regularly to ensure performance is within design specifications.* This update to wording was requested to achieve consistency and for the condition to be an effective control.	The condition has been amended to specify drip irrigators must be maintained to allow even and effective drip production and monitored to ensure performance of the irrigation system is within design specifications.
Condition 3, Table 2, Column 2 – Mount Barker Woodlot Groundwater monitoring bores	Update to the naming of PEN_MB05C monitoring bore to MB05C-19.	The name of the monitoring bore has been updated.
Condition 3, Table 2, Column 3 – Mount Barker Woodlot Fencing and site security	Condition (a) - Requested to amend the wording from: *Suitable fencing must be erected and maintained to prevent unauthorised access to the premises* to *Implement security measures at the premises to prevent unauthorised access.* This update to wording was requested to achieve consistency with other Water Corporation licences.	The Delegated Officer has determined to remove the requirement for fencing to be erected, as the WRRF is already fenced. However, the requirement for suitable fencing to be maintained to prevent unauthorised access will remain. The department assesses risk to the environment as well as the public, and this condition is considered necessary to prevent potential contact with contaminants in the irrigation area.
	Condition (c) - Requested to amend wording from: *Regular inspections must be undertaken of all security measures and damage repaired within 10 working days of identification* to *Undertake regular inspections of all security measures and repair damage as soon as practicable.*	To repair damage "as soon as practicable" is not enforceable. The Delegated Officer has determined to retain the original wording as it specifies actions with defined timeframes.

Condition	Summary of licence holder's comments	Department's response
	This update to wording was requested to achieve consistency with other Water Corporation licences.	
	Condition (d) – Requested removal of this condition requiring signage at the woodlot. This requirement is already specified in the DoH approval. The site is fenced with no public access.	The Delegated Officer has determined to retain the condition. The department assesses risk to the environment as well as the public, and this condition is considered necessary to prevent potential contact with contaminants in the irrigation area. It is also necessary to maintain a medium risk for people using the residential homestead within the premises coming into contact with contaminants.
Condition 4, Table 3, Column 3 Waste acceptance	Requested to include waste accepted via tankering to the WRRF during emergency events or maintenance works only.	Agreed. Condition updated and acceptance limited to less than 100 tonnes of tankered waste received per annual period. Acceptance volumes over this amount will require the addition of category 61 on the licence.
Condition 5, Table 4, Column 3 Waste processing - Sewage sludge	Condition (a) – *"Remove permeability. There may be situations in which the site will need to conduct a drain and dry desludging method, for which the pond will be acting as the infrastructure for desludging. Ponds have not been designed with a permeability of ≤ 1x10-9 m/s".*	The condition has been amended to allow for ponds to be used as containment during desludging.
Condition 5, Table 4, Column 3 Treated wastewater	Condition (d) - Requested removal of this condition requiring irrigation to not be undertaken when rainfall is imminent, during, or immediately after a rainfall event. *"This is already regulated under the existing DoH Approval condition 14:* *'Recycled water irrigation should be only undertaken during dry weather conditions and regular inspections should be undertaken to ensure ponding or runoff does not occur.'* *Moreover, (b) and (c) already mitigate the risk that (d) is trying to manage".*	The Delegated Officer has determined the condition will remain to maintain a medium risk profile for potential emissions from the irrigation for treated wastewater.
	Condition (e) – Requested to amend wording from: *wastewater is evenly distributed over the irrigation area, and that no ponding or pooling occurs* to *wastewater is reasonably distributed within each irrigation area, and that no ponding or pooling occurs.*	"Reasonably" is not an enforceable term. The original condition will remain.

Condition	Summary of licence holder's comments	Department's response
	Condition (f) – Requested to amend wording to require that no *reasonable* soil erosion occurs, as there will be a certain level of natural erosion.	"Reasonable" is not an enforceable term. The original condition will remain.
	Condition (i) – Requested to amend wording from "weekly" to "regular" visual inspections, as weekly is too prescriptive and regular would be more achievable.	Agreed. The Delegated Officer has determined to amend the requirement to monthly inspections, and only for areas that are actively being irrigated.
	Condition (k) – Requested to amend wording from: *No fertiliser application to the irrigation plots is permitted* to *Fertiliser must not be applied such that the total nutrient loading to the woodlot irrigation areas (including contributions from treated wastewater) exceeds the limits specified in Table 7.* *"'Fertiliser' is a very broad term, many soil improvement products to assist woodlot production and improve soil health can be classified as fertiliser that are not necessarily nitrogen and phosphorus based.* *After multiple woodlot rotations it may be necessary to apply trace elements or other establishment nutrients including lime for soil pH correction. There is also potential for application of composted material if required to improve soil structure, conserve water and reduce erosion.* *The requested amendment controls the nutrient leaching risk while allowing suitable products to be applied to maintain woodlot tree health and productivity".*	The condition has been removed. The Delegated Officer considers the risk of over-application of nutrients is sufficiently regulated under loading limits in condition 10.
	Condition (l) (now condition k) – Requested to amend wording from: *Irrigation must not take place during the year in which a woodlot plot is harvested and may only take place in the following year during re-establishment where low soil moisture conditions are experienced* to *Tree plots must not be irrigated until seedlings are adequately established.* *"Historically, irrigation has not taken place during the harvest year as an operational choice to facilitate efficient harvesting and has not been a measure related to environmental risk. Climatic conditions and the schedule of harvest operations dictate the required drying time to ensure a necessary drying period for safe and effective machinery access to the woodlot.* *Maintaining a blanket prohibition during the harvest year unnecessarily reduces the available irrigation area without delivering any environmental benefit.* *The requested amendment ensures irrigation occurs only when vegetation can effectively utilise applied water and nutrients, aligning with best practice for nutrient management and soil protection".*	The condition has been reworded to clarify the intention of the condition and ensure operational practicality.

Condition	Summary of licence holder's comments	Department's response
	Condition (m) (now condition (l)– Requested to amend wording from: *Irrigation must only occur in areas where there is permeable sandy soil at least 0.5 m deep* to *Irrigation must only occur in areas where the upper 0.5 metres of soil consists of permeable materials such as sandy loam, sand, sandy gravel, sandy clay loam, or sandy clay, or other soils with equivalent saturated hydraulic conductivity to prevent surface runoff, and with sufficient soil water storage capacity to avoid interflow.* *"Field observations presented in the Irrigation Management Plan show that sandy loam, sand, sandy gravel, sandy clay loam, and sandy clay are present within the surface 0.5 metres of the woodlot soil strata.* *These soil types were assessed as suitable for irrigation because they provide adequate saturated hydraulic conductivity to prevent surface runoff and sufficient soil water storage capacity to minimise interflow during periods of heavy rainfall.* *The requested amendment retains the environmental control while accounting for the natural variation within the woodlot topsoil".*	The condition has been amended to better reflect the intention of the condition: to allow irrigation only in areas with adequate saturated hydraulic conductivity to prevent surface runoff, and with sufficient soil water storage capacity to minimise interflow.
	Condition (n) (now condition m) – Requested to amend the buffer between irrigation areas and waterways from 50 m to 20 m. *"A 50 m buffer is considered excessive given the characteristics of the site waterways (drainage channels), existing management controls, and the low inherent risk of interflow. Implementing a 50 m buffer from the southern drainage channel (sampled at SW02) would remove approximately 1.6 ha of woodlot irrigation area, significantly reducing the available area for nutrient application.* *Interflow risk has previously been assessed as low in the submitted Technical Advice. This risk is already directly managed through Conditions (m) and the flat nature of the woodlot (all areas <10°). The Irrigation Management Plan governs appropriate water and nutrient loading for the site.* *The drainage channel is not a sensitive receptor. Water Quality Protection Note 6 (Table 1) provides guidance on recommended vegetation buffer distances to sensitive receptors. For Buffer Type C – Wellhead Protection Zones, P3 areas, which are significantly more sensitive than the Mount Barker drainage lines, the recommended buffer is 20–30 m.* *The requested amendment to a 20 m buffer maintains protection of the drainage line while preserving more irrigation area for nutrient application over the long term. This approach reduces nutrient loading rates across the woodlot and lowers overall site risk".*	The Delegated Officer considers that shallow soil interflow is likely to occur at the woodlot periodically. The Delegated Officer has also considered additional regulatory controls in the licence, and US EPA guidance which indicates an irrigation buffer distance of 20 metres is considered adequate to protect waterways (US EPA 2006). A buffer distance of 20 metres will be included in the licence. This is expected to help minimise potential impacts to waterways.
	Condition (o) (now condition n) – Requested to remove the condition relating to irrigation not occurring in areas where the slope of the land is greater than 20°. *"The attached 'elevation contour and slope analysis' figure demonstrate that all areas within the Mount Barker Woodlot are below 20°. As a result, the irrigation restriction related to slopes greater than 20° is not triggered by site conditions*	The Delegated Officer has determined to keep the condition, based on internal expert advice as detailed in section 5. The condition is considered important to maintain a medium risk profile for

Condition	Summary of licence holder's comments	Department's response
	and does not provide an operational or environmental benefit for operation of the Woodlot".	downstream receptors in the event that there are future changes to the landscape.
Condition 6, Table 5, Column 1 Vegetation material	Requested to add Eucalyptus species as a general vegetation type for the woodlot. *"The requested change is intended to provide operational flexibility and prevent administrative non-compliance. Limiting the woodlot to a single species (Eucalyptus globulus) is restrictive, other Eucalyptus species may offer equal or superior performance in terms of growth, product value, site suitability, and nutrient uptake.* *Allowing potential establishment of alternative Eucalyptus species (if identified as superior) with comparable nutrient assimilation capacity would support adaptive management and continuous improvement, while maintaining environmental outcomes consistent with the licence objectives".*	The condition has been amended to specify *Eucalyptus globulus* or species with at least equivalent nutrient and hydraulic uptake capability may be used in the irrigation woodlot.
	Condition (c) – Requested removal of condition requiring all pruned material to be removed from the premises. *"This condition is not realistically achievable. Pruning is a required silvicultural practice to ensure high-quality wood and to maintain stand form and operational access. On-site retention of pruned material is consistent with the sustainable forest management requirements for monoculture plantations outlined in Australian/New Zealand Standard 4708:2021 (Responsible Wood 2021). Retained woody material decomposes very slowly, contributing to soil organic matter, improving soil structure and water retention in the woodlot. This substrate provides habitat for fungi and soil invertebrates, which support stable nutrient cycling over time. Additionally, the retained woody debris helps to trap sediments, minimise bare soil and reduce erosion risk across the woodlot.* *The condition likely arises from an intention to limit nutrient deposition from the mineralisation of pruned material into the soil strata. However, improving soil structure and availability of organic carbon promotes biological nutrient removal pathways such as denitrification in the soil. In the submitted Irrigation Management Plan, there has been a 20% safety factor applied to the modelled woodlot vegetation nutrient removal capacity, this accounts for any additional nutrient inputs from pruned material degradation in the woodlot outside of the MEDLI modelling results".*	Accepted. The condition has been removed.
Condition 6, Table 5, Column 2 Grasses and weeds	Conditions (a) and (b) – Requested removal of these conditions. *"The nutrient removal capacity of the woodlot considers harvesting of the blue gums only, there is no reliance on grass/weed uptake and subsequent removal offsite to manage nutrient application.* *Grasses and weeds will uptake nitrogen and phosphorus from the soil and return it when they die-off, there is no net addition to the nutrient mass balance for the site that requires special management".*	The Delegated Officer has determined to keep the condition. While grasses and weeds may temporarily take up nitrogen and phosphorus, if cut material is left in place it will decompose relatively quickly and return nutrients to the soil in an uncontrolled fashion. This can increase risks associated with surface runoff and introduces uncertainties regarding timing, location and rate of nutrient reintroduction into the system which is inconsistent with the regulation of irrigated nutrient inputs,
Condition 10, Table 7	Requested to remove BOD, TSS, residual chlorine and pH discharge concentration limits.	

Condition	Summary of licence holder's comments	Department's response
Emission and discharge limits	*"BOD: < 20 mg/L BOD is an overly restrictive condition for woodlot irrigation. The Australian Guidelines for Water Recycling (AGWR) does not suggest BOD monitoring as a Water Quality objective for Non-food crops (such as woodlots). BOD degrades readily in the soil strata, the NSW DEC 'Environmental Guidelines for Use of Effluent by Irrigation' suggests a maximum BOD loading rate of 1500 kg/ha/month for most soils. Application at Mount Barker is significantly below this (typically < 10 kg BOD/ha/month).* *TSS is not an environmental concern for reuse irrigation to land. Chlorine does not present a risk to the woodlot vegetation; it is not at risk of foliar injury.* *The woodlot is an 'Extra low' exposure risk application and DoH does not require monitoring or provide a limit on residual chlorine, pH and TSS for the health aspect".*	TSS and chlorine have been removed. On review, these are not considered priority parameters. Additionally, monitoring results indicate that low levels of TSS have been detected in the irrigation water. Further advice from the department's Contaminated Sites Branch indicates dissolved oxygen concentrations in surface water are a more reliable parameter for monitoring impacts to the environment, rather than setting a discharge concentration limit for BOD. The Delegated Officer has determined to remove the discharge concentration limit for BOD, however monitoring for dissolved oxygen in groundwater and surface water will remain in the licence. This will help to identify any potential impacts to water quality and maintain a medium risk profile for downstream receptors. A pH concentration will remain to align with the DoH approval.
Condition 11	Requested update to reword *wastewater discharge point* to *wastewater discharge to environment flow meter*. The requested update to the naming convention is to align with Water Corporation's internal process control table.	The condition has been updated.
Condition 17, Table 9 Condition 19, Table 11 Condition 20, Table 12	Requested to change *E.Coli* units from cfu/100mL to MPN/100mL to align with units used by external laboratories.	The units have been amended to allow for measurement in cfu or MPN / 100mL.
Condition 17, Table 9, Column 1	Requested update to reword *Mount Barker Woodlot offtake point flow meter* to *Mount Barker effluent reuse flow meter*. The requested update to the naming convention is to align with Water Corporation's internal process control table.	The name of the flow meter has been updated.

Condition	Summary of licence holder's comments	Department's response
	Requested update to reword *Wastewater discharge point flow meter* to *Wastewater discharge to environment flow meter*. The requested update to the naming convention is to align with Water Corporation's internal process control table.	The name of the flow meter has been updated.
Condition 17, Table 9, Column 2 - 'Northern Valve' row	Requested to remove BOD, TSS, residual chlorine and TKN from emissions and discharge monitoring. *"Removal of BOD, residual chlorine, and TSS justified above. TKN is not used in the nutrient loading to land calculation, and nitrogen speciation is already well characterised by measuring TN, ammonium as N, and NOx".*	TSS and residual chlorine have been removed, as justified above. TKN has also been removed. The Delegated Officer considers nitrogen is sufficiently monitored through other parameters. BOD will remain. Condition 18 requires the calculation of contaminant loading for BOD, and as such monitoring of BOD discharged will be necessary.
Condition 18	Requested to amend *Mount Barker Woodlot offtake point* to *Dam 1 outflow meter*. *"Contaminant loads should be calculated from actual disposal volumes to the woodlot, not from flows to the storage dam (evaporation losses occur in the dam)".*	The name has been updated.
Condition 18, Table 10	Requested to remove BOD from calculation of contaminant loads, as per justification above.	The requirement to calculate the contaminant loading of BOD is an existing condition in the licence, and the amendment of this condition is out of scope of this amendment. The condition will remain.
Condition 19, Table 11 Groundwater monitoring locations	Update to the naming of PEN_MB05C monitoring bore to MB05C-19. Requested to name the new proposed bore 01-26.	The bore names have been updated.
Condition 19, Table 11 Groundwater monitoring	Requested to remove electrical conductivity (at 25°C) from field measurements. *"Electrical conductivity and TDS measure the same thing (salinity/ total dissolved ions). EC is a field surrogate for TDS. Laboratory TDS is already included in the monitoring suite and provides an accurate and definitive measure of salinity. Furthermore, ANZG does not list EC as a primary water quality parameter".*	Accepted. The parameter has been removed.
	Requested to remove redox from field measurements.	Accepted. The parameter has been removed.

Condition	Summary of licence holder's comments	Department's response
Condition 20, Table 12 Surface water monitoring	*"Field redox measurements are typically unstable and not technically reliable – particularly in shallow, oxygenated groundwater. DO and pH provide the necessary redox context, making redox redundant. Furthermore, ANZG does not list redox as a primary water quality parameter".*	
	Requested to replace Chromium VI with Chromium in metals monitoring. *"Total Chromium (Chromium) is the nationally recognised and technically defensible parameter for groundwater and surface water monitoring, consistent with ANZG 2023 and DWER guidelines. ANZG 2023 provides trigger values for total Chromium, not Chromium VI, unless there is a known source of contamination history. Therefore, requiring Chromium VI is not aligned with ANZG unless the site has an industrial chromium contamination risk (which the woodlot does not)".*	Based on further advice from the Contaminated Sites Branch, the Delegated Officer has determined to replace the requirement to monitor for Chromium VI with the requirement to monitor for Total Chromium (Chromium). However, elevated chromium concentrations should be assumed to be present in the more toxic hexavalent oxidation state, unless proven otherwise.
	Requested to remove BOD from general water quality parameters. *"BOD is an effluent-quality parameter and is not technically valid for ambient environmental waters given it is not used for ambient environmental water quality assessment. BOD is unlikely to persist through the soil profile and if organic loading from infiltration was occurring, DO in groundwater or surface water would drop, making BOD redundant. ANZG species ecosystem protection trigger values for DO ranges. This is the parameter that applies to ambient waters not BOD. [Water Corporation] request that BOD be restricted to final effluent and irrigation water monitoring only, with DO serving as the appropriate oxygen-related parameter for environmental monitoring under ANZG and DWER'S risk-based framework".*	BOD has been removed as a parameter for monitoring in groundwater and surface water. Further advice from the department's Contaminated Sites Branch indicates dissolved oxygen concentrations in surface water are a more appropriate parameter for monitoring oxygen levels. Monitoring for dissolved oxygen in groundwater and surface water will remain in the licence. This will help to identify any potential impacts to water quality and maintain a medium risk profile for downstream receptors.
	Requested to remove chlorine from general water quality parameters. *"The woodlot is an 'Extra low' exposure risk application and DoH does not require monitoring or provide a limit on residual Chlorine. Chlorine is highly reactive and rapidly degrades in the environment. Therefore, there is no plausible pathway for chlorine to reach groundwater or surface water in a measurable form".*	Chlorine has been removed as a monitoring parameter for groundwater, however will remain as a monitoring parameter for surface water due to potential environmental impacts.
	Requested to remove ferrous iron from metals monitoring. *"Ferrous iron is an unstable species that oxidises rapidly upon exposure to air during sampling. Ferrous iron is not included in standard guidelines nor typical WWTP or woodlot licences, which instead monitor for iron, which the licence*	Ferrous iron has been removed as a monitoring parameter for groundwater and surface water. The Delegated Officer considers monitoring for iron sufficient.

Condition	Summary of licence holder's comments	Department's response
	is proposing to do. There is no credible pathway for elevated ferrous iron generation attributable to irrigation activities".	
	Requested to remove selenium, mercury, molybdenum and vanadium from metals monitoring. *"The decision report recommends that selenium, mercury, molybdenum and vanadium are included in surface water and groundwater monitoring suites (ANZG 2023). Water Corporation notes that the ANZG 2023 guideline values provide ambient water quality trigger values only for contaminants that are present or reasonably expected to occur in the receiving environment. ANZG does not specify mandatory analytes and is not intended to be used as a prescriptive list of monitoring parameters. Furthermore, selenium, mercury, molybdenum and vanadium are not constituents of domestic wastewater, are not generated through the treatment process, and have no plausible pathway for mobilisation under the irrigated woodlot.* *These metals also aren't listed as CoPC in Appendix B, DWER (2021) Guideline Assessment and Management of Contaminated Sites for WWTPs. As these elements are not contaminants of potential concern for this activity, application of ANZG trigger values is not relevant, and monitoring would not provide meaningful environmental performance information".*	Partially accepted. The Contaminated Sites Branch advice considers that the woodlot is in an area where there are likely significant metal discharges from agricultural activities. Therefore, the exclusion of molybdenum and vanadium from monitoring is unlikely to increase the risk to receptors. On review, the Delegated Officer has determined to remove molybdenum and vanadium from the groundwater and surface water monitoring suites. However, mercury and selenium have the potential to appear in treated municipal wastewater at levels of environmental concern. Mercury and selenium may also be biomagnified in food webs, and it is important to determine whether irrigation of wastewater could be a source of contamination. Therefore, the Delegated Officer has determined to keep mercury and selenium in the groundwater and surface water monitoring suites.
Condition 21, Table 13 – Method	Requested to amend four depth increments to two depth increments. *"Samples at four depth intervals is excessive given the low risk of the site. For environmental surveillance purposes, we are interested in what is happening in the soil at the end of the root zone (~ 1 metre for blue gums) particularly for phosphorus adsorption parameters. A shallower depth is also important to monitor the risk to a change in the soil structure (sodicity) and nutrient availability for vegetation.* *Composites at two depths – 10 – 30 cm and 80 – 100 cm would provide all the relevant information. Testing between these depths will not add significantly to our understanding of the environmental risk.* *This approach captures the two major soil layers present (sandy loam and sandy clay)".*	Accepted. The condition has been amended to require composites to be taken for two depth increments.
Condition 21, Table 13 – Parameters	Requested removal of sulfur, copper, iron, manganese and zinc from soil monitoring. *"The rationale for requiring ongoing soil testing for sulfur, copper, iron, manganese, and zinc is unclear from an*	On review and based on advice from the Contaminated Sites Branch, the requirement to monitor for sulfur, copper, manganese, iron and zinc in soil has

Condition	Summary of licence holder's comments	Department's response
	environmental risk perspective. These analytes are not critical indicators for environmental surveillance in this context. *From a vegetation health standpoint, the blue gums have a long history of successful growth at the site under TWW irrigation.* *If the concern relates to potential transport to groundwater, these parameters are already monitored directly in groundwater sampling. The TWW is not considered a source of these contaminants, reducing the likelihood of accumulation or leaching to groundwater".*	been removed. These are not considered to be indicators of environmental health and therefore their removal is not considered to increase the risk to receptors.
Condition 26	Requested to add 2026 to the reporting due date to specify when the next biennial environmental report is due.	The condition has been amended as requested.
	Condition (b)(i) – Requested to keep the requirement to compare monitoring data with monitoring data from the previous three years, instead of "previous years". This was requested to maintain consistency with other licences, and to have a reference in years.	The condition has been amended to require monitoring data to be compared with the previous three years' data, except for soil monitoring data, which must be compared against all previous years. This is because soil monitoring is only required to be undertaken every 5 years.
	Condition (c) – Requested to amend calculation of monthly contaminant loads to quarterly contaminant loads, to ensure consistency with condition 18, Table 10 which requires quarterly calculation of contaminant loads.	The condition has been amended as requested.
	Condition (g) – Requested update to wording of *wastewater discharge point* to *wastewater discharge to environment flow meter*, to align with Condition 17, Table 9.	The condition has been updated.
Schedule 1: Maps	Replace Figure 1 and Figure 2 with updated maps.	Figures 1 and 2 have been updated. Figure 2 includes the location of the proposed new monitoring bore 01-26 and the updated naming of bore MB05C-19.