Government of Western Australia
Department of Water and Environmental Regulation

Decision Report

Review of Existing Licence

Division 3, Part V *Environmental Protection Act 1986*

Licence Number	L6270/1991/10
Licence Holder	Water Corporation
File Number	DER2013/000796
Premises	Kununurra Wastewater Treatment Plant Crown Reserve 30945 Legal description - Lot 3008 on Plan 48173
Date of Report	27 November 2024
Status of Report	Final

Executive Summary

This Decision Report presents an assessment of foreseeable Risk Events to public health and the environment from the Primary Activities currently being undertaken at the Water Corporation's (Licence Holder) Kununurra Wastewater Treatment Plant (KWWTP, the premises).

The Licence Holder has previously submitted two works approval applications to the Department of Water and Environmental Regulation (DWER) seeking authorisation to increase the KWWTP throughput capacity. These works approval applications were subsequently withdrawn by the Licence Holder in 2016 and 2020 respectively on advice from DWER that insufficient information had been submitted to inform DWER's risk assessment on the proposed throughput increase. Following the withdrawal of the most recent works approval application, DWER determined that a risk-based review (Review) of Licence L6270/1991/10 (the Licence) was required to ensure that Licence conditions contain the required degree of regulatory control for the risk of current premises operations.

Additionally, DWER considers that there is a need for a Licence review to provide assurance in Licence conditions due to historic and ongoing stakeholder concerns regarding discharges of treated wastewater (TWW) into the M1 Irrigation Channel, which is used for irrigation activities.

The M1 Channel is a purpose-built irrigation channel servicing irrigators on the Ivanhoe Plain of the Ord River Irrigation Area (ORIA). During the Dry Season irrigation period TWW from the KWWTP is diluted with irrigation water within the M1 Channel prior to use for irrigation, so it is assumed that adequate dilution of contaminants within TWW is occuring. However, during the Wet Season non-irrigation period, TWW is discharged into the M1 channel unencumbered (with potentially low to no dilution) where the undiluted waste stream then has the potential to enter the D1 drain and subsequently the Lower Ord River.The two key aspects which the review initially sought to address were:

Whether discharge of TWW to the M1 Channel during the Dry Season irrigation period represents acceptable health and environmental risks to irrigation users of the water within the M1 Channel; and

Whether discharge of TWW to the M1 Channel in the Wet Season period (when little to no irrigation occurs) represents an acceptable risk to ecological values of the Lower Ord River.

The scope of the Review was originally proposed to align with the above two key aspects:

- **Stage 1:** The department will reassess the risks associated with all emissions and discharges from the premises using information currently available.
- **Stage 2:** The department will review the risk assessment for the premises in the context of the additional information provided by the monitoring and further investigations that will be undertaken at the premises over the next 18-24 months, to ensure the risk classifications and associated regulatory controls remain appropriate.

Due to submission of assessment reports relating to Stage 2 in early May 2022 by the Licence Holder that addressed the required additional monitoring and investigations information under the proposed Stage 2 timeframe, DWER has elected to combine both stages into a single Review.

In addressing the two key aspects the Licence Holder has subsequently undertaken the following detailed assessments relating to potential risks to human health, the environment and environmental values associated with historical and current operations at the Premises:

Stage 1 Timeframe

- Baseline Assessment and Hydrological Conceptual Model – Kununurra Wastewater Treatment Plant and M1 Channel, Kununurra WA (Senversa, 2020a) (Baseline

Assessment)

- Hydrogeological Conceptual Model, and
- Site Conceptual Model.

Stage 2 Timeframe

- Environmental Site Assessment (ESA) – Water Corporation Kununurra Treatment Plant (Senversa 2022a).
- Wastewater and Surface Water Quality Assessment (WSWQA) – Kununurra Wastewater Treatment Plant (Senversa 2022b).

The combined Stage 1 and 2 reports and all available information relating to the premises and surrounding environment have been incorporated into this single Licence Review. This Review assesses the risks associated with all emissions and discharges from the Premises using all currently available information.

General Observations and Key Findings

General observations and key findings from the review are as follows:

- The KWWTP has had two upgrades since 1988, being the installation of a chlorination unit, and the installation of an automated discharge shut-off in the event that the chlorination unit stops functioning.
- Generally, concentrations of all tested analytes were lower in TWW than in inflow wastewater.
- The KWWTP premises and surrounding arboretum contain suitable soil types/habitat known to support the Threatened Flora *Typhonium sp. Kununurra* (Typhonium). The presence of Typhonium on site has been confirmed from previous targeted survey and is noted to be a sensitive receptor to KWWTP operations.
- Discharge from the KWWTP to the M1 Channel occurs under three distinct flow regimes:
    - A Dry season irrigation period;
    - A Wet season non-irrigation period; and
    - An Intermediate period, representing a short transition period between the other regimes.
- The investigation levels applied by Water Corporation to each receptor scenario are appropriate for comparison with monitoring results.
- If undiluted, both untreated and TWW at the KWWTP have the potential to represent an unacceptable risk to relevant receptors due to contaminant concentrations.
- Achieving acceptable levels of contaminants at receptors requires the TWW discharge to be diluted– most notably for the Dry and Intermediate periods, with linear reductions in M1 contaminant concentrations to distance from the KWWTP observed for all three of the seasonal flow regimes.
- Where there is irrigation/dilution water in the M1 channel, the sampling undertaken for the WSWQA indicates water is diluted so that contaminant concentrations are below relevant investigation levels within 1 km of the discharge pipe.
- There are other sources of contamination for water in the M1/D1 drainage system, most notably from surrounding agricultural industry, runoff from which has a similar contaminant profile to treated wastewater.
- The groundwater monitoring network for the Premises does not extend beyond the premises boundary down hydraulic gradient of the WWTP ponds and there is limited

information available regarding how potential contaminants will migrate through groundwater.

- Groundwater monitoring indicates the KWWTP is responsible for at least localised groundwater contamination and that a leak in the pond lining system may be occurring.

Premises Risk Assessment

Based on this Licence Review, the risk ratings determined in accordance DWER's regulatory framework for key emissions from the KWWTP are summarised below:

Risk	Pathway	Risk Rating
Discharge to M1 Channel Dry Season irrigation period	Direct discharge to surface waters	Environmental **Medium** Public Health **Medium**
Discharge to Lower Ord River Wet Season non-irrigation period (includes Maintenance period)		Environmental **Low** Public Health **Low**
Discharge to M1 Channel Intermediate period		Environmental **Medium** Public Health **Medium**
Odour	Air / wind dispersion	Environmental **Low**
Overtopping	Direct discharge to land and surface water	Environmental **Medium** Public Health **Low**
Seepage	Lateral and vertical subsurface migration to groundwater	Environmental **Medium** Public Health **Low**

Data Gaps

Based on a review of the supporting information submitted to inform the Licence Review, Reports, and a review of historical monitoring and sampling undertaken by the Licence Holder, the following data gaps have been determined regarding the operation of the WWTP:

1. Further groundwater monitoring results are required to determine potential contribution of the WWTP operations to groundwater contamination.
2. The groundwater monitoring bore network is insufficient, with bore placement down

hydraulic gradient of KWWTP lacking, meaning the migration of contaminants through groundwater towards the M1 channel cannot be tracked.

3. Further sampling of TWW is required to provide a better representation of contaminant loadings of TWW across long term KWWTP operations.
4. Further and expanded ground- and surface- water monitoring across all M1 channel flow regime will clearly identify the potential contribution of the WWTP to groundwater/surface water contamination in the area.
5. It is difficult to distinguish where increased contaminant loadings within samples are directly attributable to the impacts of the TWW discharge given the similarity of the contaminant profile to inputs from surrounding agricultural industry.
6. The potential of TWW discharges to reach the Lower Ord River via the D1 drain during the Wet Season flow regime is unclear.

Outcomes

Based on the outcomes of the Licence Review and in consideration of outstanding data gaps, the following key requirements have been incorporated into the KWWTP Licence.

Additional monitoring of surface water and groundwater across the three distinguished flow regimes to provide more certainty in conclusions drawn from monitoring data. Additional groundwater and surface water conditions have been included in the Proposed Licence. This will address Date Gap 1.

Conditions include incorporating the requirement for a three (3) year surface water and groundwater monitoring program to be undertaken, with the intent that a minimum of 4 sampling events occur per flow regime, with the results of this sampling to be summarised and a report prepared for submission and review by DWER. Conditions implemented to enforce this monitoring program would replace current surface water and groundwater monitoring conditions on the Licence. This will address Date Gaps 1, 2, 3, 4, 5, and 6.

Installation requirements for at least one (1) additional bore down hydraulic gradient groundwater monitoring bores, likely located between 50m to 100m to the northwest of the premises boundary, to address Data Gap 2.

Surface water sampling points will be clearly defined within the monitoring program conditions. Additional sampling points have been included in the Licence within the M1 Chanell, D1 drain, and the Lower Ord River has also been incorporated into the monitoring schedule, which will address Data Gap 5 and 6.

Fingerprint WWTP contaminant parameters have been included into the surface water and groundwater monitoring program to identify the direct KWWTP discharges from the Premises and thus can trace/track the emission, pathway and receptor model directly associated with the KWWTP - therefore assisting in removing uncertainty from contributing contaminants from the surrounding environment and agricultural industry. The inclusion of these additional parameters will help address Data Gaps 5 and 6. The following ‘fingerprint’ parameter suite has been incorporated into all groundwater and surface water monitoring licence conditions through the Licence Review:

- Boron;
- Sucralose; and
- Caffeine.

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1. Definitions of terms and acronyms

In this Decision Report, the terms in Table 1 have the meanings defined.

Table 1: Definitions

Term	Definition
AACR	Annual Audit Compliance Report
ACN	Australian Company Number
ADWG	Australian Drinking Water Guidelines
AER	Annual Environment Report
ANZECC 1997	National Water Quality Management Strategy Australian Guidelines for Sewerage Systems Effluent Management 1997
ANZECC 2000	Australian and New Zealand Guidelines for Fresh and Marine Quality. Paper No. 4, Australian and New Zealand Environment and Conservation Council (ANZECC) and Agriculture and Resource Management Council of Australian and New Zealand (ARMCANZ)
BOD	Biochemical Oxygen Demand
BOD_5	5-day Biochemical Oxygen Demand
BA	Baseline Assessment and Hydrogeological Conceptual Model – Kununurra Wastewater Treatment Plant and M1 Channel, Kununurra WA (Senversa, 2020a).
CoPC	Contaminant of potential concern
Category/ Categories/ Cat.	Categories of Prescribed Premises as set out in Schedule 1 of the EP Regulations
CS Act	*Contaminated Sites Act 2003* (WA)
Decision Report	refers to this document.
Delegated Officer	an officer under section 20 of the EP Act.
Department	means the department established under section 35 of the *Public Sector Management Act 1994* and designated as responsible for the administration of Part V, Division 3 of the EP Act.
Dry Season	May to October
DBCA	Department of Biodiversity Conservation and Attractions
DoH	Department of Health

Term	Definition
DO	Dissolved oxygen
DPIRD	Department of Primary Industries and Regional Development
DR	Decision Report
DWER	Department of Water and Environmental Regulation As of 1 July 2017, the Department of Environment Regulation (DER), the Office of the Environmental Protection Authority (OEPA) and the Department of Water (DoW) amalgamated to form the Department of Water and Environmental Regulation (DWER). DWER was established under section 35 of the *Public Sector Management Act 1994* and is responsible for the administration of the *Environmental Protection Act 1986* along with other legislation.
DoW	Department of Water
DoW (2013)	Department of Water Ord Surface Water Allocation Plan, 2013
DVGs	Default Guideline Values
EC	Electrical conductivity
EPA	Environmental Protection Authority
ESA	Environmental Site Assessment – Water Corporation Kununurra Treatment Plant (Senversa 2022a)
EP Act	*Environmental Protection Act 1986* (WA)
EP Regulations	*Environmental Protection Regulations 1987* (WA)
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Cth)
Existing Licence	The Licence issued under Part V, Division 3 of the EP Act and in force prior to the commencement of, and during this Review
ESA	Environmental Site Assessment – Water Corporation Kununurra Wastewater Treatment Plant (Senversa 2022a)
GME	Groundwater Monitoring Event
Hydrobiology	Environmental Assessment of Kununurra WWTP and M1 Channel. 14 February 2013.
HEPA (2020)	Heads of EPAs Australia and New Zealand
HCM	Hydrogeological Conceptual Model

Term	Definition
IL	Investigation Levels
KWWTP	Kununurra Wastewater Treatment Plant
Licence Holder	Water Corporation
LOR	Limit of Reporting
LTGV	Long Term Guideline Value
m^3	cubic metres
Minister	the Minister responsible for the EP Act and associated regulations
mg/L	milligrams per litre
NEPM	National Environmental Protection Measure
Noise Regulations	*Environmental Protection (Noise) Regulations 1997* (WA)
NPUG	Domestic Non-Potable Use Guidelines, Department of Health (2014)
NHMRC 2008	National Health and Medical Research Council, Canberra Guidelines for Managing Risk in Recreational Water
Occupier	has the same meaning given to that term under the EP Act.
OIC	Ord Irrigation Cooperative
ORIA	Ord River Irrigation Area
OU	Odour Units
FRP	Filterable Reactive Phosphorus
Prescribed Premises	has the same meaning given to that term under the EP Act.
Premises	refers to the premises to which this Decision Report applies, as specified at the front of this Decision Report
Primary Activities	as defined in Schedule 2 of the Revised Licence
PFAS	Per-and polyfluorinated alkyl substances
PFOA	Perfluorooctanoic acid
PFOS	Perfluorooctanesulfonic acid
PFHxS	Perfluorohexanesulfonic acid

Term	Definition
POP	Persistent organic pollutants
P&DC	Production and Design Capacity
Review	this Licence review
Revised Licence	the amended Licence issued under Part V, Division 3 of the EP Act following the finalisation of this Review.
Risk Event	As described in *Guideline: Risk Assessments*
RIWI Act	Rights in Water and Irrigation Act 1914
SCM	Site Conceptual Model
STGV	Short Term Guideline Value
SWEK	Shire of Wyndham East Kimberley
TN	Total Nitrogen
TP	Total Phosphorus
TDS	Total Dissolved Solids
TSS	Total Suspended Solids
TWW	Treated Wastewater
UDR	*Environmental Protection (Unauthorised Discharges) Regulations 2004* (WA)
Wet Season	November to April
WWTP	Wastewater Treatment Plant
WSWQA	Wastewater and Surface Water Quality Assessment – Kununurra Wastewater Treatment Plant (Senversa 2022b)

2. Purpose and scope of assessment

2.1 Background

DWER has undertaken a risk-based licence review of KWWTP Licence L6270/1991/10 to determine whether current Licence conditions apply an appropriate level of regulatory control for the risk of current premises operations.

The KWWTP is currently licensed under Licence L6270/1991/10 to treat up to 2000 kL/day (2 MLD) of wastewater to a secondary standard. Following pond treatment, effluent is subject to chlorination before being discharged to the M1 Channel. The licenced operational inflow allows for standard operations as well as any additional influx of wastewater due to spikes in volumes that result from the Dry Season tourist peak season and Wet Season extreme rainfall events.

The M1 Channel is a purpose-built main water delivery channel servicing irrigators on the Ivanhoe Plain of the Ord River Irrigation Area (ORIA). During the Dry Season irrigation period, TWW from the KWWTP is diluted with irrigation water within the M1 Channel prior to use for irrigation, and it has been long assumed that adequate dilution of contaminants within TWW is occuring. However, during the Wet Season non-irrigation period, TWW is discharged into the M1 channel unencumbered (with potentially low to no dilution) where the undiluted waste stream then has the potential to enter the D1 drain and subsequently the Lower Ord River.

Any significant degradation to the quality of the water within the M1 Channel as a result of discharges from the KWWTP may have impacts on the suitability of the water for irrigation purposes and the freshwater aquatic ecosystem in the Lower Ord River.

This decision report presents an assessment of the foreseeable Risk Events to public health, amenity, water resources and the environment from the Primary Activities currently being undertaken at the KWWTP. Therefore, this decision report will only assess emissions and discharges associated with current operations at the Premises.

Table 2 lists the prescribed premises categories for the Existing Licence.

Table 2: Prescribed Premises Categories in the Existing Licence

Classification of Premises	Description	*Approved Premises production or design capacity or throughput*
54	Sewage facility; premises – (a) on which sewage is treated (excluding septic tanks); or (b) from which treated sewage is discharged onto land or into waters	2000 m^3/day

2.2 Submitted information

Documents and reports submitted across Stage 1 and Stage 2 of the Licence Review by the Licence Holder that directly consider the Risk Events arising from the Primary Activities at the Premises are detailed in Table 3.

Table 3: Documents submitted by Licence Holder to inform the Review

Document/ information description
Stage 1

Document/ information description
Baseline Assessment and Hydrological Conceptual model, Kununurra Wastewater Treatment Plant and M1 Channel, Kununurra WA, 26 August 2020. (BHCM)
Hydrogeological Conceptual Model (HCM).
Site Conceptual Model.
Stage 2
Environmental Site Assessment – Water Corporation Kununurra Wastewater Treatment Plant (Senversa 2022a) (ESA)
Wastewater and Surface Water Quality Assessment - Kununurra Wastewater Treatment Plant (Senversa 2022b) (WSWQA)

On receipt of the documents submitted under Stage 1 of the Licence Review process, a number of data gaps were identified and relayed to the Licence Holder, as it was identified that additional information would need to be provided to enable a source-pathway-receptor risk-assessment model for relevant emissions and discharges from the Premises to be undertaken. The subsequent submission of additional documents under Stage 2 of the Licence Review process has aimed to address these data gaps. A summary of the identified data gaps and information submitted in response is as follows:

- ***Depth to groundwater***. Depth to groundwater information and groundwater flow data was very limited at the Premises. The ESAhas provided information relevant to this data gap.
- ***Groundwater quality***. There was no Premises specific data previously available for groundwater quality which presented difficulties in the assessment of impacts from seepage of contaminants to groundwater. The ESA has provided an assessment of groundwater quality up-hydraulic gradient and down-hydraulic gradient of key KWWTP infrastructure.
- ***Potential Contaminant Sources***. Adequate information was not available for various contaminants of potential concern associated with WWTPs (including metals and PFAS). The WSWQA, submitted during the review period, has provided water quality data for wastewater and TWW at the KWWTP to enable assessment of additional contaminants of potential concern.
- ***Water quality in the M1 Channel and associated drainage network***. The interpretive value of the current dataset, particularly samples collected in the M1 Channel closer to the WWTP discharge outlet, was initially thought to be compromised by potentially inadequate mixing within the channel prior to the Ivanhoe Road Crossing, approximately 1 km downstream of the WWTP. Concerns were that inadequately mixed laminal flow from the discharge point remained concentrated on the eastern side of the channel. Sampling under the current licence is from the western bank of the channel and therefore may not be representative of treated wastewater concentrations within the channel until at least after the Ivanhoe Road Crossing. The WSWQA has provided water quality data from representative locations to improve assessment of concentrations of contaminants.
- ***Mixing Zones***. The HCM identifies three mixing zones that were not well quantified with respect to the spatial gradient of contaminant concentrations:
    - Treated wastewater discharged to the M1 Channel.
    - D1 discharge to the Ord River.
    - D4 discharge to the Ord River.

The HCM postulated, through 2D modeling and high spatial resolution water quality monitoring,

that mixing may still occur beyond 1 km from the KWWTP discharge point in the M1 Channel. The modelled plume tracks along the eastern side of the M1 Channel until fully mixed.

The HCM identified that initial dilution modelling of the near-field (0-50 m) treated wastewater plume could be conducted to establish the existing dilutions and spatial dynamics of the plume, as well as test diffuser designs that would aid in improved mixing within the near field. Initial dilution modeling and 2D modeling of the D1 and D4 mixing zones within the Lower Ord River could also identify the spatial extent of any elevated contaminant zones. It is expected that these would be small due to the significantly larger flows in the Ord River.

The WSWQA assessment provided further data on mixing zones within the M1 Channel. Based on the WSWQA, TWW does not flow into the Lower Ord River via the D1 drain during the Wet Season non-irrigation period. Therefore, no further assessment of TWW mixing zones in the Lower Ord River was conducted by the Licence Holder.

3. Overview of Premises

3.1 Operational aspects

The KWWTP is currently licensed to treat up to 2000 m^3/day of wastewater to a Secondary standard operating a facultative pond system using two series (Train A and B) of primary, secondary, tertiary and quaternary ponds, in parallel. All treatment ponds are clay lined with rip rap protection on the internal surface. Following pond treatment, effluent is subject to chlorination before being discharged to the M1 Channel.

Each pond embankment has a minimum of 200 mm freeboard. The volume of each pond allows the KWWTP to operate without overtopping based on a 1 in 10 year annual exceedance probability event. External embankments are constructed so that all components of the KWWTP are above flood level for a 1 in 20 annual exceedance probability event. Stormwater catch drains cater for a 1 in 20 annual exceedance probability event around the perimeters of the treatment ponds. Stormwater catch drains and external spillways have been designed to discharge directly into the M1 Channel from the treatment pond system without overtopping back into the ponds during extreme rainfall events.

Constructed in 1967, the KWWTP was upgraded in 1988. The M1 Channel is located approximately 200m to the west of the WWTP and the discharge point into the M1 Channel is approximately 2 km downstream from the start of the M1 Channel, which draws water from the Kununurra Diversion Dam and supplies this water via a gravity-fed system to irrigators on the Ivanhoe Plain of the ORIA. The M1 Channel finally discharges to the Ord River. Figure 1 provides an overview of the current KWWTP layout.

During the Dry Season irrigation period, TWW discharged into the M1 Channel, diluted with the bulk supply water in the M1 Channel. During the Wet Season non-irrigation period, the Kununurra Diversion Dam inlet is closed as additional water is not required for irrigation by customers, so undiluted TWW discharged into the M1 Channel has potential to flow along the M1 drain and into the D1 drain prior to discharge into the Lower Ord River.

The Licence Holder has a surface water licence SWL158784(7) under the *RIWI Act* which provides for up to 2.8 GL per year of water to flush the M1 Channel, noting that this is an estimated volume which can vary from year to year. Whilst the Licence Holder owns the M1 Channel, it relies on agreements (Water Supply and Operation & Maintenance Agreements) with the Ord Irrigation Cooperative (OIC) for operation of the infrastructure. The agreements relate to the supply of water to the OIC and the conditions under which OIC will take delivery and subsequent control of the water. During the Wet Season, flows in the Lower Ord River is almost twice the Dry Season's. During this time, maintenance of the M1 Channel is undertaken by OIC. Following maintenance, which is undertaken in several stages, OIC opens the intake from Lake Kununurra and flushes approximately 400 ML of water down the M1 Channel into the

D1 drain to the Lower Ord River over a period less than 24 hours. Depending on the specific irrigation demand (which will occur on occasions during the Wet Season if there has been insufficient rainfall, OIC then fill the M1 Channel to the M1/C1 gate before releasing water down the M1 Channel for irrigation. It was previously understood (and described and modelled in the Baseline Assessment and Hydrological Conceptual Model) that except when maintenance was being completed, the OIC allows a continuous flow of water from Lake Kununurra to pass down the M1 channel into the D1 to dilute TWW prior to entering the Lower Ord River. As confirmed by flow data, field observation and liaising with the OIC, this does not occur due to reduced flows in the M1 being necessary during the Wet Season as a flood mitigation measure.

Any significant degradation to the quality of the water within the M1 Channel as a result of discharges from the KWWTP may have impacts on the suitability of the water for irrigation purposes and (potentially) the freshwater aquatic ecosystem in the Lower Ord River.

For noting: The Delegated Officer notes that the Licence Holder may not have total control over water supplies in the M1 Channel to ensure that treated wastewater achieves a specified level of dilution at all times.

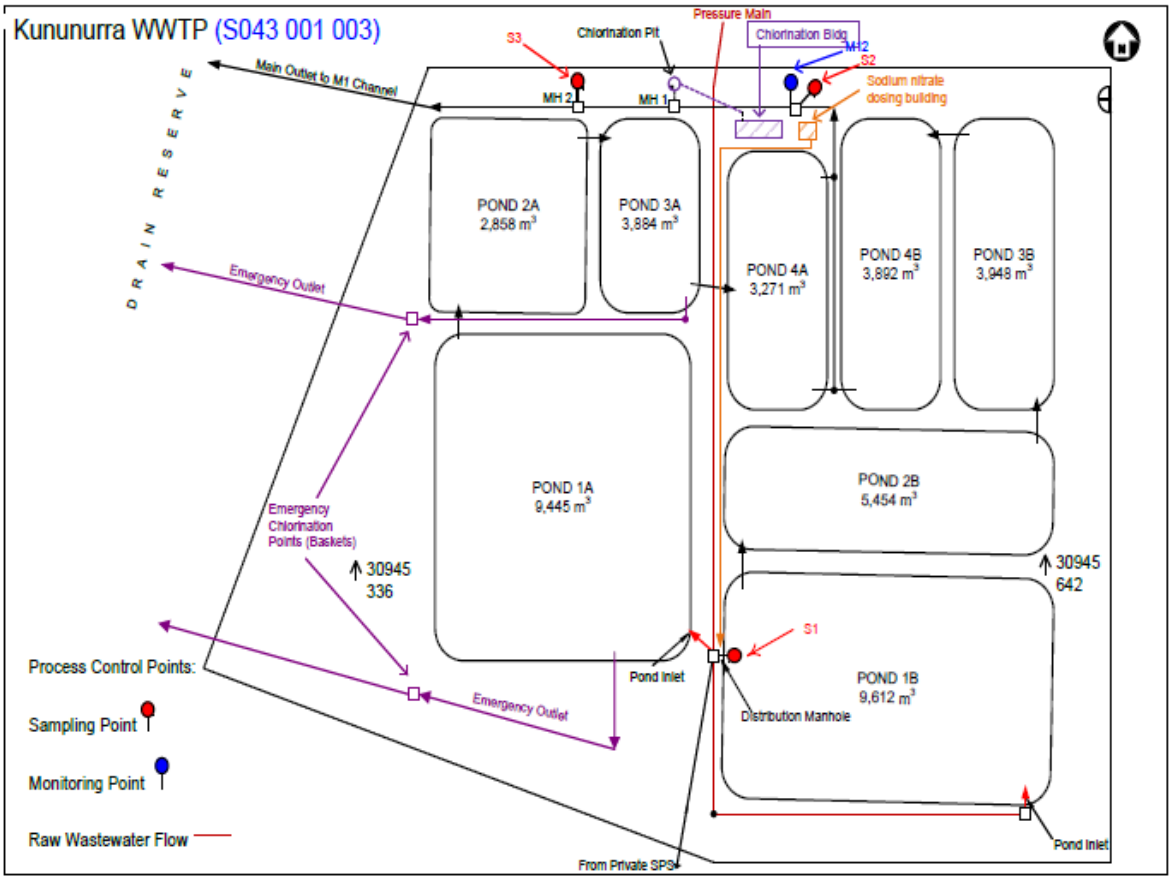


Figure 1: Current WWTP layout

3.2 Infrastructure

The KWWTP infrastructure, as it relates to Category 54 activities, is detailed in Table 4 and with reference to the Site Plan (attached in the Revised Licence).

Table 4 lists infrastructure associated with each prescribed premises category.

Table 4: Sewage facility Category 54 infrastructure

	Infrastructure	Site Plan Reference
	Prescribed Activity Category 54	
Wastewater Treatment Plant: the WWTP constitutes two (2) treatment trains A and B each containing five treatment ponds per train. Hydraulics of the WWTP include: The height of all ponds caters for a hydraulic design based on high season flow of 2 MLD and a peak instantaneous inflow of 68 L/s; Each pond embankment has a minimum of 200 mm freeboard. This effective volume of each pond allows the WWTP to manage the 1 in 10 annual exceedance probability events; External embankments ensure that all components of the WWTP are above flood level for a 1 in 20 annual exceedance probability; Emergency spillways are constructed between each of the ponds; Catch drains provided to cater for a 1 in 20 annual exceedance probability event around the perimeters of the treatment ponds to collect stormwater; and Stormwater catch drains and external spillways have been designed to discharge directly into the M1 Channel from the treatment pond system without overtopping back into the pond embankments during extreme rainfall events.		
1	Facultative primary pond 1A and 1B – floating aerators per pond to ensure adequate mixing is achieved.	Attachment 1 Site Plan
2	Secondary ponds 2A and 2B	
3	Tertiary ponds 3A and 3B	
4	Quaternary ponds 4A and 4B	
5	Sludge drying bed – concrete hardstand and suitable piping to return liquid fraction to Facultative Pond 1A.	
6	Emergency spillways between ponds	
7	Flow meters on outlet	
	Other activities	
1	Chlorination unit with automatic chlorine dosing with feedback control.	Attachment 1 Site Plan

4. Legislative context

Table 5 summarises approvals relevant to the assessment.

Table 5: Relevant approvals and tenure

Legislation	Number	Subsidiary	Approval
RIWI Act 1914	SWL158784	Water Corporation	Water allocation licence for 4.8 GL/y, where:

Legislation	Number	Subsidiary	Approval
			• 2 GL is used for irrigation;and • 2.8 GL is used for flushing of M1 Channel; Noting that these are estimated volumes only and can vary year to year. This licence is not for the Prescribed Premises but is for diluting the M1 Channel post treated effluent discharge into the M1 Channel.

4.1 Contaminated sites

The Premises appears to have no current classification status under the *Contaminated Sites Act 2003* (CS Act).

For noting: The Licence Holder has an obligated under the CS Act to report any known or suspected contamination to DWER for further investigation.

4.2 Other relevant approvals

4.2.1 Planning approvals

KWWTP is classed as Public Works and therefore is not subject to Planning Approval.

4.2.2 Department of Health

The Licence Holder has advised that the discharge of TWW from the KWWTP is not considered a reuse scheme and no DoH approval is required.

4.2.3 Department of Water and Environmental Regulation

DWER manages the Ord Surface Water Allocation Plan (DoW 2013). DWER prepared the plan to manage the growing water demands on the Ord River. The plan is used to manage competing demands for water between hydroelectricity generation and the expanding irrigation industry, while maintaining sufficient flow into the lower Ord River to protect the riverine environment.

4.3 Part V of the EP Act

4.3.1 Applicable regulations, standards and guidelines

The overarching legislative framework of this assessment is the EP Act and EP Regulations.

The guidance documents which inform this assessment are:

- *Guidance Statement: Setting conditions (October 2015)*
- *Guidance Statement: Licence duration (August 2016)*
- *Procedure: Prescribed premises works approval and licence (October 2019)*
- *Guideline: Decision making (December 2020)*
- *Guideline: Environmental siting (December 2020)*
- *Guideline: Regulatory principles (December 2020)*

- *Guideline: Risk assessments (December 2020)*

4.3.2 Works approval and licence history

Table 6 summarises the licence history for the premises.

Table 6: Works approval and licence history

Instrument	Issued	Nature and extent of works approval, licence or amendment
L6270/1991/10	31/10/2013	Licence template conversion
L6270/1991/10	26/03/2015	Licence amendment to give effect to Ministers Appeal determination 371/13
L6270/1991/10	11/06/2015	Licence amendment to allow Duckweed in the treatment ponds
L6270/1991/10	29/04/2016	Licence amendment to extend licence expiry date
L6270/1991/10	09/06/2016	Licence amendment to allow operation of the Sodium Nitrate Dosing unit at the treatment plant
L6270/1991/10	Draft	Licence Review

4.3.3 Key and recent works approvals

The Licence Holder applied for works approvals in September 2015 and November 2018 for proposed upgrades to the KWWTP to increase the production and design capacity throughput from 1.7 MLD to 2.7 MLD. The Licence Holder withdrew the works approval applications in April 2016 and June 2020, respectively. DWER had requested further information in relation to emissions and associated impacts for the Dry Season irrigation period and Wet Season non-irrigation periods for both applications, but the Licence Holder was unable to submit the requested information without further detailed studies being undertaken, and subsequently withdrew the applications.

4.3.4 Compliance inspections and compliance history

DWER has not identified any incidents considered materially significant to inform the assessment of this Licence Review through compliance inspections or reports.

It is noted that the previous Licence contains Improvement Reference (IR) conditions which relate to the identification of appropriate discharge standards, assessment of plant performance against those standards, investigation of reuse options and the feasibility of continued discharge.

Whilst documents requied for submission under the IR conditions were received by DWER, compliance with these condition requirements was never formalised as it was identified through the preliminary assessment of the two withdrawn works approval that additional studies were required to adequately assess the risk of the TWW to receptors. Subsequently, this Licence Review was initiated and the requirements originally outlined in the IR conditions will be addressed through an assessment of supporting information submitted to inform this assessment.

For noting: As the supporting information submitted to inform this Licence Review contains additional information to inform DWER's assessment of the ongoing suitability of discharges to the M1, the Delegated Officer considers that the IR conditions can be removed from the Licence.

5. Modelling and monitoring data

5.1 Flow regimes

Investigations that have been undertaken for flow regimes for the M1 Channel under the WSWQA have identified the following three flow regimes as the most representative for the M1 Channel and hence should be considered in the emission-pathway-receptor model risk assessment for the Premises:

- **Dry Season irrigation period**: Characterised by high volume flows within the M1 Channel, use by irrigators and continuation of flow to the M2 Channel. The D1 drain gate is closed at this time. Concurrently, the D4 wastewater discharges to the Lower Ord River some 15 km from the premises. Discharge volumes of the Lower Ord River at this time are low compared to Wet Season flows, noting that year-round hydropower production supports higher volume flows in the Lower Ord River than would otherwise occur in the dry season.
- **Wet Season non-irrigation period**: Characterised by low water flows in the M1 channel as there is low demand for irrigation water. The intake from Lake Kununurra is closed for most of the time, and the only water entering the channel is TWW, stormwater runoff, and potentially some groundwater. The gate to the D1 drain is open, but the flow is not sufficient to reach the Lower Ord River (unless there is a large amount of stormwater). Flows in the Lower Ord River are about twice as high as during the dry season.

  During the wet season, the Ord Irrigation Cooprative (OIC) conducts maintenance on the M1 Channel several times. After maintenance, the intake from Lake Kununurra is opened and around 400 ML of water is flushed down the M1 Channel into the D1 drain and the Lower Ord River over a period of less than 24 hours. If there is demand for irrigation water (which can happen during the wet season if there has not been enough rain), the OIC will fill the M1 Channel to the M1/C1 gate before releasing water for farms.
- **Intermediate period** - somewhat variable, but generally occurs for around one month at the beginning of the Dry Season irrigation period (between April and May) and again in October at the end of the Dry Season irrigation period. This describes the period where demand is beginning to either increase (at the start of the Dry Season) or decrease (at the end of the Dry Season). Flow rates in the M1 channel are lower than peak Dry Season flows due to reduced demand for irrigation water.

Figure 2 provides an overview of the seasonal flows within the ORIA drainage system – the green pathway shows the Dry Season irrigation flow path and the yellow shows the Wet Season non-irrigation flow path.

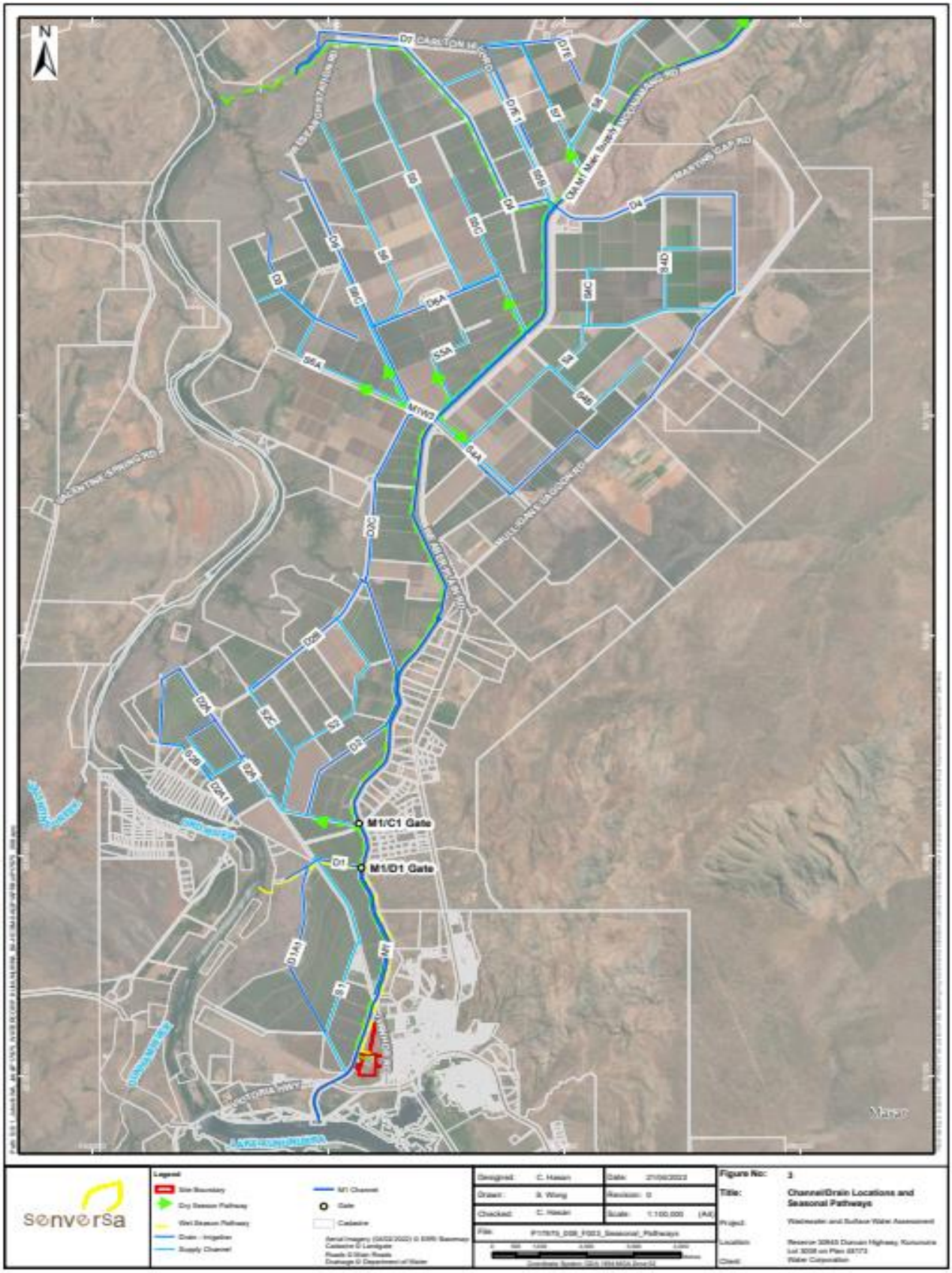


Figure 2: ORIA Channel/Drain flow paths

5.2 Surface Water Users and Allocations

The M1 Channel is used to supply water for irrigation to ORIA users. The following surface water allocations for the M1 Channel for OIC and the Licence Holder are summarised below:

- OIC: Licence allocation of 335,000,000 kL with expiry date 18/06/2027; and
- Water Corporation: allocation of 4,800,000 kL with expiry date 09/09/2024 (Note: a renewal application has been recieved for this allocation and will be assessed. In the interim of this assessment, the current allocation Licence will remain valid).

For noting: In relation to the current relevant surface water allocations, the Delegated Officer notes that**:**

1. DWER has granted a Licence to Take Water under section 5C of the *RIWI Act* to the Licence Holder. Licence number SWL158784(7) for 4,800,000 kL annual entitlement. Duration of Licence is 9/11/2018 to 9/09/2024.
2. DWER has granted a Licence to Take Water under section 5C of the *RIWI Act* to OIC. Licence number SWL156287(5) for 335,000,000 kL annual entitlement. Duration of Licence is 26/06/2020 to 25/06/2030.
3. The Licence Holder has provided DWER with copies of applicable Water Supply and Operations and Maintenance Agreements between the Licence Holder, which stores and supplies water to OIC, and OIC, which takes delivery and supplies water to irrigators.
4. The Water Supply Agreement provides that OIC acknowledges the Licence Holder currently discharges, and will continue to discharge, treated wastewater into the M1 Channel throughout the term of the Agreement.
5. The Water Supply Agreement states that the Licence Holder and OIC will agree on a set of procedures whereby OIC can control the flow of water through metering points within the Channel system.

5.3 Dilution rates

Representative dilution rates for the M1 Channel have been provided in the WSWQA and are summarised in Table 7.

The previous dilution rates were based on assumptions of flow rates that have since been revised. The Licence Holder has also stated that no flow of diluted TWW from the D1 drain directly into the Lower Ord River occurs during the wet season. This means that the dilution rates in the wet season non-irrigation period and the wet season maintenance period will be lower than previously thought.

The revised dilution rates provided in supporting documentation to the application reflect the current conditions in the M1 channel and are therefore more accurate for consideration through this assessment that previosuly provided values based on old assumptions. They will be used to assess the impact of TWW on the water quality of the channel and the Lower Ord River.

Table 7: Dilution rates

Location	**Dilution factor[1]**	
	Dry Season irrigation period	*Wet Season Maintenance period[2]*
M1 Flow	409	16.8
Lower Ord River	3,498	400

1 Based on medium M1 Channel and Lower Ord flow rates between 2015-2020 (DWER 2020 and Water Corporation 2020). WWTP discharges if 1.7 MLD were applied for deriving dilution factors.

2 Based on a maintenance period of 14 days and a 400 ML flushing volume in the M1 Channel via the D1 drain. The low dilution factor of the Lower Ord River is due to the assumption that a larger volume (400 ML) is discharged from the M1 Channel in a day.

5.4 Mixing Zones

Mixing zones were initially postulated in the BHCM submitted under Stage 1 of the Review for the M1 Channel and Lower Ord River. A review of this report identified data gaps, with subsequent information requested from the Licence Holder, This information was submitted in reports under Stage 2 of the Review.

In relation to the M1 Channel, the mixing zone was inferred to be from the point of discharge from the KWWTP discharge pipe to the Ivanhoe Road Bridge approximately 1.2 km downstream of the discharge pipe. Additional data submitted under the WSWQA indicates that TWW is fully mixed to below assigned screening levels within 1 km of the KWWTP discharge pipe and that this trend is observable under the Dry Season irrigation period and Intermediate period flow regimes where water from Lake Kununurra is released into the M1 for irrigation purposes. Given no water is released from Lake Kununurra into the M1 Channel for irrigation purposes during the Wet Season non-irrigation period, the mixing zone is less relevant as TWW is the major constituent of water within the M1 Channel – however, the data submitted under the WSWQA identifies a discernable trend in reducing concentrations within the M1 Channel relative to distance from the KWWTP discharge pipe.

It was identified through a review of data submitted within the BHCM that samples collected from the western bank of the M1 Channel may not be representative of water quality within the M1 Channel as the KWWTP discharge pipe enters, and is situated, on the eastern bank of the M1 Channel. It was thought that TWW discharged into the M1 Channel may remain concentrated on the eastern bank in laminal flow conditions. Data submitted under the WSWQA identifies a slightly higher concentration of contaminant analytes on the eastern bank than the western bank for 500 m downstream from the TWW discharge pipe, but that this tends to level out further downstream so that there is no significant discrepancy between the two banks. This is consistent under all three flow regimes – Dry Season irrigation period, Wet Season non-irrigation period and Intermediate period.

The mixing zone for the Lower Ord River is now understood to be from the point of discharge from the D1 drain to approximately 200 m downstream, as this was not modelled under the BHCM. However, the mixing zone in the Lower Ord River has not been sampled or modelled under the WSWQA and no consideration has been given to the change in flow regimes, particularly for the change in the Wet Season non-irrigation flow regime in that TWW does not typically discharge into the Lower Ord River.

5.5 Investigation levels for the Review

A review of the BHCM submitted for Stage 1 of the licence review, DWER identified several data gaps associated with contaminants of potential concern which were critical in undertaking a detailed risk assessment for discharges to the M1. The Licence Holder has subsequently sampled and analysed a more robust suite of contaminants for the Premises, in relation to inflow of sewage and discharge of TWW to the M1 Channel, particularly under the WSWQA. Accordingly, the investigation levels presented in Table 8 have been considered and applied as most representative of the Premises activities and associated discharges to the environment and therefore are used throughout the Review.

Table 8: Investigation Levels

Investigation Level	Receptor	Source	Comments
Environmental Health			
Fresh water quality - Irrigation water quality	Irrigation	ANZECC 2000 ANZG (2018)	Water from the M1 Channel is used for irrigation in the Dry Season irrigation period and Intermediate period. Due to the application of irrigation water that contains TWW the ANZECC LTGV Irrigation have been used as an investigation level.
Fresh water quality – ecosystem maintenance (FW)	Aquatic ecology of the Ord River	ANZECC 2000 ANZG (2018) HEPA (2020)	<u>Toxicants</u> 95% species protection level for freshwater (ANZG 2018) is applied with recognition of the long-term pastoral and irrigation activities in the ORIA along the Ord River. <u>Physical and Chemical Stressors</u> As per the hierarchy of guideline values for physical and chemical stressors in ANZG (2018) and noting there are no specific DGVs published for the 12 inland water drainage divisions, then the physical and chemicals stressor DGVs were sourced from the ANZECC 2000. In recognition of the long-term pastoral and irrigation activities in the ORIS along the Ord River the trigger values for slightly disturbed lowland river ecosystems in tropical Australia have been adopted. These trigger values are used to assess the risks of adverse indirect effects due to nutrients. However, the ANZECC 2000 guidelines highlight that no data is available for tropical Western Australia, so a precautionary approach is required when applying the DVGs to these systems. <u>PFAS</u> The freshwater guidelines for aquatic ecosystems have been adopted. As recommended in ANZG (2018) the 99% species protection level has been adopted for PFAS as a contaminant that bioaccumulates and biomagnifies in wildlife in slightly to moderately disturbed ecosystem.
Ord Surface Water Allocation Plan (DoW)		DoW (2013)	During the Wet Season non-irrigation period and Intermediate period water in the M1 Channel is flushed over a period of <24 hours and may flow directly to the Ord River.
Human Health			
NPUG	Irrigators Non-potable	DoH (2014) HEPA	Protective for no-potable use situations such as irrigation gardens, domestic duties and

	water users	(2020)	mechanical duties and use by irrigators. Where non-potable use guidelines are not available, values have been derived by applying a conservative 10-fold factor to available ADWG. As surface water is used for crop irrigation, the ADWG for PFAS have been adopted in relation to consumption of food. For all other contaminants the drinking water guidelines have not been considered as the Kununurra potable drinking water bore field is not considered a potential receptor.
Recreational water use	Recreational users of the Lower Ord	DoH (2014) HEPA (2020) NHMRC (2008)	As there is potential recreational exposure to humans to contaminants in surface water and groundwater where it discharges into surface water, the Guidelines for Managing Risks in Recreational Water NHMRC (2008) apply. DoH (2014) has specified NPUG should be applied for assessment of substances in recreational waters, or groundwater that discharges to surface water. Where no published value is available for a contaminant, the NPUG was derived by applying a 10-fold factor to the published ADWG. For pathogens, the NHMRC (2008) recreational water quality guideline for *enterococci* of ≤ 40 CFU/100mL was adopted as a microbiological screening guideline. Currently in the NHMRC (2008) there is insufficient data to establish a reliable screening criterion for *E. coli* in freshwater – *enterococci* are the preferred screening indicator for fresh water.
Fresh water – Irrigation water quality	Irrigation	ANZECC 2000 ANZG (2018)	Due to the application of irrigation water that contains TWW the ANZECC LTGV Irrigation values have been used as an EIL. PFAS investigation levels are based on drinking water guidelines from HEPA (2020).

Key Finding: The Delegated Officer has reviewed the information in Table 8 and considered that the investigation levels applied by the Licence Holder to each receptor scenario are appropriate for comparison with monitoring results.

5.6 Monitoring of sewage inflow and outflow

The Licence Holder monitors sewage inflows into the KWWTP and outflow of discharges of TWW to the M1 Channel under Existing Licence condition 3.3.1 and condition 3.2.1 respectively. The inflow and outflow data are presented below in Table 9; Italic data is from respective Licence Holder annual monitoring reports compared to data provided in the Reports (WSWQA Table 2.3).

The KWWTP has a production and design capacity throughput of 1.7 MLD but is licensed to accept 2.0 MLD to allow for seasonal fluctuations.

Table 9: Average sewage inflow and outflow

Year	Inflow to KWWTP		Outflow to M1 Channel	
	Cumulative m^3	*Average daily flow m^3*	*Cumulative m^3*	*Average daily flow m^3*
2010-2011	560,959	1536.9	675,031 *(529,201)*	1849.4 *(1450)*
2011-2012	566,984	1553.4	620,940 *(623,074)*	1701.2 *(1702)*
2012-2013	501,761	1374.7	515,605 *(545,512)*	1412.6
2013-2014	425,541	1165.9	671,033 *(527,890)*	1838.4
2014-2015	483,397 *(483,397)*	1324.4 *(1324.4)*	459,498 *(459,498)*	1259
2015-2016	442,745 *(442745)*	1213 *(1209)*	450,733 *(451,756)*	1234.9
2016-2017	596,045	1670.9 *(1633)*	609,891 *(609,891)*	1670.9
2017-2018	523,737	1434.9 *(1435)*	500,323 *(500,324)*	1370.8
2018-2019	483,199	1323.8 *(1324)*	410,960 *(40 9,653)*	1125.9
2019-2020	402,742 *(480,182)*	1320.5 *(1312)*	423,605 *(484,512)*	1388.9
2020-2021	*522,057*	1434 (*1400)*	*530,467*	1453.3 (1450)

For noting: For the purpose of this Licence Review assessment, the Delegated Officer will consider the dilution factors listed in Table 7 above as these are considered to be the most accurate representation.
As such, the inflow of sewage into the KWWTP and the outflow of TWW into the M1 Channel is considered to be 1.5 MLD.

5.7 Monitoring of Treated Wastewater

The Licence Holder samples TWW to the specifications required under Existing Licence conditions 3.2.1 Table 3.2.1, from a sampling point within the Premises boundary and prior to discharging to the M1 irrigation. A review of the previous 11 year's results is provided in Table 10. The Annual Reporting period is 1 July to 30 June each respective year.

Table 10: Average annual water quality of the final effluent prior to discharge to the M1 Channel

Annual year	Parameter						
	pH	**TSS** mg/L	**TN** mg/L	**TP** mg/L	**TDS** mg/L	***E. coli*** (CFU/100mL) *Post Chlorination*	**BOD** mg/L
Guideline *	**6-9**	**N/A**	**5[1]**	**0.05[2]**	**N/A**	**1000[3]**	**N/A**
2010-2011	7.8	35	31	6.7	502	10.5	27
2011-2012	7.7	66	33	6.8	485	496	32
2012-2013	7.9	80.4	33.1	6.7	550	14	33
2013-2014	8.0	55	29.3	5.9	512.5	17.8	31.3
2014-2015	7.9	90	36	6.4	538	439	29
2015-2016	8.1	71.3	31.5	7.2	509	507	41.7
2016-2017	8	96.3	34	6.2	512.5	10	36.3
2017-2018	8.1	90	35.5	6.7	500	4175	33.8
2018-2019	8.1	60.8	34.7	6.6	537.5	859	47.5
2019-2020	8.1	70.7	34.4	6.4	560	1723.5	39.3
2020-2021	7.9	97	34.75	6.3	68.25	23.25	36.25
Average	**8**	**74**	**33.4**	**6.5**	**439**	**752.2**	**32.5**

*Guideline values for irrigation as detailed in ANZECC (2000)

1- Long Term Guideline Value (LTGV) (maximum concentration that can be tolerated up to 100 years). The Short-Term Guideline Value (STGV) (maximum concentration that can be tolerated up to 20 years) for TN is 25-125mg/L.
2- Lower Limit of STGV (upper limit is 12mg/L). The LTGV for TP is 0.05mg/L. The STGV for TP is considered to be more appropriate indicator of the potential environmental impacts of phosphorus within the irrigation water whereas the LTGV is for the purpose of minimising the bioclogging of irrigation equipment.
3- Based on the end uses of the irrigation water.

From 2010 to present, there have been multiple analysis submitted relating to the inflow of untreated sewage into the plant and the discharge of TWW. The WSWQA outlines the TWW Sampling Methodology and sampled contaminants for the most recent comprehensive analysis across the Dry Season irrigation period, Wet Season non-irrigation period and Intermediate period. A review of the analytical data from all submitted reports to inform the Licence Review, with an emphasis on the analyses of contaminants within the WSWQA is provided in Table 11 below and can be summarised as follows:

<u>General comments</u>

- Concentrations of all analytes (ammonia/ammonium as N, total kjeldahl nitrogen, TP, BOD and TDS) were lower in TWW than compared to inflow Wastewater;
- Concentrations of nutrients in TWW were greater in the Dry Season irrigation period when compared to the Wet Season non-irrigation period; and

- Compared to ANZECC (1997) treatment processes the median TP concentrations are within the typical range while the median for TN, BOD and TSS are above the typical range.

Major Ions

- TWW was sodium carbonate dominant across the sample events; and
- Fluoride, chloride and sulfate did not exceed investigation levels.

Nutrients

- Nitrogen species in TWW were dominated by ammonia and ammonium;
- Ammonium exceeded the ANZECC 2000 FW and DoW (2013) and ammonia exceeded ANZECC 2000 FW and NPUG (aesthetic) IL during all monitoring events;
- Ammonium and ammonia concentrations were the greatest and most consistent during the Dry Season irrigation period and Intermediate period;
- TN in TWW exceeded the FW, ANZECC 2000 LTGV Irrigation, and DoW (2013) IL during all monitoring events for the Dry Season irrigation period, Wet Season non-irrigation and Intermediate period. Concentrations were generally consistent across the monitoring periods;
- Filterable Reactive Phosphorous (FRP)comprised an average of 73% TP during the monitoring period;and
- TP in TWW exceeded the ANZECC 2000 FW, ANZECC 2000 LTGV Irrigation and DoW (2013) IL. FRP exceeded the ANZECC 2000 FW and DoW (2013) IL criteria. TP and FRP concentrations were greatest during the Dry Season irrigation period.

Metals

- Total copper concentrations exceeded the ANZECC 2000 FW IL with concentrations consistent across the Dry Season irrigation period, Wet Season non-irrigation period and Intermediate period; and
- The ANZECC 2000 FW IL were exceeded for dissolved copper on three of the six sample events and dissolved zinc in the Dry Season irrigation period in July 2021.

Pathogens/microbial indicators

- *E. coli* concentrations exceeded NPUG and ANZECC 2000 LTGV during all monitoring events – the Dry Season irrigation period, Wet Season non-irrigation period and Intermediate period; and
- *Enterococci* was analysed during the October 2020 and November 2021 monitoring events and exceeded the IL for Recreational water use

PFAS

- PFOS in the TWW exceeded the 99% ANZECC FW guideline during all monitoring events, however it was lower than the 95% FW protection value and drinking water value.

Table 11: TWW Investigation Level Summary Exceedances

Contaminant	Drinking water	NPUG	Rec	FW 99%	FW 95%	LTGV	DoW (2013)	Dry Season		Intermediate Season		Wet Season	
								29/10/20	20/7/21	14/4/21	9/11/21	9/2/21	9/3/21
Nutrients (mg/L)													
Ammonium as N	-	-	-	-	0.01	-	0.023	9.47	17.1	18.5	17.8	15.6	7.79
Ammonia as N	-	0.41		-	0.9	-	-	9.86	17.8	19.2	18.9	16	7.92
TN	-	-	-	-	0.3	5	0.29	18.1	26.8	18.8	19	22.9	13.7
TP	-	-	-	-	0.01	0.05	0.018	4.48	6.41	3.04	3.83	2.19	2.04
Ortho-phosphate	-	-	-	-	0.004		0.009	3.45	4.48	0.94	3.88	1.55	1.84
Dissolved metals (mg/L)													
Copper	-	20	-	-	0.014	0.2	-	0.0088	0.0088	<0.0005	0.0052	<0.0005	0.0019
Zinc	-	3		-	0.008	2	-	0.017	0.017	0.001	0.007	0.001	0.006
Total Metals (mg/L)													
Copper	-	20	-	-	0.014	0.2	-	0.0031	0.0031	0.0032	0.0015	0.0032	0.0017
Pathogens													
E. coli (CFU/100ml)	-	*10*	-	-	-	*10*	-	*2,700*	*41,000*	*11,000*	*27,000*	*100,000*	*12,000*

Enterococci (orgs/100ml)	-	*<40*	-	-	-	-	-	*89,000*	-	-	*20,000*	-	-
PFAS (µg/L)													
PFOA	0.56	5.6	10	19	220	-	-	0.0265	0.0055	0.0175	0.0073	0.0154	0.0182
PFOS	-	-	-	0.00023	0.13	-	-	0.0043	0.0047	0.0104	0.0016	0.0057	0.0098
Sum of PFHxS and PFOS	0.07	0.7	2	-	-	-	-	0.0061	0.0181	0.0437	0.0046	0.0222	0.037

Additionally, Table 12 below provides a comparison of pathogens in chlorinated TWW to concentrations within the M1 Channel for the sample events specific to the WSWQA sample frequency. It is noted that background concentrations of *E. coli* are generally comparable to, or greater than those of chlorinated samples discharged from the KWWTP except for February and July 2021. Exceptions have occurred where there may have been a temporary short term break down in the treatment system as indicated by sample concentrations >24,000 CFU/mL but in review of the WSWQA data relative to these episodes (February 2021), there does not appear to be any marked increase in microbial activity resulting from the discharge of TWW within the M1 Channel.

Table 12: Comparison of microbial levels in chlorinated TWW to concentrations in the M1 Channel

Event	Chlorinated TWW	Background		25m downstream of TWW discharge pipe		1 km downstream of TWW discharge pipe		5.3 km downstream of TWW discharge pipe	
		SW01E	SW01W	SW02E	SW02W	SW05W	SW05W	SW07E	SW07W
CoPC	E. coli CFU/100ml								
NPUG	<10								
LTGV[1]	<10								
Oct 20	<10	100	51	34	7	18	100	13	29
Jul 21	98	33	35	29	98	58	26	36	26
Apr 21	<10	4	4	150	34	220	120	530	2,600
Nov 21	10	24	10	64	25	81	48	3,700	14,000
Feb 21	>24,000	230	260	250	1,500	340	600	-	-
Mar 21	<10	1,600	410	3,800	32	3,200	580	-	-

1 LTGV is only relevant to the risk assessment when there is demand for irrigation – Dry Season irrigation period only.

Key Finding: The Delegated Officer notes that:

1. Comparison of inflow and outflow data indicates that the treatment process at the KWWTP is resulting in a reduction of concentrations of all analytes in TWW compared to sewage inflow.
2. Comparison against investigation levels of TWW from the KWWTP indicates that unattenuated TWW has the potential to represent an unacceptable risk to relevant downstream receptors and that the Licence Holder must rely on adequate dilution of the TWW with water in the M1 to achieve compliance with investigation levels at receptors.

5.8 Monitoring of emissions to surface water

The Licence Holder currently samples surface water quality 50 m upstream and 225 m, 1 km and 6 km downstream of the KWWTP discharge point in the M1 Channel quarterly for TP, TN and *E. coli* as required under Existing Licence conditions 3.4.1 and Table 3.4.1. A review of the previous 11 year's results is provided in Table 13. The Existing Licence does not currently require monitoring of Lower Ord River surface water.

Table 13: Average annual surface water quality within the M1 Channel.

Annual Period	**Parameter** ➢ 50 m upstream ➢ 225 m, 1000 m and 6000 m downstream											
	TN (mg/L)				**TP** (mg/L)				***E. coli*** (CFU/100mL)			
	50	**225**	**1000**	**6000**	**50**	**225**	**1000**	**6000**	**50**	**225**	**1000**	**6000**
2010-2011	0.23	0.68	058	0.45	0.005	0.12	0.09	0.10	66	34	222	131
2011-2012	0.2	0.5	0.7	0.5	<0.05	0.071	0.052	0.031	82	89	131	90
2012-2013	0.35	1.05	1.15	0.55	<0.05	0.32	0.3	0.08	21	40	184	621
2013-2014	0.33	0.3	0.53	0.4	0.05	0.05	0.1	0.052	*800*	*7700*	-	-
2014-2015	0.34	1.33	0.9	0.61	<0.05	0.1	0.11	0.35	44	28	402	2.9
2015-2016	0.3	0.6	0.76	0.6	<0.05	0.13	0.13	0.05	56	103	61	29
2016-2017	0.25	0.3	0.35	0.34	<0.05	<0.05	<0.05	0.06	77	417	63	63
2017-2018	0.3	0.3	0.35	0.4	<0.05	<0.05	<0.05	<0.05	15	10	10	20
2018-2019	0.35	0.33	0.38	0.43	<0.5	<0.5	<0.5	0.08	74	102	36	61
2019-2020	0.33	0.35	0.38	0.4	<0.5	<0.5	<0.5	<0.5	58	39	33	44
2020-2021	0.4	0.43	0.43	0.47	<0.05	0.05	0.07	<0.05	27.3	17	85	49

There have been multiple analysis and monitoring reports submitted historically on the surface water quality of the M1 Channel in relation to TWW discharged from the Premises. The WSWQA outlines the Surface Water Sampling methodology, locations and sampled contaminants within the M1 Channel and Diversion Drains (D1 and D4) for the most recent analysis across the three flow regimes for the Dry Season irrigation period, Wet Season non-irrigation period and Intermediate period.

Under the BHCM submitted for Stage 1 of the Licence review, flow regimes were modelled for contaminants in the M1 Channel and Lower Ord River, including mixing zones. Following the identification of data gaps under the BHCM modelling, additional sampling and analysis work has been conducted under the WSWQA. Accordingly, the surface water results will be discussed under the corresponding Dry Season irrigation, Wet Season non-irritation and Intermediate flow regimes.

The WSWQA provides average daily flow rates of TWW and water from Lake Kununurra into the M1 Chanel compared with sampling dates as Figure 3. Figure 4 provides an overview of the ORIA drain system in reference to the surface water sample locations for the WSWQA.

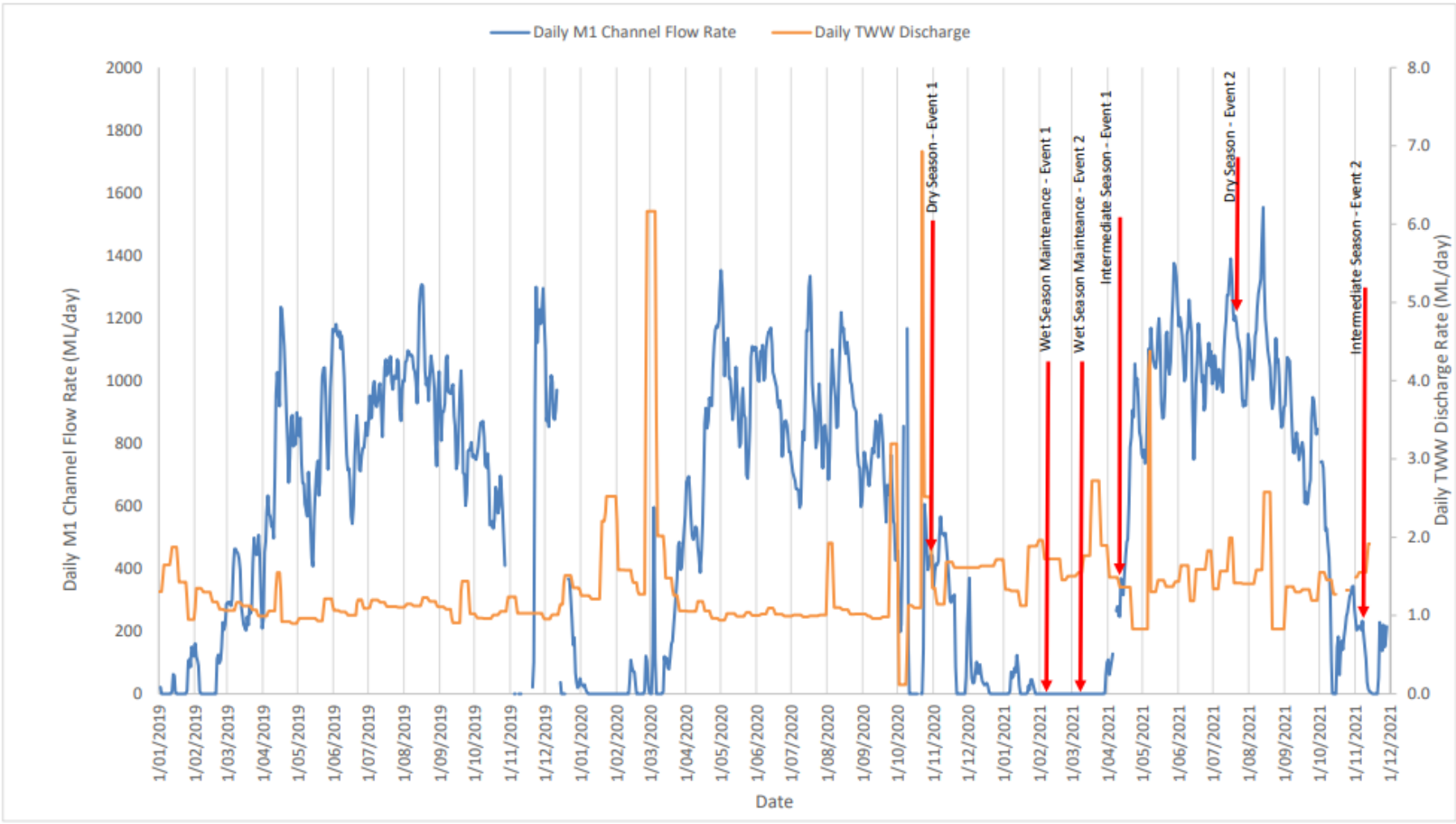


Figure 3: Daily TWW discharge and the M1 Channel flow rate.

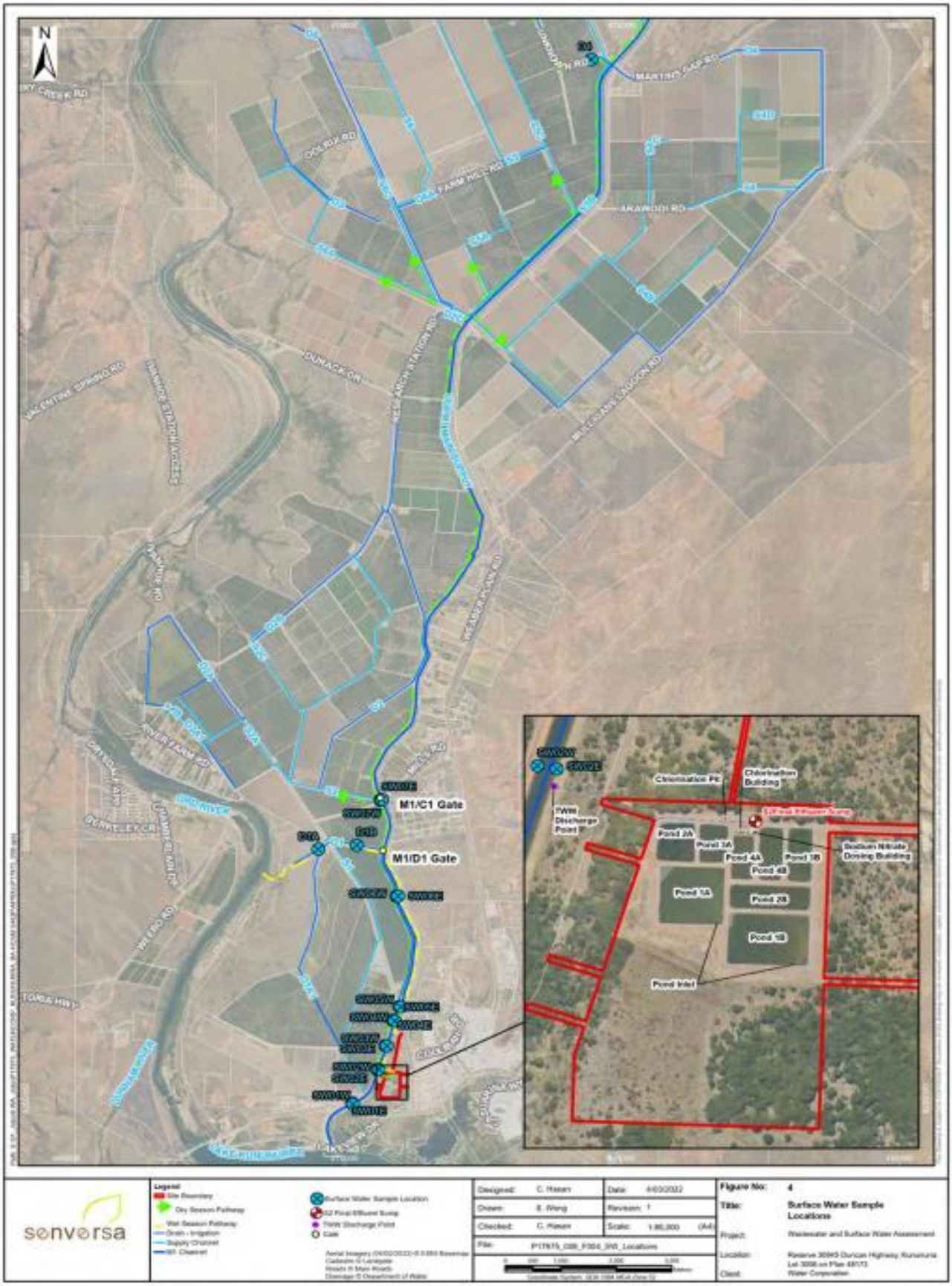


Figure 4: Surface water sample locations.

5.8.1 Dry Season irrigation period

A summary of the key Dry Season irrigation period monitoring events is provided in Table 14. As results are comparable between the two Dry Seasons monitoring events the results can be discussed as one data set.

Table 14: Dry Season irrigation period summary

<table>
<tr><th>Item</th><th>Description</th></tr>
<tr><td>Flow regime</td><td>Characterized by high volume flows from Lake Kununurra into the M1 Channel that mixes with TWW discharged from the WWTP. Water is used by irrigators and continues to flow to the M2 Channel. Concurrently, the D4 wastewater discharges to the Lower Ord River some 15 km from the premises.

The M1/D1 drain gate is closed during the Dry Season irrigation period, the D1 drain is not receiving any flow which contains TWW and thus there are no discharges of TWW to the Lower Ord River from the D1 drain.

Flows in the Lower Ord River are relatively low compared to Wet Season flows.</td></tr>
<tr><td>Key Receptors</td><td>Irrigators within ORIA and non-potable water users

The nearest receptors drawing water from the M1 Channel are a take-off 1.2 km downstream from the WWTP discharge pipe for non-potable uses only.

Irrigation of domestic gardens and/or agricultural land is approximately 5 km downstream from the WWTP discharge pipe near the S2 drain.</td></tr>
<tr><td>Monitoring dates</td><td>29-30 October 2020

20 July 2021</td></tr>
<tr><td>Flow rate</td><td>The average daily flow rates for this period during the monitoring period are provided below.
<table>
<tr><th></th><th>29-30 Oct 20</th><th>20 July 21</th><th>HCM model flow</th></tr>
<tr><td>TWW (MLD)</td><td>2.17</td><td>1.41</td><td>1.7</td></tr>
<tr><td>M1 Channel (MLD)</td><td>442</td><td>1,207</td><td>696</td></tr>
<tr><td>Ord River*(MLD)</td><td>7,112</td><td>4,987</td><td>5,947</td></tr>
</table>
*Tarrara bar station located on the Ord River downstream of the D4 drain</td></tr>
<tr><td>Sampling rationale</td><td>During this period monitoring events the following samples were collected (as identified by the sample locations in Figure 4):

▪ SW01E/W to assess background conditions in the M1 Channel approximately 1.2 km upstream from the WWTP discharge pipe.

▪ SW02E/W to SW07E/W to assess surface water quality in the M1 Channel approximately 25m, 500m, 1 km, 3.5 km and 5.3 km respectively downstream from the WWTP discharge pipe.

▪ D1A/B drain and D4 drain, just after the inlets, to assess ambient conditions which included any influences by irrigation activities. It is noted that D1B was not collected in July 2021 as there was no flowing water within the channel.</td></tr>
</table>

The WSWQA provides a detailed analysis of surface water samples collected for the Dry Season irrigation period for major ions, nutrients, microbial pathogens, total and dissolved metals and PFAS concentrations. Figure 5 provides TN. TP, *E. coli* and PFOS concentrations relative to applicable EILs. Analytical results are summarised as follows:

Nitrogen

- No nitrogen species exceeded the NPUG or ANZECC 2000 LTGV Irrigation EILs in any samples from the M1 Channel, although, except for ammonium, concentrations of nitrogen downstream of the TWW discharge pipe were slightly higher than background samples;
- TN concentrations in the M1 Channel were generally slightly higher closer to the TWW discharge pipe (0.2-0.3mg/L) than with concentrations further downstream which more closely resemble background (0.1mg/L);
- There was no distinction between concentrations taken from the eastern and western bank sample locations;and
- The highest concentration of nitrogen was recorded in the D4 drain in July 2021 – exceeding ANZECC 2000 LTGV irrigation for TN and NPUG for ammonia.

Phosphorus

- No phosphorus species exceeded ANZECC 2000 LTGV Irrigation EIL (0.05mg/L) for TP in any of the samples from the M1 Channel. Similar to nitrogen, phosphorus concentrations downstream of the TWW discharge pipe were slightly higher than background;
- Like nitrogen, phosphorus concentrations were consistent on the eastern and western bank sample locations within the M1 Channel. Concentrations were slightly greater within the first 500m downstream of the TWW discharge pipe (0.01-0.04mg/L) compared to those further downstream (0.01-0.02mg/L); and
- Similar to nitrogen, the highest concentration of phosphorus was recorded in the D4 drain in October 2020 – exceeding ANZECC 2000 LTGV irrigation for TP.

Pathogens/Microbial Indicators

- *E. coli* concentrations exceeded the NPUG and ANZECC 2000 LTGV EILs for most of the sample locations in the M1 Channel, noting concentrations were higher downstream of the TWW discharge pipe compared to background samples;
- *Enterococci* concentrations did not exceed the REC EILs within the M1 Channel downstream of the TWW discharge pipe. Exceedances were noted upstream of the TWW discharge pipe and within the D1 and D4 drains; and
- There was no distinction between concentrations taken from the eastern and western bank sample locations.

Dissolved Metals

- No dissolved metal samples exceeded the NPUG and ANZECC 2000 LTGV Irrigation in the M1 Channel;
- There was no distinction between concentrations taken from the eastern and western bank sample locations; and
- Dissolved metals concentrations were greatest in the D1 and D4 drains compared with those in the M1 Channel. Aluminium and iron in the D1 and D4 variably exceeded the NPUG and ANZECC 2000 LTGV Irrigation.

Total Metals

- Total metals did not exceed the NPUG and ANZECC 2000 LTGV Irrigation in the M1 Channel except for SW05E in October 2020 which variably exceeded the ILs for total aluminium and iron;
- There was no distinction between concentrations taken from the eastern and western bank sample locations; and
- The highest total metal concentrations were recorded in the D1 and D4 drains, variably exceeding the NPUG and ANZECC 2000 LTGV Irrigation for aluminium, iron and manganese.

PFAS

- There were no exceedances of the NPUG for PFAS at any sample locations within the M1 Channel or D1 and D4 drains;
- PFOS concentrations within background samples were similar to those reported within the M1 Channel and the D1 drain (at D1B location only) and D4 drain;
- There was no distinction between concentrations taken from the eastern and western bank sample locations for PFOS concentrations; and
- PFAS concentrations were not detected above LOR at the D1A sample location.

Exit Water

Exit water from the ORIA (water not used for irrigation from the M1 Channel and water runoff from irrigated pastures) normally discharges down the D drains. Under the Dry Season irrigation period the D1 drain is closed so most of the Exit Water in the ORIA discharges into the Lower Ord River via the D4 drain some 15 km downstream from the WWTP discharge pipe (Figure 2).

As the D1 drain is closed during the Dry Season irrigation period water discharged to the Lower Ord River is not directly influenced by TWW. Water quality within the D1 during this period is therefore more likely to be representative of ambient conditions with contamination arising from agricultural activities. As a general observation from the samples, water quality within the D1 drain as a result of primarily agricultural activities is similar to, or worse than, that of the M1 Channel that incorporates TWW.

Noting that it is assumed TWW is fully mixed within the M1 Channel approximately 1 km downstream from the WWTP discharge pipe, there is also very limited influence from TWW on discharges of exit water from the D4 drain into the Lower Ord River approximately 15 km downstreamfrom the WWTP discharge pipe. Observations from D4 samples indicates that investigation level exceedances are related to ambient conditions and contamination from agricultural activities rather than from discharges from the KWWTP.

Key Finding: The Delegated Officer notes that:

1. M1 Channel flow regimes are managed by a third-party operator (OIC) which has no control over the WWTP operations.
2. The first non-potable offsite receptor from the M1 Channel is 1.2 km from the WWTP discharge point and the nearest receptor offtake for irrigation is approximately 5 km downstream from the WWTP M1 Channel discharge point.
3. Undiluted TWW from the KWWTP exceeds numerous EILs, however data submitted within the WSWQA indicates that TWW is fully mixed within the M1 channel to below relevant EILs within 1 km of the TWW discharge pipe.
4. The data submitted under the W&SWQA identifies a discernible trend in reducing concentrations of TWW contaminants within the M1 Channel relative to distance

from the KWWTP discharge pipe.

5. Generally during the Dry Season irrigation period, the highest concentrations of contaminants were observed in the D1 and/or D4 drains rather than the M1, indicating contamination from agricultural sources.
6. There was no distinction between contaminant concentrations taken from the eastern and western M1 Channel bank sample locations.
7. Only two detailed sampling events have been undertaken for the Dry Season irrigation period flow regime. This may not constitute sufficient information to adequately characterise the Dry Season irrigation period, nor to draw conclusions around contaminant concentrations and the dilution capacity of the M1.

Figure 5: Dry Season irrigation period TN, TP, *E. coli* and PFOS concentrations relative to applicable EIL

5.8.2 Wet Season non-irrigation period

A summary of the key Wet Season non-irrigation period monitoring events is provided in Table 15. As results are comparable between the two Wet Season non-irrigation period monitoring events the results can be discussed as one data set.

Table 15: Wet Season non-irrigation period summary

<table>
<tr><th>Item</th><th>Description</th></tr>
<tr><td>Flow regime</td><td>Characterised by no significant, regular flows from Lake Kununurra into the M1 Channel as water is not used by irrigators.

Water within the M1 Channel is primarily composed of undiluted TWW discharged from the WWTP for the majority of the Wet Season non-irrigation period.

The M1/D1 drain gate is open during the Wet Season non-irrigation period and therefore the D1 drain is receiving flow which contains undiluted TWW however the Licence Holder’s investigations indicate that during normal operations flow is insufficient to reach to Lower Ord River directly and dissipates via infiltration/evaporation within the D1 drain.

There is potential for stormwater, generated from rain fall events to convey diluted TWW directly to the Lower Ord River although this has not been observed in the Licence Holders investigations.

Following maintenance (which is undertaken several times in this period by OIC) the intake from Lake Kununurra is opened to flush approximately 400ML of water down the M1 Channel into the D1 drain to the Lower Ord River over a period less than 24 hours. Due to this short period of time to flush the M1 Channel after maintenance it was not possible to sample this flushing regime under the W&SWQA. This maintenance scenario was however modeled under the original Baseline Assessment Report.

Flows in the Lower Ord River are relatively high compared to Dry Season flows.</td></tr>
<tr><td>Key Receptors</td><td>Freshwater ecological values in the Lower Ord River</td></tr>
<tr><td>Monitoring dates</td><td>9-11 February 2021

9-10 March 2021</td></tr>
<tr><td>Flow rate</td><td>The average daily flow rates for this period during the monitoring period are provided below.
<table>
<tr><th></th><th>9-11 Feb 21</th><th>9-10 March 21</th><th>HCM model flow</th></tr>
<tr><td>TWW (MLD)</td><td>1.72</td><td>1.60</td><td>1.7</td></tr>
<tr><td>M1 Channel (MLD)</td><td>0</td><td>0</td><td>400</td></tr>
<tr><td>Ord River*(MLD)</td><td>34,116</td><td>4,987</td><td>9,504</td></tr>
</table>
*Short term flushing</td></tr>
<tr><td>Sampling rationale</td><td>During this period monitoring events the following samples were collected (as identified by the sample locations in Figure 4):

▪ SW01E/W to assess background conditions in the M1 Channel.</td></tr>
</table>

	▪ SW02E/W to SW06E/W to assess surface water quality in the M1 Channel approximately 25m, 500m, 1 km and 3.5 km respectively downstream from the WWTP discharge pipe. ▪ D1 drain (D1A and D1B) to assess water quality prior to entering the Lower Ord River.

The WSWQA provides a detailed analysis of surface water samples collected for the Wet Season non-irrigation period for major ions, nutrients, microbial pathogens, total and dissolved metals and PFAS concentrations. Figure 6 provides TN. TP, *E. coli* and PFOS concentrations relative to applicable EILs. Analytical results are summarised as follows:

Nitrogen

- TN, nitrate, ammonia, ammonium and total oxidized nitrogen variably exceeded NPUG, DoW (2013) and ANZECC FW EILs along the M1 Channel;Concentrations of nitrogen species were greatest within the mixing zone up to 1 km downstream of the TWW discharge pipe (SW02, SW03, SW04 and SW05) with concentrations further downstream (SW06) resembling background;
- Concentrations within the mixing zone closest to the TWW discharge pipe and particularly at SW02 were greater on the eastern bank of the M1 Channel compared to the western bank; and
- Concentrations within the D1 drain closely resembled background and SW06 concentrations and variably exceeding ANZECC FW and DoW (2013) EIL for TN, total oxidized nitrogen and ammonium.

Phosphorus

- Phosphorus species exceeded the ANZECC FW and DoW (2013) EILs at all locations within the M1 Channel, being higher within the mixing zone up to 1 km downstream of the TWW discharge pipe (SW02, SW03, SW04 and SW05) with concentrations further downstream (SW06) resembling background;
- Concentrations within the mixing zone closest to the TWW discharge pipe (SW02, SW03, SW04 and SW05) were greater on the eastern bank of the M1 Channel compared to the western bank; and
- Concentrations within the D1 drain were higher at D1A, at the intersection of the D1 drain and the S1 supply channel, compared to D1B which closely resembled those at SW06, 3.5 km downstream of the WWTP.

Pathogens

- *E. coli* concentrations exceeded NPUG ILs at all locations within the M1 Channel, noting no clear trends were identified along the channel;
- *Enterococci* was not analysed for the Wet Season sampling events;
- There was no distinction between concentrations taken from the eastern and western bank sample locations; and
- Concentrations were greatest in the D1 drain at D1B in February 2021.

Dissolved Metals

- No exceedances for the NPUG or ANZECC 2000 FW EILs within close proximity of the TWW discharge pipe (SW02, SW03 and SW04). There were variable exceedances for the ANZECC 2000 FW IL within background, 1 km and 3.5 km downstream of the TWW discharge pipe for dissolved copper;
- One exceedance for aluminium for ANZECC 2000 FW was identified at 3.5 km

downstream (SW06);

- There was no distinction between concentrations taken from the eastern and western bank sample locations; and
- Dissolved metal concentrations exceeded ANZECC 2000 FW EIL for copper within the D1.

Total Metals

- The NPUG and ANZECC 2000 FW ILs were exceeded variably in the M1 Channel for total aluminium, chromium, cobalt, copper, iron and zinc;
- Concentrations of metals were higher in background locations compared to those closest to the TWW discharge pipe, although concentrations further downstream (SW05 and SW06) tended to resemble background;
- There was no distinction between concentrations taken from the eastern and western bank sample locations; and
- Both sample locations exceeded ANZECC 2000 FW EILs within the D1 drain for copper and chromium.

PFAS

- There were no exceedances of the NPUG or REC for PFAS at any sample locations in the M1 Channel or within the D1 drain. All sample locations exceeded the FW 99% species protection EIL but were below the 95% protection levels for PFOS;
- PFOS concentrations were slightly higher downstream of the TWW discharge pipe compared to background and comparable between eastern and western banks; and
- PFOS concentrations in the D1 drain were similar to those downstream of the TW discharge pipe (SW02, SW03, SW04, SW05 and SW06).

Exit Water

TWW does not pass the M1 Channel beyond the C1 gate during the Wet Season non-irrigation period and the M1 Channel does not generate a flow of water from Lake Kununurra for irrigation purposes during the Wet Season. There is therefore no potential for the D4 drain to discharge diluted TWW to the Lower Ord River. During the Wet Season non-irrigation period there is minimal exit water from agricultural activity as water for irrigation is not required.

For the majority of the time during the Wet Season non-irrigation period TWW dissipates via infiltration / evaporation in the M1 and D1 channels and does not flow into the Lower Ord River. There are very small windows of time under the flushing for maintenance regime and during periods of significant stormwater ingress where this may occur. Accordingly, Investigation Levels for this period have been described above relevant to ecological values.

Key Finding: The Delegated Officer notes that:

1. TN, nitrate, ammonia, ammonium and total oxidized nitrogen variably exceeded NPUG, DoW (2013) and ANZECC FW EILs along the M1 Channel during this period.
2. There was no distinction between contaminant concentrations taken from the eastern and western M1 Channel bank sample locations except for Nitrogen and Phosphorus in the mixing zone sample locations (SW02, SW03, SW04 and SW05) where concentrations were greater on the eastern bank.
3. No information has been submitted under the WSWQA to identify the pathway / receptors for the TWW that dissipates (infiltration/evaporation) into the D1 Drain prior to the Lower Ord River. The ESA indicates that the direction of groundwater flow is northwest so this would indicate that any TWW that disseminates into the

environmental along the D1 Drain may interact with shallow water during the Wet Season which may then discharge into the Lower Ord River. Currently there is no understanding of the fate of TWW that seeps and disseminates into the D1 Drain.

4. Two sampling events have been undertaken for the Wet Season non-irrigation period flow regime – this may not constitute sufficient information to adequately characterise the Wet Season non-irrigation period, or draw long term conclusions around contaminant concentrations or pathways to the Lower Ord River.

Figure 6: Wet Season non-irrigation period TN, TP, *E. coli* and PFOS concentrations relative to applicable EIL

5.8.3 Intermediate period

A summary of the key Intermediate Season period monitoring events is provided in Table 16. As results are comparable between the two Intermediate Season monitoring events the results can be discussed as one data set.

Table 16: Intermediate Season period summary

<table>
<tr><th>Item</th><th>Description</th></tr>
<tr><td>Flow regime</td><td>Characterised by lower irrigation water demand from irrigators and lower flows from Lake Kununurra into the M1 Channel - Flow is approximately 300 MLD.

TWW discharged from the KWWTP is diluted within the M1 Channel. Concurrently, the D4 drain wastewater discharges to the Lower Ord River some 15 km from the premises.

The M1/D1 drain gate is closed during the period and therefore the D1 drain does not receive any TWW nor discharge TWW to the Lower Ord River. The S1 intake upstream of the KWWTP is closed and does not discharge water to the D1 drain.

Flows in the Lower Ord River are relatively low compared to Wet Season flows.</td></tr>
<tr><td>Key Receptors</td><td>Irrigators within ORIA and non-potable water users

The nearest receptors drawing water from the M1 Channel are a take-off 1.2 km downstream from the WWTP discharge pipe for non-potable uses only.

Irrigation of domestic gardens and/or agricultural land occurs approximately 5 km downstream from the WWTP discharge pipe near the S2 drain.</td></tr>
<tr><td>Monitoring dates</td><td>14-15 April 2021

9-11 November 2021</td></tr>
<tr><td>Flow rate</td><td>The average daily flow rates for this period during the monitoring period are provided below.
<table>
<tr><th></th><th>14-15 April 21</th><th>9-11 Nov 21</th></tr>
<tr><td>TWW (MLD)</td><td>1.36</td><td>1.55</td></tr>
<tr><td>M1 Channel (MLD)</td><td>348</td><td>130</td></tr>
<tr><td>Ord River*(MLD)</td><td>5,340</td><td>7,780</td></tr>
</table>
* Tarrara bar station located on the Ord River downstream of the D4 drain</td></tr>
<tr><td>Sampling rationale</td><td>During this period monitoring events the following samples were collected (as identified by the sample locations in Figure 4):

SW01E/W to assess background conditions in the M1 Channel.

SW02E/W to SW07E/W to assess surface water quality in the M1 Channel approximately 25m, 500m, 1 km, 3.5 km and 5.3 km respectively downstream from the WWTP discharge pipe.

D4 drain to assess water quality to assess ambient conditions – the D1 was not receiving water.</td></tr>
</table>

The WSWQA provides a detailed analysis of surface water samples collected for the Dry Season irrigation period for major ions, nutrients, microbial pathogens, total and dissolved metals and PFAS concentrations. Figure 7 provides TN. TP, *E. coli* and PFOS concentrations relative to applicable EILs. Analytical results are summarised as follows:

Nitrogen

- No nitrogen species exceeded the NPUG or ANZECC 2000 LTGV Irrigation EILs in any samples from the M1 Channel except for SW02E which slightly exceeded the NPUG in April 2021;
- TN concentrations in the M1 Channel were generally slightly higher closer to the TWW discharge pipe (SW02, SW03 and SW04) than with concentrations further downstream (SW05 and SW06) which more closely resemble background. Interestingly, sample location SW07 5.3 km downstream from the TWW discharge pipe recorded the greatest nitrogen concentration in April 2021, double that which was recorded at the TWW discharge pipe; and
- Nitrogen concentrations were slightly higher on the eastern bank compared to the western bank within the mixing zone (SW02 and SW03).

Phosphorus

- There were three (3) locations that exceeded ANZECC 2000 LTGV Irrigation EIL (0.05mg/L) for TP within the mixing zone and close to the TWW discharge pipe – SW02 in April 2021, SW03 in November 2021 and just prior to the S2 off-take 5.3 km downstream SW07 in April 2021; and
- Like nitrogen, phosphorus concentrations were slightly higher on the eastern bank compared to the western bank within the mixing zone.

Pathogens/Microbial Indicators

- *E. coli* concentrations exceeded the NPUG and ANZECC 2000 LTGV EILs for all of the sample locations in the M1 Channel, noting concentrations were comparable to the background samples up to SW06 3.5 km downstream from the TWW discharge pipe the greatest E. coli concentration was recorded just before the S2 off-take at SW07 5.5 km downstream;
- *Enterococci* concentrations exceeded the REC EILs within the M1 Channel up until the end of the mixing zone (SW05), including background. Exceedances were also noted in the D4 drain and at SW07 5.3 km downstream; and
- There was no distinction between concentrations taken from the eastern and western bank sample locations.

Dissolved Metals

- Dissolved metal samples collected in the M1 Channel exceeded the NPUG EIL for aluminium and iron at various locations close to the TWW discharge pipe (SW02, SW03 and Sw04) and just before the S2 take-off 5.3 km downstream (SW07).; The ANZECC 2000 LTGV Irrigation was exceeded for dissolved aluminium and manganese at SW03 in November 2021, with no exceedances recorded further downstream;
- There was no distinction between concentrations taken from the eastern and western bank sample locations;
- Dissolved metals concentrations were greatest in November 2021 compared to April 2021; and
- The D4 drain exceeded the NPUG IL for aluminium and iron.

Total Metals

- Total metals did not exceed the NPUG and ANZECC 2000 LTGV Irrigation in the M1 Channel except for SW07E 5.5 km downstream of the TWW discharge pipe which variably exceeded the NPUG and ANZECC LTGV Irrigation EILs for total aluminium and iron;
- There was no distinction between concentrations taken from the eastern and western bank sample locations; and
- The highest total metal concentrations were recorded in the D1 channel, variably exceeding the NPUG and ANZECC 2000 LTGV Irrigation for aluminium and iron.

PFAS

- There were no exceedances of the NPUG for PFAS at any sample locations within the M1 Channel or D1 and D4 drains; and
- Most of the samples collected recorded total PFAS below LOR along the M1 Channel and D4 drain. PFAS was detected in background samples (SW01), close to the TWW discharge pipe (SW02 and SW03) and just before the S2 off-take which is 5.3 km downstream of the TWW discharge pipe.

Exit Water

Exit water to the Lower Ord is discussed in section 6.7.1, noting it broadly applies to the Intermediate period. Generally, for the Intermediate period, water quality is better in the Intermediate period than the Dry Season irrigation period as there is less demand for irrigation water and thus less agricultural activity, which appears to be the primary source of contamination in the D channels.

Key Finding: The Delegated Officer notes that**:**

1. M1 Channel flow regimes are managed by a third-party operator (OIC) who has no control over the WWTP operations.
2. Undiluted TWW from the KWWTP exceeds numerous EILs, however data submitted within the WSWQA indicates that TWW is fully mixed within the M1 channel to below relevant EILs within 1 km of the TWW discharge pipe.
3. There was no distinction between contaminant concentrations taken from the eastern and western M1 Channel bank sample locations for Total metals, Dissolved metals and Pathogens while for both Nitrogen and Phosphorus concentrations were slightly higher on the eastern bank compared to the western bank within the mixing zone (SW02 and SW03).
4. The data submitted under the WSWQA identifies a discernible trend in reducing concentrations within the M1 Channel relative to distance from the KWWTP discharge pipe.
5. Two sampling events have been undertaken for the Intermediate period flow regime – this may not constitute sufficient information to adequately characterise the intermediate period, or draw long term conclusions around contaminant concentrations.

Figure 7: Intermediate Season period TN, TP, *E. coli* and PFOS concentrations relative to applicable EIL

5.9 Monitoring of discharges to groundwater

Currently there are no groundwater monitoring conditions on the Existing Licence, and the Licence Holder has not previously undertaken any detailed groundwater or hydrogeological assessments. Additionally, no data as be required under the Existing Licence to determine the adequacy of WWTP pond liners. Accordingly, an understanding of underlying groundwater and the suitability of current WWTP pond lining was identified as a knowledge data gap under Stage 1 of the Review. The Licence Holder has subsequently undertaken an ESA for the Premises and submitted this in parallel to the WSWQA.

5.9.1 Scope of Works

The ESA includes a detailed groundwater assessment of the Premises including the following scope of works as outlined in Table 17 for the respective bore locations provided in Figure 8. As as result of investigations undertaken to inform the ESA, the Premises now has 10 functional groundwater monitoring bores – three (3) Deep bores and seven (7) Shallow bores.

Table 17: Environmental Site Assessment summary of works

Works	Task	Scope
Field Mobilisation 1 5-7 October 2020	Groundwater bore installation and development	▪ Reconditioned three existing bores 2/99#, 3/99* and 4/99#. ▪ Installed seven new bores 01S/20*, 01D/20#, 02/20*, 03/30*, 0/20*, 05/20* and 06/20*. ▪ Developed bores for future monitoring events.
Filed Mobilisation 2 28-29 October 2020	Groundwater monitoring post Dry Season	▪ Sampled the 10 groundwater bores – sampled for contaminants of potential concern including nutrient, pathogens dissolved metals, major ions and PFAS. ▪ Collected representative TWW samples from S2 Final Effluent monitoring point (licence condition monitoring point). ▪ Submitted results for laboratory analyses.
Filed Mobilisation 3 13-14 April 2021	Groundwater monitoring post Wet Season	▪ Sampled the 10 groundwater bores – sampled for contaminants of potential concern including nutrient, pathogens dissolved metals, major ions and PFAS. ▪ Collected representative TWW samples from S2 Final Effluent monitoring point (licence condition monitoring point). ▪ Submitted results for laboratory analyses.

* Shallow water bores

Deep water bores

Figure 8: Monitoring bore locations.

5.9.2 Groundwater depth and flow direction

During the Dry Season October 2020 GME, groundwater in the shallow bore network was between 2.845 mbgl and 5.7 mbgl. The inferred groundwater contours indicate a northwesterly groundwater flow direction towards the M1 Channel. This is consistent with regional groundwater mapping.

During the Wet Season April 2020 GME, groundwater in the shallow bore network was between 1.632 mbgl and 4.373 mbgl. Groundwater elevations were consistently higher in the (post) Wet Season GME when compared to the Dry Season GME with differences ranging between 0.137 m and 1.73 m. The inferred groundwater contours indicate a northwesterly groundwater flow direction towards the M1 Channel. This is consistent with regional groundwater mapping.

Figures 9 and 10 outline groundwater flow for the Dry (October) and Wet (April) Season GME.

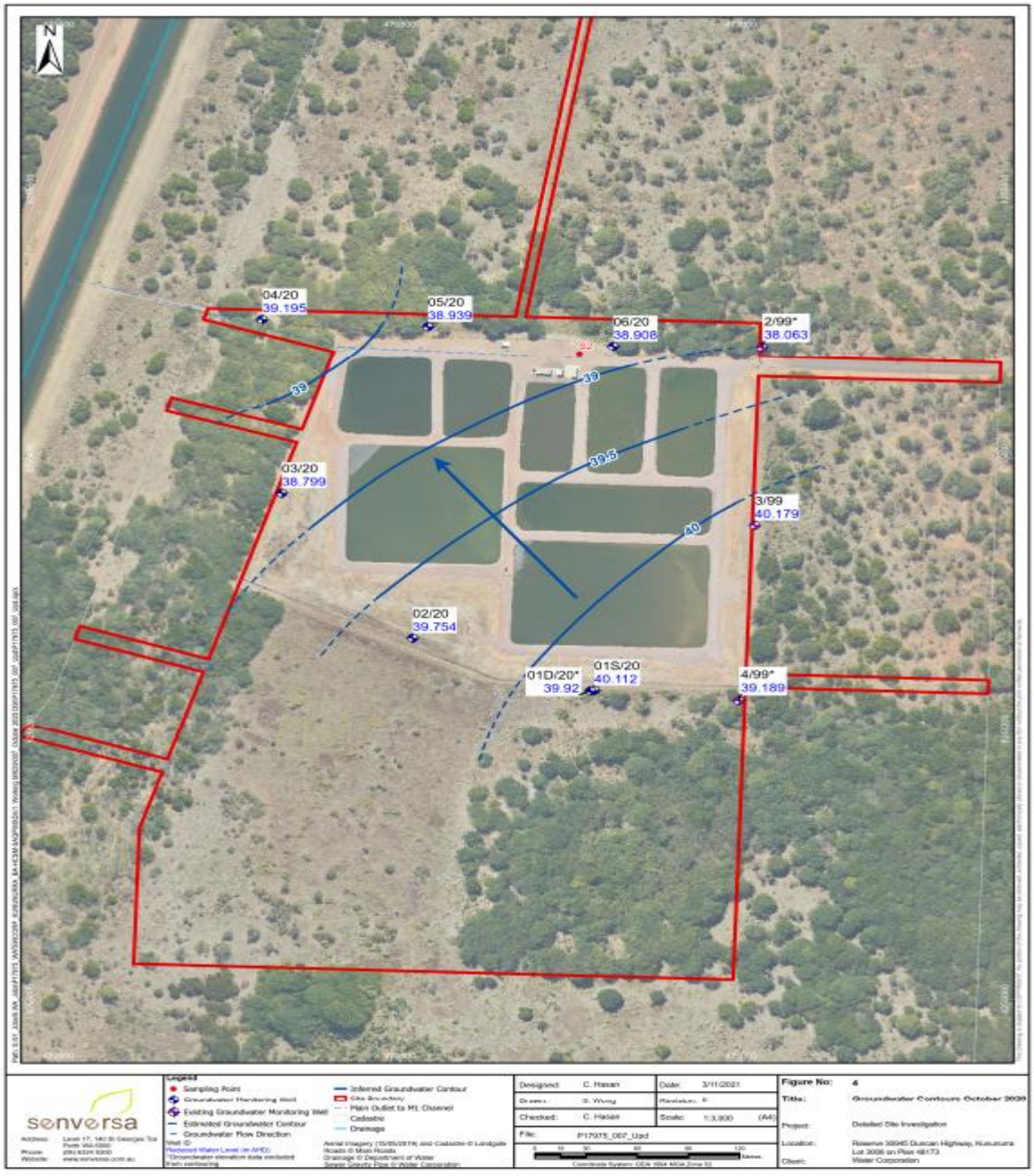


Figure 9: Groundwater map October 2020

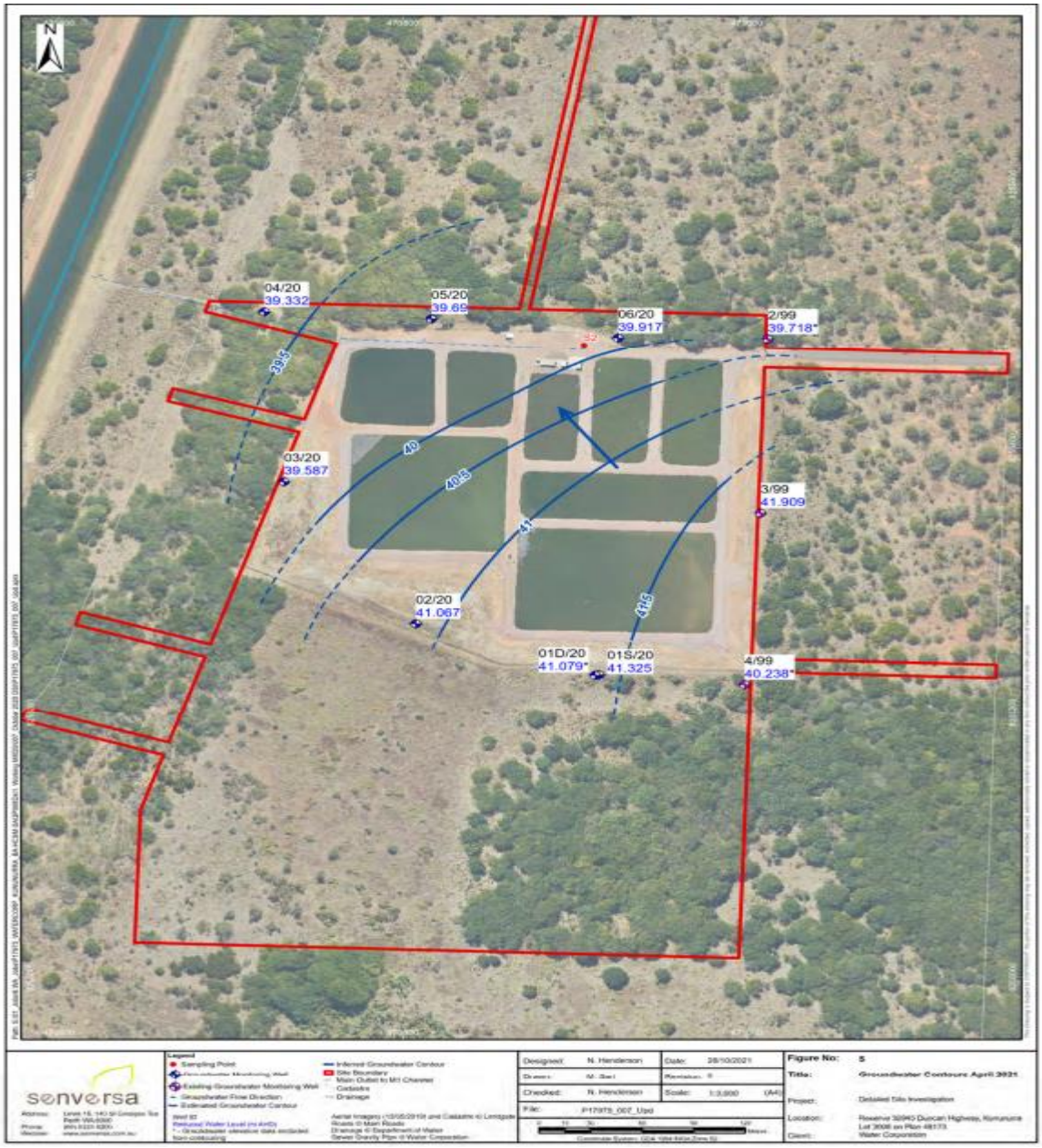


Figure 10: Groundwater map April 2021

5.9.3 Groundwater Field Chemistry

Groundwater field parameters from the 10 bores sampled in October 2021 and April 2022 are provided below in Table 18.

Table 18 Groundwater field parameters

Parameter	October 2020		April 2021		Comments
	Minimum	Maximum	Minimum	Maximum	
DO (mg/L)	0.01	0.59	0.08	0.53	DO data was indicative anaerobic conditions (<0.5 mg/L) at all bores during October 2020 and

					April 2021 GMEs.
EC (µS/cm)	1,012	9,061	868	3,329	October 2020: marginal to saline were reported across all bore networks. Saline was associated with deeper bores that inferred to be screened within a confined aquifer. April 2021: marginal to brackish were reported with a 5-fold increase in the maximum EC compared with the October data.
TDS (ppm)	648	5,799	556	2,131	
pH	6.77	7.37	6.87	7.52	pH was circum-neutral during both GMEs
Eh (mV)	-200.9	+84.7	-160.4	+136.7	October 2020: reducing conditions were indicated in groundwater across the majority of the bore network, consistent with anaerobic conditions. April 2021: reducing conditions were indicated at five locations, inconsistent with the DO data and oxidizing at the five remaining bores.
Temp (^{0}C)	29.0	35.2	29.4	33.8	October 2020: temperature had a range of 6.2 ^{0}C across the bore network. April 2021: temperature had a range of 4.4 ^{0}C across the bore network.

5.9.4 Groundwater Analytical Results

Table 19 and 20 provides a summary of the groundwater results for both the shallow and deep bore network respectively at the Premises for the October 2021 and April 2022 sampling dates for major ions, nutrients, microbial pathogens, dissolved metals and PFAS concentrations above relative applicable EILs.

Groundwater analytical results are summarised as follows:

Nutrients

- Nutrient concentrations within the deep and shallow bores showed some variability between the GMEs across the Seasons, however, there was no discernible trend;
- TN was dominated by nitrate (NO_3-N) at the up and cross-hydraulic gradient bores (4/99, 01S/20, 01D/20, 2/99 and 02/20) and by ammonium (NH_4^+-N) at down-hydraulic gradient bores (03/20, 04/20, 05/20 and 06/20);
- Ammonium nitrogen (NH_3-N) exceeded the aesthetic EIL at cross-hydraulic bore 3/99 and down gradient bores 05/20 and 06/20 across the seasonal range. The greatest nutrient concentrations were consistently recorded in bore 05/20 and 06/20 which are adjacent to the secondary, tertiary and quaternary ponds;
- Total oxidized nitrogen (NO_x) exceeded the ANZECC 2000 FW EIL at up-hydraulic

gradient bores 01S20, 01D/20 and cross hydraulic bore 2/99 across the seasonal range. Down-hydraulic bore 03/20 and 05/20 exceeded during the Wet Season GME only;

- Ammonium (NH_4^+-N) variably exceeded the ANZECC 2000 FW EIL across the seasonal range in both shallow and deep bores across the network. Up-gradient shallow bore 01S/20 did not exceed the EIL during both GME;TP and FRP variably exceeded the ANZECC 2000 FW across the seasonal range at the bores, except down-hydraulic gradient bore 03/20 and cross-hydraulic gradient bore 2/99;
- TP marginally exceeded the ANZECC 2000 LTGV at bore 06/20 in the Dry Season GME only and
- TN exceeded the ANZECC 2000 LTGV at down-hydraulic gradient bore 05/20 and 06/20 by up to 4-fold across the seasonal range.

Dissolved Metals

- No dissolved metal concentrations were detected above NPUG EILs except for aesthetic value for iron at bore 05/20 and 06/20 down-hydraulic gradient of the secondary, tertiary and quaternary ponds and 01D/20 up-hydraulic gradient of the WWTP;
- Zinc and copper variably exceeded the ANZECC 2000 FW EIL across the seasonal range, noting exceedances were not detected in background bore 01S/20;
- Iron concentrations exceeded the NPUG and ANZECC 2000 LTGV at bore 01D/20, 05/20 and 06/20; and
- Manganese exceeded the ANZECC 2000 LTGV at bore 04/20, 05/20, 06/20 and 01D/20 by up to three-fold.

Major Ions

- No major ions exceeded EILs, other than chloride;
- Chloride concentrations exceeded the aesthetic-based NPUG EIL at deep up-gradient bore 4/99 and deep cross-gradient bore 2/99; and
- Other major ions, including sulphate, magnesium, sodium and alkalinity were consistent across the bore network.

Microbial Pathogens

- Enterococci concentrations ranged from below the LOR (1 orgs/100mL) to 21 orgs/mL at cross-hydraulic gradient bore 02/20. Enterococci concentrations were not compared with NPUG guidelines as the salinity across the bore network was <1% and therefore *E. coli* is a more appropriate indicator;
- *E. coli* concentrations in groundwater were generally at or below LOR (1 CFU/100mL) across the seasonal range at most locations;
- *E. coli* concentrations were higher in the Dry Season October 2020 compared to the Wet Season April 2021. The highest concentrations were recorded at bore 02/20 and 03/20 in the western portion of the premises;
- It is noted that *E. coli* was detected above the LOR and the EILs at the up-gradient bores 01S/20 and 01D/20 – both the deep and shallow bores; and
- *E. coli* exceeded the NPUG and ANZECC 2000 LTGV in the Dry Season GME only at bore 02/20 and 03/20.

PFAS

- There were no health guideline exceedances in groundwater for PFAS during either GME; and

- The FW 99% protection guideline was exceeded at all bores across the seasonal range for PFOA. No bore locations exceeded the guideline for 95% species protection.

Key Finding: The Delegated Officer notes that:

1. The Licence Holder has now established 10 groundwater monitoring bores at the Premises. Two groundwater sample events have been undertaken in October 2020 and April 2021 to represent the (post) Dry and Wet Season, respectively. Of the 10 monitoring bores seven are Shallow Bores and three are Deep Bores. Prior to this recent sampling event there has been no previous groundwater samples or studies for the Premises in relation to seepage discharges from the KWWTP and potential impacts to the environment and human health.
2. The premises is adjacent to *Typhonium spp. Kununurra* (Typhonium) habitat which is undergoing Commonwealth threatened listing assessment, due 30-Oct-2025, and which is considered a sensitive receptor for groundwater impacts.
3. Nutrient concentrations within the deep and shallow bores showed some variability between the GMEs across the Seasons, however, there was no discernible trend.
4. Concentrations of dissolved metals were generally greater in the (post) Dry Season GME compared to the Wet Season, likely due to dilution from freshwater rainfall. Like nutrients, dissolved metal concentrations were greatest in the northern portion of the premises- bores 5/20 and 6/20, down-hydraulic gradient of the WWTP.
5. Nutrients in groundwater were above the environmental EILs for total oxidised nitrogen, TN, TP and FRP at shallow background bore 1S/20 and up/cross-hydraulic gradient bores (1D/20, 2/99 and 4/99) screened in the deep aquifer. Exceedances of the environmental EILs for ammonium in all the deep bores was also recorded. This indicates that nutrients are present at elevated concentrations above background conditions within both the shallow and deep aquifers.
6. Nutrients concentrations of nitrogen species in down-hydraulic gradient bores where generally greater than background bore 1S/20 and particularly along the northern premises boundary (5/20 and 6/20) where concentrations of ammonia, ammonium and TN were comparable to those recorded in TWW. This indicates that although nitrogen species are present in ambient background conditions, it is possible the wastewater and TWW is leaking at some point in the treatment process train and contributing to down-hydraulic nitrogen concentrations.
7. No consideration has been given to any potential groundwater mounding beneath the WWTP, which is considered likely given there is evidence that the ponds are seeping.
8. Bores 5/20 and 6/20 consistently recorded elevated contaminants across the seasonal range.
9. The groundwater monitoring network does not extend beyond the premises boundary down hydraulic gradient of the WWTP ponds. This indicates that there is no information available regarding how potential contaminants will migrate through groundwater.
10. Two sampling events have been undertaken in October 2020 and April 2021 to represent the (post) Dry and Wet Season respectively. This may not encompass sufficient information to draw accurate conclusions as to the KWWTPs potential impact to groundwater contamination.

Table 19: Groundwater Exceedance for EILs October 2020

Contaminant	Exceeded EIL	Up-hydraulic Gradient			Cross-hydraulic Gradient			Down-hydraulic Gradient			
		4/99	01S/20	01D/20	2/99	02/20	3/99	03/20	04/20	05/20	06/20
Nutrients (mg/L)											
NH_4+N	0.01[1]	0.04	<0.01	<0.01	0.02	0.04	2.72	0.05	0.05	5.94	10.6
NH_3-N	0.41[2]/0.9[1]	0.04	0.005	0.01	0.02	0.04	2.74	0.05	0.05	5.98	10.7
NO_X-N	0.01[1]	0.03	0.09	0.06	1.57	0.22	0.01	0.004	0.004	0.004	0.006
TN	0.3[1]/5[3]	<0.1	<0.1	<0.1	1.7	0.3	3.5	0.2	<0.1	8.8	20.2
TP	0.01[1]/0.05[3]	0.03	0.02	0.02	0.01	0.02	0.02	0.01	0.03	0.02	0.06
FRP	0.004[1]	0.02	0.02	0.014	0.01	0.02	0.01	0.01	0.03	0.006	0.012
Dissolved Metals (mg/L)											
Cu	0.0014[1]	0.0155	0.0013	0.0149	0.0009	0.0103	0.0008	0.0007	0.0019	0.0008	0.0115
Fe	0.3[2]/0.2[3]	0.017	0.003	0.015	0.002	0.007	0.083	0.045	0.008	5.05	11.3
Mn	0.2[3]	0.051	0.0721	0.0273	0.0575	0.0277	0.174	0.178	0.217	0.565	0.503
Zn	0.008[1]	0.012	0.002	0.02	0.003	0.016	0.007	0.001	0.002	0.005	0.011
Major Ions (mg/L)											
Cl	250[2]	567	40	72	754	85	40	37	15	35	31
Pathogens (CFU/100ml)											

E. coli	<10[2]/<10[3]	1	1	1	1	390	1	280	1	4	<1
PFAS (µg/L)											
PFOS	0.00023[4]	0.0476	0.0113	0.0072	0.0046	0.0483	0.0073	0.0079	0.007	0.0041	0.002

Notes:

[1] ANZECC 2000 FW

[2] DoH (2014) Non-potable Groundwater Use (NPUG)

[3] ANZECC 2000 Irrigation LTGV

[4] HEPA (2020) PFAS Freshwater Guideline for Ecological Protection (99% species protection)

Table 20: Groundwater Exceedance for EILs April 2021

contaminant	Exceeded EIL	Up-hydraulic Gradient			Cross-hydraulic Gradient			Down-hydraulic Gradient			
		4/99	01S/20	01D/20	2/99	02/20	3/99	03/20	04/20	05/20	06/20
Nutrients (mg/L)											
NH_4+N	0.01[1]	<0.01	<0.01	0.12	0.02	0.02	0.77	0.03	<0.01	10.2	9.94
NH_3-N	0.41[2]/0.9[1]	0.01	0.01	0.12	0.02	0.02	0.78	0.03	<0.005	10.3	10
NO_X-N	0.01[1]	0.01	0.98	0.011	1.42	2.14	1.68	0.02	<0.002	0.1	0.003
TN	0.3[1]/5[3]	<0.1	1.1	0.4	1.4	2.3	2.7	0.2	0.1	10.4	11.4
TP	0.01[1]/0.05[3]	0.02	0.02	0.03	<0.01	0.02	0.03	0.02	0.03	0.02	0.02
FRP	0.004[1]	0.02	0.01	0.007	0.008	0.02	0.01	0.01	0.04	<0.001	0.001

Dissolved Metals (mg/L)											
Cu	0.0014[1]	<0.0005	<0.0005	0.008	<0.0005	0.0005	0.0015	<0.0005	<0.0005	<0.0005	<0.0005
Fe	0.3[2]/0.2[3]	0.006	0.007	0.341	0.002	0.002	0.03	0.009	<0.002	2.46	7.41
Mn	0.2[3]	0.015	0.0486	0.474	0.0551	0.0966	0.14	0.0192	0.0332	0.303	0.664
Zn	0.008[1]	0.002	<0.001	<0.001	0.001	0.001	0.013	<0.001	<0.001	0.002	0.002
Major Ions (mg/L)											
Cl	250[2]	205	100	15	640	155	74	79	61	56	56
Pathogens (CFU/100ml)											
E. coli	<10[2]/<10[3]	<1	<1	31	<1	3	<1	<1	<1	6 <1	
PFAS (µg/L)											
PFOS	0.00023[4]	0.0527	0.0148	0.0055	0.003	0.0635	0.0069	0.0071	0.0022	0.003	0.0016

Notes:

[1] ANZECC 2000 FW

[2] DoH (2014) Non-potable Groundwater Use (NPUG)

[3] ANZECC 2000 Irrigation LTGV

[4] HEPA (2020) PFAS Freshwater Guideline for Ecological Protection (99% species protection)

6. Consultation

DWER advertised the Licence Review on 9 November 2020 seeking public comment(s), with submissions open for 21 days, closing 30 November 2020. DWER received no public comments.

DWER consulted with the following organisations or government departments in accordance with section 54 of the EP Act, as DWER considered they may have a direct interest in the subject matter of the Licence Review.

- DWER sent a letter dated 24 September 2020 to the Shire of Wyndham East Kimberley (SWEK) requesting advice / comment on the Review by 16 October 2020. A written submission from SWEK was received on 14 October 2020.
- DWER sent a letter dated 24 September 2020 to the Department of Health (DoH) requesting advice / comment on the Review by 16 October 2020. A written submission was provided on 13 November 2020. DWER requested additional advice/comments from DoH on 13 November 2021.
- DWER sent a letter dated 24 September 2020 to the Department of Primary Industries and Regional Development (DPIRD) requesting advice / comment on the Review by 16 October 2020. A written submission was provided on 13 October 2020. DWER request further clarification from DPIRD in relation to their comment dated 4 June 2021. No response was provided.
- DWER sent a letter dated 24 September 2020 to the Department fo Biodiversity, Conservation and Attractions (DBCA) requesting advice / comment on the Review by 16 October 2020. DBCA requested an extension and subsequently provided a response on 28 October 2020.
- DWER sent a letter dated 24 September 2020 to the Ord Irrigation Cooperative (OIC) requesting advice / comment on the Review by 16 October 2020. OIC requested an extension on 1 October 2020 to provide comment and an extension was granted until 15 January 2021. OIC provided a written submission on 15 January 2021.

All Stakeholder comments are summarised in Appendix 2.

7. Location and siting

7.1 Siting context

The KWWTP is located 1.3 kilometres southwest of the Kununurra town centre, which is in the Kimberley region of Western Australia and is the administrative and commercial precinct for the ORIA. The premises are 16.8ha in size and is surrounded by native vegetation and the DBCA arboretum. The Kununurra Airport is located a kilometre to the west but buffered by agriculture crops.An Industrial precinct is located to the east and to the south is the Kununurra Public Drinking Water Source P1 Area which further borders the RAMSAR listed wetland Lake Kununurra. Refer to Figure 13 below for the location of the KWWTP.

7.2 Potential contaminating sources

The land surrounding the KWWTP is utilised for various purposes as described below:

- North: DBCA Kununurra Arboretum, land parcels for agriculture purposes and commercial and recreational areas.
- East: DBCA Kununurra Arboretum, Ivanhoe Road verge and commercial precinct – Light Industrial Precinct.

- South: DBCA Kununurra Arboretum, Victoria Highway verge, P1 Public Drinking Water Source Area bore field, Lake Kununurra, and Kununurra Golf Course.
- West: DBCA Kununurra Arboretum and Kununurra Airport and agricultural land.

Industrial activities that may contribute potentially contaminating sources to the environment and human health include the East Kimberley Regional Airport (hydrocarbons and historic use of aqueous film foaming foam) which is located approximately 500 m to the southwest of the Premises, the Coles Express service station approximately 380 m to the northeast, and the CGL Fuel service station located approximately 550 m to the southeast.

There are limited numbers of industrial businesses in Kununurra that have approved Water Corporation trade waste permits to discharge wastewater in the sewerage system that reports to the KWWTP.

Run-off water from irrigation farms does enter the D1 and D4 drains which would generally include high nutrient sediment and also nutrients and chemicals from herbicides and fertilisers. OIC regularly apply Acrolein (hydrocarbon-based herbicide) to the M1 Channel to control aquatic weeds.

Stormwater from the Kununurra township and airport does flow into and impact the M1 Channel.

Key Finding: The Delegated Officer notes that**:**

1. The ESA indicates the groundwater flow at the Premises and surrounding location is northwest towards the M1 Channel and that this is consistent with the regional groundwater mapping.
2. Giving consideration to groundwater flow direction, it is unlikely that industrial activities located west of the premises (such as the Airport) will be contributing to potential contamination of the M1 channel.
3. The Licence Holder has only conducted two groundwater monitoring events in October 2020 and April 2021, with two data sets not providing comprehensive data to make long-term conclusions about transmission potential of contaminants through groundwater.
4. There are currently no groundwater monitoring bores outside of the premises boundary, indicating that the potential of contaminants to migrate through groundwater is poorly understood.
5. The potential for contaminants from surrounding sources to impact the M1 channel, and the percentage of contaminants arising from other inputs vs. from the KWWP discharge to the M1 channel is not well understood.

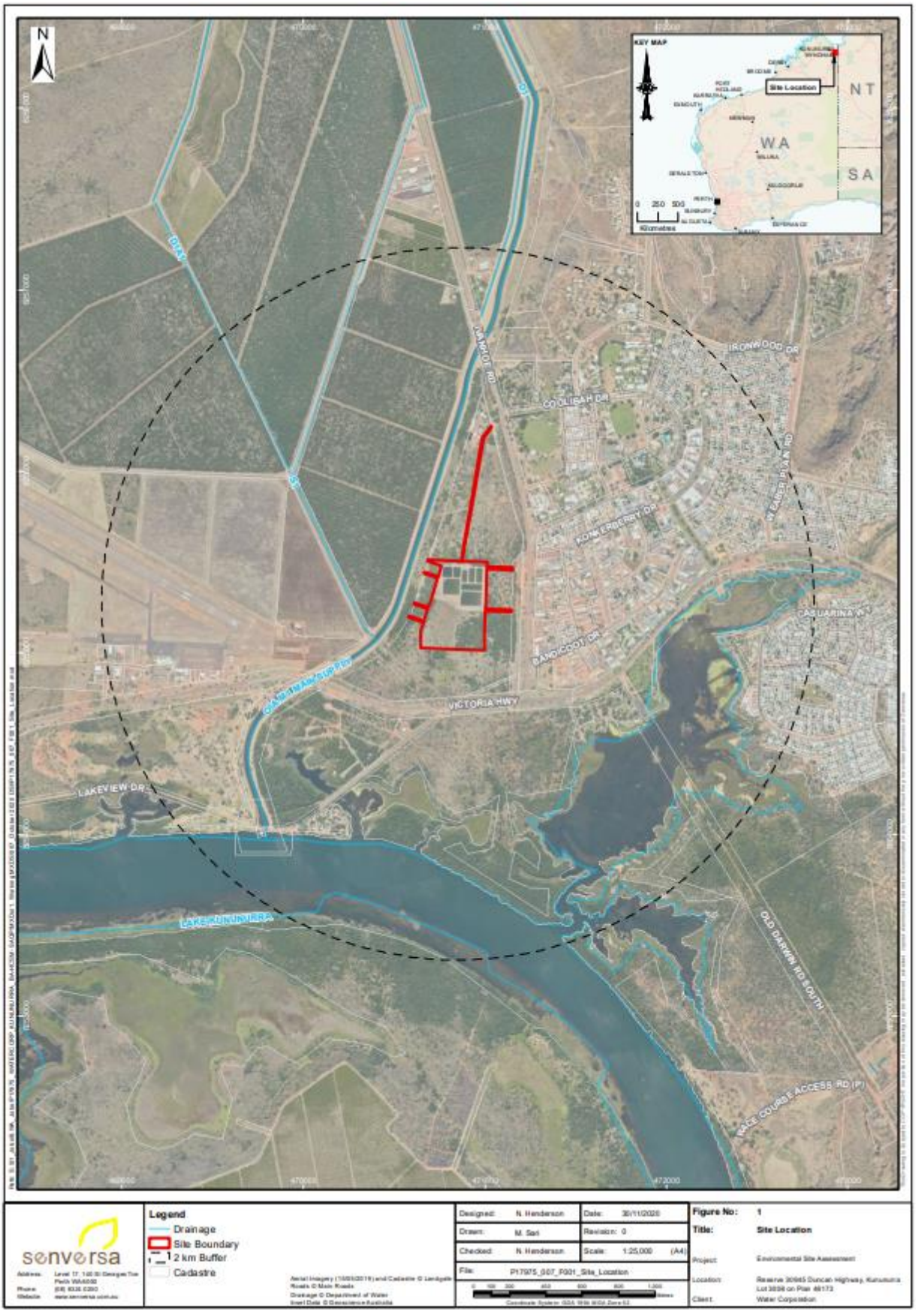


Figure 13: Premises Location

7.3 Residential and sensitive receptors

The distances to residential and sensitive receptors are detailed in Table 21.

Table 21: Receptors and distance from activity boundary

Sensitive Land Uses	Distance from Prescribed Activity
Residential Premises	800 m southeast of ponds – Kimberleyland Holiday Park
Ivanhoe Road Industrial area (Zoned Mixed Business) Predominantly Engineering businesses	310 m east of the ponds

7.4 Specified ecosystems

Specified ecosystems are areas of high conservation value and special significance that may be impacted as a result of activities at or Emissions and Discharges from the Premises. The distances to specified ecosystems are shown in Table 22. Table 22 also identifies the distances to other relevant ecosystem values which do not fit the definition of a specified ecosystem.

The table has also been modified to align with the *Guideline: Environmental Siting.*

Table 22: Environmental values

Specified ecosystems	Distance from the Premises
Ramsar Sites in Western Australia	Site 60 (Lake Kununurra): ▪ 1000 m southeast of WWTP ▪ 1200 m south of WWTP Site 65 Ord River Floodplain 70 km downstream from D1 drain outlet at Lower Ord River
Environmentally Sensitive Area	Lake Kununurra: ▪ 1000 m southeast ▪ 1300 m south Lower Ord River: 4 km west
RIWI Act Groundwater area	Canning – Kimberley Groundwater area Premises lies within area
RIWI Act Surface Water Area and Irrigation Districts	Ord Irrigation District Premises lies within area
Parks and Wildlife Managed Lands and Waters	Kununurra Arboretum – surrounds Prescribed Premises
Biological component	**Distance from the Premises**
Threatened/Priority Flora	*Typhonium sp. Kununurra* - Habitat within premises boundary and spp identified 143m east

Threatened/Priority Fauna	Within Premises Boundary: Wood Sandpiper – *Tringa glareola* Sharp Tailed Sandpiper – *Calidris acuminate* Pacific Golder Plover – *Pluvialis fulva* White Winged Black Tern – *Chlidonias leucopterus* Glossy Ibis – *Plegadis falcinellus* 600 m east Barn Swallow – *Hirundo rustica,* Peregrine Falcon – *Falco peregrinus,* Oriental Plover – *Charadrius veredus,* Marsh Sandpiper – *Tringa stagnatilis*

7.5 Groundwater and water sources

The distances to groundwater and water sources are shown in Table 23.

Table 23: Groundwater and water sources

Groundwater and water sources	Distance from Premises	Environmental value
Public drinking water source areas	P1 Public Drinking Water Source Area – 200 m South from WWTP	Public drinking water (Kununurra town water supply bore field)
Major watercourses/waterbodies	Lake Kununurra: ▪ 1000 m southeast ▪ 1300 m south Lower Ord River: 4 km west	Recreational and Irrigation
Groundwater	During the Dry Season groundwater in the shallow bore network was between 2.845 mbgl and 5.7mbgl. During the Wet Season groundwater in the shallow bore network was between 1.632 mbgl and 4.373 mbgl. Groundwater elevations were consistently higher in the Wet Season when compared to the Dry Season with differences ranging between 0.137 m and 1.73 m. Numerous bores located within 1 of Premises (based on available GIS dataset –WIN Groundwater Sites) – however most are not operational and provide no information. Bores in the P1 Public Drinking Water Source Area and DWER groundwater monitoring bores are greater than 500 m south. Groundwater flow at P1 bores is considered south towards Lake Kununurra. Depth to groundwater is 6m. Bores located in Industrial precinct more	Water is used for potable or industrial use. Groundwater system linked to Ord River.

	than 1 km east of WWTP.	

7.6 Soil type

DWER identifies the soil class at the premises as CC53 - Flat to gently sloping flood plains: chief soils are grey clays (Ug5.24) on the nearly flat plains with small areas of brown clays (Ug5.34). Associated are areas of (Um5.52), (Gn2.12), (Uc4.21), and (Uc1.43) soils on levee formations. Small areas of other soils such as (Dr2) occur marginal to adjoining units Fz20 and BA3. Various undescribed loamy and clayey soils occur in gully systems that may be quite steep. Alluvial deposits including micaceous sands may underlie the (Ug5) soils at depths of 7 to 10 ft. Occurs on sheet(s): 8,9.

7.7 Meteorology

Kununurra has a tropical climate with two distinct seasons: Wet and Dry seasons. The Wet Season (October to April) experiences heavy rainfall and is subject to Monsoonal rainfall events that can deliver large amounts of rainfall in a very short timeframe.

The respective annual 9am and 3pm wind roses for Kununurra are taken from Bureau of Meteorology Wyndham site, located approximately 100 km northwest from the Premises and are represented in Figure 14 below while the mean rainfall is provided in Figure 15 below.

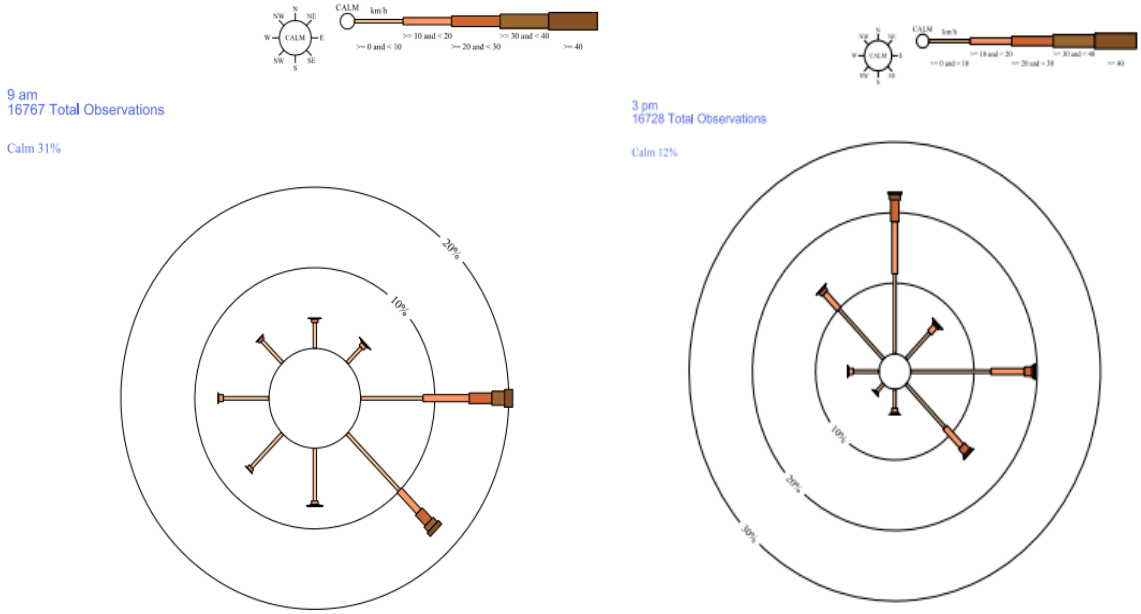
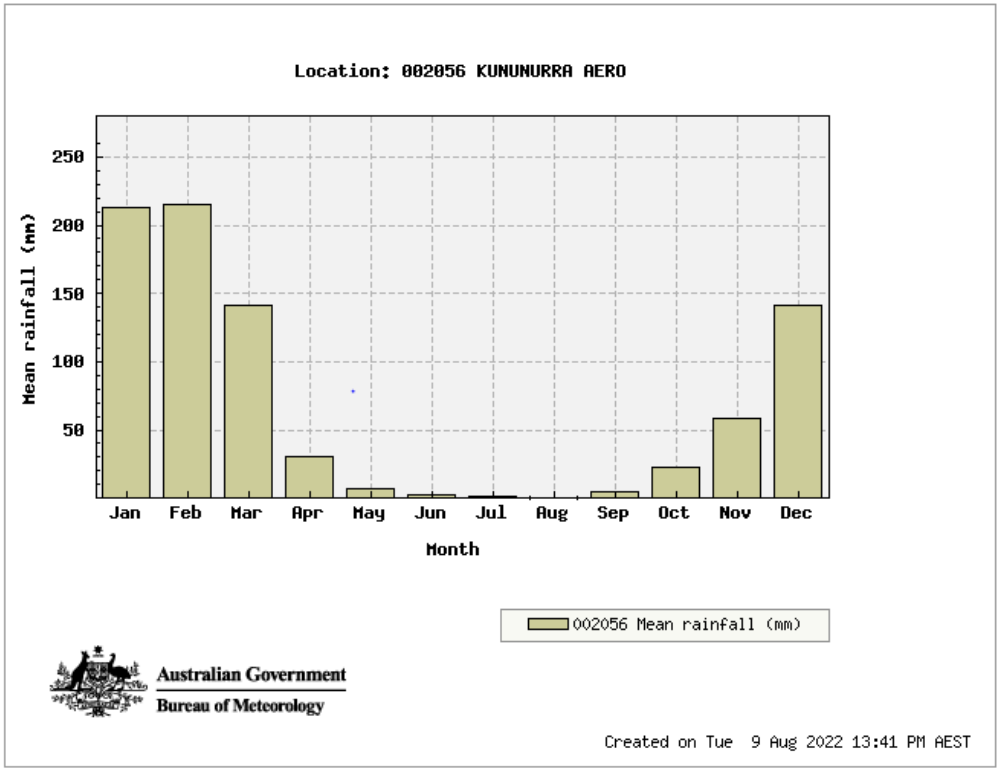


Figure 14: 9am and 3pm Wind Roses



Statistics	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual	Years
Mean rainfall (mm) for years 1971 to 2022	212.5	215.2	141.6	30.1	6.7	2.9	1.4	0.1	5.1	23.0	58.7	141.6	859.1	48

Figure 15: Kununurra rainfall statistics

8. Risk assessment

8.1 Determination of emission, pathway and receptor

In undertaking its risk assessment, DWER will identify all potential emissions pathways and potential receptors to establish whether there is a Risk Event which requires detailed risk assessment.

To establish a Risk Event there must be an emission, a receptor which may be exposed to that emission through an identified actual or likely pathway, and a potential adverse effect to the receptor from exposure to that emission. Where there is no actual or likely pathway and/or no receptor, the emission will be screened out and will not be considered as a Risk Event. In addition, where an emission has an actual or likely pathway and a receptor which may be adversely impacted, but that emission is regulated through other mechanisms such as Part IV of the EP Act, that emission will not be risk assessed further and will be screened out through Table 24.

The identification of the sources, pathways and receptors to determine Risk Events are set out in Table 24 below.

Table 24. Identification of emissions, pathway and receptors during operation

Risk Events						Continue to detailed risk assessment	Reasoning
Sources/Activities		Potential emissions	Potential receptors	Potential pathway	Potential adverse impacts		
KWWTP	Operation of WWTP	Noise	800 m southeast – Kimberleyland Holiday Park Industrial Area 310m east	Air / wind dispersion	Amenity impacts causing nuisance	No	There is only very limited access to the WWTP so vehicle movement will be restricted and infrequent. The size of the Premises does not allow for vehicles to gain speed and thus noise is restricted. The Aerators will not generate significant noise above current operational noise. Distance to receptors, scale and type of operations and lack of reasonably foreseeable impact. No known significant emission sources or history of noise emission impacts. Noise can be adequately regulated by the EP Noise Regs.
		Dust		Air / wind dispersion	Amenity impacts causing nuisance	No	Only a very small area of internal gravel track occurs within the Premises and combined with limited vehicle speed, there will be minimal dust disturbance. Distance to receptors, scale and type of operations and lack of reasonably foreseeable impact. No known significant emission sources or history of dust emission impacts. Dust can be adequately regulated by section 49 of the EP Act.
	Treatment of sewage	Odour	800 m southeast – Kimberleyland Holiday Park	Air / wind dispersion	Amenity impacts causing nuisance	Yes	See section 9.4

Risk Events						Continue to detailed risk assessment	Reasoning
Sources/Activities		Potential emissions	Potential receptors	Potential pathway	Potential adverse impacts		
			Industrial Area 310m east				
	Sewage ponds	Discharge of TWW	Surface water M1 Channel Dry Season irrigation period	Direct discharge to surface waters	Surface water contamination (nutrient loading, metals, heavy metals and PFAS) inhibiting vegetation growth and survival Human health	Yes	See section 9.5
			Surface water M1 Channel Intermediate period	Direct discharge to surface waters	Surface water contamination (nutrient loading, metals, heavy metals and PFAS) inhibiting vegetation growth and survival Human health	Yes	See section 9.6
			Surface water Lower Ord River Wet Season non-irrigation period	Direct discharge to surface waters on lower Ord River via the D1 Drain Direct discharge via seepage to land and groundwater in the D1 Drain	Surface water, groundwater and soil contamination (nutrient loading, metals, heavy metals and PFAS) inhibiting vegetation growth and survival Human health	Yes	See section 9.7

Risk Events						Continue to detailed risk assessment	Reasoning
Sources/Activities		Potential emissions	Potential receptors	Potential pathway	Potential adverse impacts		
	Sewage Ponds	Overtopping of TWW	Vegetation (incl *Typhonium spp*.) and fauna adjacent to discharge area, groundwater surrounding the area and surface water M1 Channel	Direct discharge to land and surface water Seepage through soil into groundwater	Soil contamination (nutrient loading, metals, heavy metals and PFAS) inhibiting vegetation growth and survival Surface water contamination Groundwater contamination	Yes	See section 9.8
		Seepage from base of ponds and sludge drying bed	Groundwater dependent ecosystems. Depth to groundwater encountered at 1.632 mbgl	Seepage: lateral and vertical subsurface migration of leachate to groundwater	Groundwater contamination (nutrient loading metals, heavy metals and PFAS) inhibiting vegetation growth and survival	Yes	See section 9.9

8.2 Consequence and likelihood of risk events

A risk rating will be determined for risk events in accordance with the risk rating matrix set out in Table 25 below.

Table 25: Risk rating matrix

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

DWER will undertake an assessment of the consequence and likelihood of the Risk Event in accordance with Table 26 below.

Table 26: Risk criteria table

Likelihood		Consequence		
The following criteria has been used to determine the likelihood of the Risk Event occurring.		The following criteria has been used to determine the consequences of a Risk Event occurring:		
			Environment	Public health* and amenity (such as air and water quality, noise, and odour)
Almost Certain	The risk event is expected to occur in most circumstances	Severe	• **onsite impacts**: catastrophic • **offsite impacts local scale**: high level or above • **offsite impacts wider scale:** mid-level or above • Mid to long-term or permanent impact to an area of high conservation value or special significance^ • Specific Consequence Criteria (for environment) are significantly exceeded	• Loss of life • **Adverse health effects:** high level or ongoing medical treatment • Specific Consequence Criteria (for public health) are significantly exceeded • **Local scale impacts:** permanent loss of amenity
Likely	The risk event will probably occur in most circumstances	Major	• **onsite impacts**: high level • **offsite impacts local scale**: mid-level • **offsite impacts wider scale**: low level • Short-term impact to an area of high conservation value or special significance^ • Specific Consequence Criteria (for environment) are exceeded	• **Adverse health effects:** mid-level or frequent medical treatment • Specific Consequence Criteria (for public health) are exceeded • **Local scale impacts**: high level impact to amenity
Possible	The risk event could occur at some time	Moderate	• **onsite impacts**: mid-level • **offsite impacts local scale**: low level • **offsite impacts wider scale**: minimal • Specific Consequence Criteria (for environment) are at risk of not being met	• **Adverse health effects:** low level or occasional medical treatment • Specific Consequence Criteria (for public health) are at risk of not being met • **Local scale impacts:** mid-level impact to amenity
Unlikely	The risk event will probably not occur in most circumstances	Minor	• **onsite impacts**: low level • **offsite impacts local scale**: minimal • **offsite impacts wider scale**: not detectable • Specific Consequence Criteria (for environment) likely to be met	• Specific Consequence Criteria (for public health) are likely to be met • **Local scale impacts:** low level impact to amenity
Rare	The risk event may only occur in exceptional circumstances	Slight	• **onsite impact**: minimal • Specific Consequence Criteria (for environment) met	• **Local scale**: minimal to amenity • Specific Consequence Criteria (for public health) met

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

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

"onsite" means within the Prescribed Premises boundary.

8.3 Acceptability and treatment of Risk Event

DWER will determine the acceptability and treatment of Risk Events in accordance with the Risk treatment Table 27 below:

Table 27: Risk treatment table

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

8.4 Risk Assessment – Odour

8.4.1 Description of Odour

Odour may be generated by the acceptance, storage and treatment of sewage wastes, removal and processing of sewage sludge. Sewage can contain high loads of BOD and can also contain aromatic molecules which can result in odour. Odour emissions can also be exasperated where overloading of the WWTP occurs which can be considered a foreseeable abnormal operating condition, especially in the Wet Season.

8.4.2 Identification and general characterisation of emission

Odour can occur continuously from all the ponds while the WWTP is operational. Abnormal operating conditions may give rise to higher frequency and duration odour emission events.

During desludging, the sludge removed from the ponds will be required to be stored to allow for drying prior to disposal of the sludge solids to landfill. There may be additional odours during the desludging process.

Wind plots from Figures 13 and 14 indicate that the pathway, via the air shed – wind dispersal, at 9am is east and southeast and for 3pm is north. There are no current sensitive receptors down wind of these pathways.

8.4.3 Description of potential adverse impact from the emission

Odour has the potential to cause amenity impacts causing nuisance to local sensitive receptors and the general public. Meteorological factors are expected to have a significant influence on the pathway for odour emissions and therefore the potential level of impact on receptors. Residential receptors are expected to be more sensitive than industrial receptors.

8.4.4 Criteria for assessment

No specific consequence criteria are applicable. The health, welfare, convenience, comfort and amenity of receptors are relevant in determining the consequence of odour. The closest residential receptors are 800 m to the southeast at Kimberleyland Caravan Park. Industrial receptors lie to the east 300 m from the WWTP.

In it's operation history, the KWWTP has received three odour complaints in 2014. 2015 and 2016.The complainant was located upwind for all incidents, and it was concluded that there was no evidence to substantiate that the KWWTP was the generator of the emission.

8.4.5 Licence Holder controls

This assessment has reviewed the controls set out in Table 28 below.

Table 28: Licence Holder's proposed controls for Odour

Control type	Infrastructure control	Operational control
Siting	Sewage facility siting	Under the February 2019 Local Planning Scheme No. 9 SWEK have a 500 m nominal buffer identified where developments including a permanent residential or temporary residential component including tourist accommodation may not be approved if SWEK considers that such development may be affected by the odour buffer area.
Sewage treatment	Treatment of sewage through the sewage facility under normal operating conditions	The Applicant provides treated sewage that is between the pH range of ≥ 6.5 and ≤ 8.5 (Table 10 average pH is 8)

8.4.6 Key findings

The Delegated Officer has reviewed the information regarding Odour and has found:

- The closest residential receptor is located 800 m southeast and does not appear to be impacted by odour emissions.
- The KWWTP has received two complaints in 2014 and 2015 respectively, and one complaint in 2016 from the public for odour although for each complaint the complainant was upwind which may indicate the WWTP was not the source of emission.

8.4.7 Consequence

If odour occurs, then the Delegated Officer has determined that the impact of odour will be local scale minimal impacts to amenity. Therefore, the Delegated Officer considers the consequence of odour to be **Slight.**

8.4.8 Likelihood of Risk Event

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

8.4.9 Overall rating of Odour

The Delegated Officer has compared the consequence and likelihood ratings described above with the risk rating matrix (Table 25) and determined that the overall rating for the risk of odour is **Low**.

8.5 Risk Assessment – Surface Water Discharges to the M1 Channel during Dry and Intermediate Season irrigation periods

8.5.1 Description of Surface Water Discharge to the M1 Channel - Dry and Intermediate Season irrigation periods

Current operations potentially receive a continuous inflow loading of sewage during the Dry Season irrigation period subject to seasonal fluctuations. The Dry Season is typically from April to September.

The Intermediate period is somewhat variable, but generally occurs for around one month at the beginning of the Dry Season irrigation period (between April and May) and again in October at the end of the Dry Season irrigation period. This describes the period where demand for irrigation water is beginning to either increase (at the start of the Dry Season) or decrease (at the end of the Dry Season). Flow rates in the M1 channel are lower than peak Dry Season flows due to reduced demand for irrigation water.

Discharge of TWW will occur continuously from the KWWTP to the M1 Channel during these periods. The KWWTP discharge point is located approximately 2 km downstream from the start of the M1 Channel. Any discharge of TWW into the M1 Channel has the potential to be used and incorporated into irrigation supply water in the ORIA.

8.5.2 Identification and general characterisation of emission

As sewage proceeds through the treatment ponds some contaminants undergo biological treatment, and some contaminants settle to the base of the ponds to form sludge. Generally, as the sewage proceeds through the treatment ponds, the concentration of contaminants decreases. The quantity and quality of sewage, raw or treated, discharge to surface water will vary depending on the nature of the inflows as there will be daily variances during the year and effectiveness of the sewage facility treatment process. TWW is also chlorinated prior to discharge to reduce pathogen and indicator species to acceptable levels. Table 10 above provides a review of the previous 11 years of TWW data which is representative of the TWW discharged to the M1 Channel during the Dry Season and Intermediate Season irrigation periods.

The undiluted TWW discharge exceeds numerous investigation levels for a range of parameters. The Licence Holder must rely on dilution to meet investigation levels for TN and TP and all other environmental and health contaminant parameters in the receiving M1 Channel.

The discharge will contain contaminants including TN and TP nutrients, pathogens and other contaminants of potential concern. Contaminants and nutrients could impact the terrestrial crops and aquatic ecosystem functions within the M1 Channel. Pathogens could impact food crops and be transmitted to humans (health and wellbeing) if contaminated food is consumed.

Based on sampling to date, metals, PFAS and the other contaminants tested for are not considered as significant components of the waste stream. However, it is noted that only two samples for each characterised monitoring period (four across the Intermediate and dry season irrigation periods) have been undertaken, which may not be sufficiently comprehensive to draw accurate long term conclusions from in regards to health and environmental impacts resulting from discharges of TWW to the M1.

For further detail on the identification, characterisation of the TWW discharge, refer to Section 6.7 of the Decision Report.

8.5.3 Description of potential adverse impact from the emission

Based on a surface water pathway to the M1 Channel during the Dry and Intermediate Season irrigation periods the following impacts may occur:

- Negative impacts on ecology of surface water in the M1 Channel and irrigated crops within ORIA from the uptake of pathogens, nutrients, metals, PFAS and dissolved solids within the M1 channel
- Excess TN and TP within the M1 channel can lead to leaching of Nitrogen and Phosphorus into surface water, over-stimulation of plant growth (decreasing yields) and stimulation of algal growth in surface water and eutrophication. Food contaminated with pathogens may impact human health and wellbeing.

8.5.4 Criteria for assessment

Relevant EIL surface water quality criteria are provided in Table 8 and include:

- ANZECC & ARMCANZ (2000) – Chapter 4 Primary Industries Table 4.2.2 Trigger values for *E. coli* (1000 CFU/100mL);
- ANZECC & ARMCANZ (2000) – Chapter 4 Primary Industries Table 4.2.10 Trigger values for heavy metals and metalloids;
- ANZECC & ARMCANZ (2000) – Chapter 4 Primary Industries LTGV (Table 4.2.11) TN (5mg/L) and TP (0.05mg/L) respectively as the KWWTP been operational since 1969 (over 50 years);
- ANZECC 2000 95% species protection for freshwater (ANZG 2018) for recognition of the long-term irrigation activities in the ORIA;
- PFAS HEPA (2020) criteria ANZG (2018) 99% species protection; and
- NPUG – DoH (2014) and HEPA (2020).

8.5.5 Licence Holder controls

The Licence Holder discharges TWW directly to the M1 Channel which then combines with water in the M1 Channel and is used for irrigation purposes. Discharge of TWW into the M1 Channel is approximately 1.5 MLD.

The dilution rates provided in Table 7 are now considered the most representative for the M1 Channel as these have been obtained through investigations undertaken to inform the WSWQA.

Section 6.4 of the Decision Report outlines Mixing zones for the M1 Channel. Data submitted under the WSWQA indicates that TWW is fully mixed to below relevant screening levels within 1 km of the KWWTP discharge pipe and that this trend is observable under the Dry Season irrigation period.The data submitted under the WSWQA identifies a discernable trend in reducing concentrations within the M1 Channel relative to distance from the KWWTP discharge pipe.

The Licence Holder samples treated effluent generally every month, or quarterly as required under Existing Licence conditions 3.2.1 Table 3.2.1, from a sampling point within the Premises boundary and prior to discharging to the M1 Channel. A review of the previous 11 year's submitted monitoring results is provided in Table 10 of the Decision Report. Section 6.7 of the Decision Report provides a detailed review of TWW monitoring including a review of the analytical data from the reports submitted to inform this Licence review, with an emphasis on the analyses of contaminants against EILs within the WSWQA as provided in Table 12 of the Decision Report.

The Licence Holder currently samples Surface water quality 50 m upstream and 225 m, 1 km and 6 km downstream of the KWWTP discharge point in the M1 Channel quarterly for TP, TN and *E. coli* as required under Existing Licence conditions 3.4.1 and Table 3.4.1. A review of the previous 11 year's submitted monitoring results is provided in Table 13 of the Decision Report. Section 6.8.1 of the Decision Report provides the detailed analysis of surface water discharges

and a summary of monitoring events as provided in Table 14 and Figure 5 provides TN, TP, *E. coli* and PFOS concentrations relative to applicable EILs.

The closest offtake for irrigation water within the M1 Channel is located 5 km and 5.5 km (S2 supply channel) respectively downstream from the WWTP discharge point.

This assessment has reviewed the controls set out in Table 29 below.

Table 29: Licence Holder's proposed controls for Discharges to Surface Water M1 Channel Dry and Intermediate Season irrigation periods

Risk Event infrastructure controls	Risk Event operational controls
The KWWTP treats wastewater to a secondary standard operating a facultative pond system using two series (A and B) of primary, secondary, tertiary and quaternary ponds in parallel.	• Discharge of TWW is approximately 1.5 MLD. • Maintain minimum flow for the dilution/attenuation of TWW in the M1 Channel - a dilution of 696 ML/d was modelled under the HCM but the W&SWQA advises during the respective GMEs the flow was 442 MLD. • Dilution factor of 409 as per Table 7. • Existing Quarterly monitoring of TWW prior to discharging to the M1 Channel. • Existing Surface water Quarterly monitoring of surface water at 50 m upstream, 225 m, 1 km and 6 km downstream from discharge point into M1 Channel. • Chlorination of TWW prior to discharging TWW to the M1 Channel.

8.5.6 Summary review information for sampling of the M1 Channel during the Dry and Intermediate Season irrigation periods

Key summary information regarding sampling in the M1 Channel during the Dry and Intermediate Season irrigation periods is as follows:

- TWW is diluted with irrigation water within the M1 Channel and used for irrigation purposes in the ORIA. Exit water from the ORIA which that may contain TWW enters the Lower Ord River via the D4 drain 15 km downstream of the WWTP discharge pipe.
- M1 Channel flow regimes are managed by a third-party operator (OIC) who has no control over the WWTP operations. However, results from the WSWQA indicate that adequate dilution of TWW within the M1 channel appears to be occurring within 1 km.
- The Licence Holder has measured a flow rate of 696 ML/d and a dilution factor (ratio) of 409 for these periods.
- Undiluted TWW discharge exceeds numerous EILs as identified in Table 12 of the Decision Report.
- No Nitrogen species exceeded the NPUG or ANZECC 2000 LTGV Irrigation ILs in any samples from the M1 Channel, although, except for ammonium, concentrations of nitrogen downstream of the TWW discharge pipe were slightly higher than background samples. TN concentrations in the M1 Channel were generally slightly higher closer to the TWW discharge pipe (0.2-0.3 mg/L) than with concentrations further downstream which more closely resemble background (0.1 mg/L).
- No Phosphorus species exceeded ANZECC 2000 LTGV Irrigation EIL (0.05 mg/L) for TP in any of the samples from the M1 Channel. Phosphorus concentrations downstream of the TWW discharge pipe were slightly higher than background. Concentrations were slightly greater within the first 500 m downstream of the TWW discharge pipe (0.01-0.04

mg/L) compared to those further downstream (0.01-0.02 mg/L).

- No Dissolved metal samples exceeded the NPUG and ANZECC 2000 LTGV Irrigation in the M1 Channel.
- Total metals did not exceed the NPUG and ANZECC 2000 LTGV Irrigation in the M1 Channel except for SW05E in October 2020 which variably exceeded the EILs for total aluminium and iron.
- TWW is chlorinated at the KWWTP prior to being discharged into the M1 Channel. Data from the Reports indicate E. coli concentrations exceeded the NPUG and ANZECC 2000 LTGV EILs for most of the sample locations in the M1 Channel. Enterococci concentrations did not exceed the REC EILs within the M1 Channel downstream of the TWW discharge pipe. Exceedances were noted upstream of the TWW discharge pipe and within the D1 and D4 drains. There was no distinction between concentrations taken from the eastern and western bank sample locations.
- While E. coli averages are provided in Table 10, there are isolated instances during the reporting periods where E. coli discharges are high post-chlorination. For example, there were incidents in the 2017-2018 reporting period where E. coli samples were >24,000 CFU/100mL (July and December 2017) with a further incident in October 2017 (1,600 CFU/100mL) and December 2019 (6,900 CFU/100mL) where the E. coli discharge was greater than ANZECC guidelines (1,000 CFU/100m/L). The Licence Holder has not provided an explanation for these elevated results.
- There were no exceedances of the NPUG for PFAS at any sample locations within the M1 Channel or D1 and D4 drains.
- PFOS concentrations within background samples were similar to those reported within the M1 Channel and the D1 drain (at D1B location only) and D4 drain.

8.5.7 Key findings

The Delegated Officer has reviewed the information regarding surface water discharges to the M1 Channel during the Dry and Intermediate Season irrigation period and has found:

- Available dataindicates that TWW is fully mixed to below relevant EILs within 1 km of the KWWTP discharge pipe during this period. The data identifies a discernible trend in reducing concentrations within the M1 Channel relative to distance from the KWWTP discharge pipe
- However, six sampling events for TWW across all flow regimes is not considered representative of the contaminant loadings of TWW across long term WWTP operations and is not considered comprehensive to inform decision making as to whether TWW discharges to the M1 channel are having health and environmental impacts.
- Two sampling events for each flow regime is not considered sufficiently rigorous to clearly identify the potential contribution of the KWWTP to groundwater/surface water contamination in the area.
- It is difficult to distinguish if/where/how far TWW is migrating through the M1 drain/D1 drain across the different flow regime seasons, given the similarity of the contaminant profile to inputs from surrounding agricultural industry.
- It is difficult to distinguish where increased contaminant loadings within samples are directly attributable to the impacts of the TWW discharge given the similarity of the contaminant profile to inputs from surrounding agricultural industry.
- It is noted that generally during the Dry and Intermediate Season irrigation period, the highest concentration of surface water analytes was observed in the D1 and/or D4

drains, indicating potentially significant additional contamination from agricultural sources and ambient conditions.

- There are no significant differences between concentrations of samples taken at the eastern bank compared to the western bank of the M1. This is consistent under all three flow regimes.
- Noting that six sample events may not be representative of the longer-term operations and discharges from the WWTP, there is a need to validate assumptions made within the ESA and WQWSA submitted by the Licence Holder through additional monitoring.
- Additional evidence is required to clearly indicate whether or not the KWWTP is a significant source of elevated concentrations of chemical constituents in surface water (and groundwater) at downstream receptors and the Lower Ord, In particular, including a suite of specific chemical constituents in the surface water monitoring program that would clearly identify if the WWTP is a significant source of contamination would have increased the level of confidence in the results that were obtained from the Senversa investigations. Specific chemical constituents in surface water that could be used to "fingerprint" the WWTP as a distinct source of contamination were recommended as boron, sucralose and carbamazepine.

8.5.8 Consequence

Environment

The Delegated Officer has determined that the environmental impact of discharges to the M1 Channel will be minimal off-site impacts at a local scale. Therefore, the Delegated Officer considers the environmental consequence of discharges to surface water M1 Channel to be **Minor**.

Public Health

The Delegated Officer has determined that the relevant Specific Consequence Criteria (Investigation Levels) at receptors in the M1 Channel are likely to be met for TWW discharges to the M1 Channel. Therefore, the Delegated Officer considers the health consequence of discharges to the M1 Channel for these periods to be **Minor**.

8.5.9 Likelihood of Risk Event

Environment

The Delegated Officer has determined that potential adverse environmental effects to receptors from discharges to the M1 Channel during Dry and Intermediate Season irrigation periods occurring will probably not occur in most circumstances. Therefore, the Delegated Officer considers the likelihood of the Risk Event occurring to be **Unlikely**.

Public Health

The Delegated Officer has determined that potential adverse health effects to the receptors from discharges of TWW to the M1 Channel during Dry and Intermediate Season irrigation periods will probably not occur in most circumstances. Therefore, the Delegated Officer considers the likelihood of the Risk Event occurring to be **Unlikely**.

8.5.10 Overall rating of Surface Water Discharges to M1 Channel Dry and Intermediate Season irrigation period

Environment

The Delegated Officer has compared the consequence and likelihood ratings described above with the risk rating matrix (Table 25) and determined that the overall rating for the environmental risk of discharges to the M1 Channel during Dry and Intermediate Season irrigation periods is

Medium.

Public Health

The Delegated Officer has compared the consequence and likelihood ratings described above with the risk rating matrix (Table 25) and determined that the overall rating for the health risk of discharges to the M1 Channel during Dry and Intermediate Season irrigation periods is **Medium**.

8.6 Risk Assessment – Discharges to surface water during the Wet Season non-irrigation period

8.6.1 Description of discharges to Surface Water during the Wet Season non-irrigation period

The KWWTP receives a continuous inflow loading of sewage up to 2.0 MLD during the Wet Season non-irrigation period subject to seasonal fluctuations. The Wet Season is typically from October to May.

The Wet Season non-irrigation period is characterised by low volume flows within the M1 Channel as there is no consistent demand for irrigation water. For the majority of the time the intake from Lake Kununurra is closed and the only water entering the M1 Channel is TWW, stormwater runoff after rain and potentially some limited contribution from groundwater.

8.6.2 Identification and general characterisation of emission

Discharged TWW will contain contaminants including TN and TP nutrients, pathogens and other contaminants of potential concern. Contaminants and nutrients could impact the groundwater, soils and aquatic ecosystem functions within and around/along the D1 Drain and the Lower Ord River. The Lower Ord River is used extensively by recreational and commercial (guiding) fisherman. There is generally no swimming or similar activity due to the presence of crocodiles.

Based on sampling undertaken to date, metals, PFAS and the other contaminants tested for are not considered likely to be significant components of the waste stream.

For further information regarding the identification and characterisation of the TWW, refer to section 6.7 of the Decision Report.

8.6.3 Description of potential adverse impact from the emission

Based on a surface water pathway to the Lower Ord River during the Wet Season non-irrigation period, potential impacts on ecology of surface water in the Lower Ord River from the addition of pathogens, nutrients, metals, PFAS, contaminants of potential concern and dissolved solids. Excess TN and TP can lead to leaching of Nitrogen and Phosphorus into surface water, over-stimulation of plant growth (decreasing yields) and stimulation of algal growth in surface water and eutrophication.

8.6.4 Criteria for assessment

Relevant surface water quality criteria are provided in Table 8 and includes:

- ANZECC 2000 95% species protection for freshwater (ANZG 2018);
- PFAS HEPA (2020) criteria ANZG (2018) 99% species protection;
- DoW (2013) - locally derived reference values of TN (0.29mg/L) and TP (0.018mg/L); and
- DoH (2014), HEPA (2020) and NHMRC (2008) for Recreational users.

8.6.5 Licence Holder controls

The gate to the D1 drain is open during the non-irrigation period and water within the M1 Channel is able to pass into the D1 drain but it is understood the flow is insufficient to reach the Lower Ord River (exceptions may include large contributions of stormwater).

This assessment has reviewed the controls set out in Table 30 below.

Table 30: Licence Holder's proposed controls for discharges to surface water in the Wet Season non-irrigation period

Risk Event infrastructure controls	Risk Event operational controls
The KWWTP treats wastewater to a secondary standard operating a facultative pond system using two series (A and B) of primary, secondary, tertiary and quaternary ponds in parallel.	• Discharge of TWW is approximately 1.5 MLD. • During this time maintenance of the M1 Channel is undertaken by OIC. Following maintenance (which is undertaken several times) OIC open the intake from Lake Kununurra and flush approximately 400ML of water down the M1 Channel into the D1 drain to the Lower Ord River over a period less than 24 hours. Depending on the specific irrigation demand (which will occur on occasions during the Wet Season if there has been insufficient rainfall OIC then fill the M1 Channel to the M1/C1 gate before releasing water down the M1 Channel for irrigation. • A dilution factor of 16.8 is applied as per Table 7. • The C1 and S2 Gates are closed which restricts flow of TWW in the M1 Channel. • Existing Quarterly monitoring of TWW prior to discharging to the M1 Channel. • Existing Surface water Quarterly monitoring of surface water at 50 m upstream, 225 m, 1 km and 6 km downstream from discharge point into M1 Channel. • Chlorination of TWW occurs prior to discharge.

8.6.6 Summary review information for sampling of the M1 Channel during the Wet Season non-irrigation period

Key summary information regarding discharges to surface water in the Wet Season non-irrigation period is as follows:

- During the Wet Season non-irrigation period, TWW is characterised by low volume flows within the M1 Channel as there is no consistent demand for irrigation water. There is no regular flow of dilution/attenuation water from Lake Kununurra within the M1 Channel
- For the majority of the time the intake from Lake Kununurra is closed and the only water entering the M1 Channel is TWW, stormwater runoff after rain and potentially some limited contribution from groundwater. The gate to the D1 drain is open and water within the M1 Channel is able to pass into the D1 drain but it is understood the flow is insufficient to reach the Lower Ord River (exceptions may include large contributions of stormwater). Flows in the Lower Ord River are close to twice those during the Dry Season.
- Following maintenance (which is undertaken several times in this period by OIC) the intake from Lake Kununurra is opened and approximately 400ML of water is released down the M1 Channel into the D1 drain to the Lower Ord River over a period less than 24 hours. Depending on the specific irrigation demand (which will occur on occasions during the Wet Season if there has been insufficient rainfall) OIC may then fill the M1 Channel to the M1/C1 gate before releasing water down the M1 Channel for irrigation.

- A Wet Season dilution factor (ratio) of 16.8 has been determined by the applicant's consultants based on flushing water and stormwater content in the M1.
- Undiluted TWW exceeds numerous EILs as identified in Table 12 of the Decision Report.
- TN, nitrate, ammonia, ammonium and total oxidized nitrogen variably exceeded NPUG, DoW (2013) and ANZECC FW EILs along the M1 Channel.
- Concentrations of nitrogen species were greatest within the mixing zone up to 1 km downstream of the TWW discharge pipe (SW02, SW03, SW04 and SW05) with concentrations further downstream (SW06) resembling background. Concentrations within the D1 drain closely resembled background and SW06 concentrations and variably exceeding ANZECC FW and DoW (2013) EIL for TN, total oxidized nitrogen and ammonium.
- Phosphorus species exceeded the ANZECC FW and DoW (2013) EILs at all locations within the M1 Channel, being higher within the mixing zone up to 1 km downstream of the TWW discharge pipe (SW02, SW03, SW04 and SW05) with concentrations further downstream (SW06) resembling background. Concentrations within the D1 drain were higher at D1A, at the intersection of the D1 drain and the S1 supply channel, compared to D1B which closely resembled those at SW06, 3.5 km downstream of the WWTP.
- E. coli concentrations exceeded NPUG EILs at all locations within the M1 Channel, noting no clear trends were identified along the channel. Enterococci was not analysed for the Wet Season non-irrigation period sampling events. Concentrations were greatest in the D1 drain at D1B in February 2021.
- For Dissolved metals there was no exceedances for the NPUG or ANZECC 2000 FW EILs within close proximity of the TWW discharge pipe (SW02, SW03 and SW04). There were variable exceedances for the ANZECC 2000 FW EIL within background, 1 km and 3.5 km downstream of the TWW discharge pipe for dissolved copper. One exceedance for aluminium for ANZECC 2000 FW was identified at 3.5 km downstream (SW06). Dissolved metal concentrations exceeded ANZECC 2000 FW EIL for copper within the D1.
- For Total metals, the NPUG and ANZECC 2000 FW EILs were exceeded variably in the M1 Channel for total aluminium, chromium, cobalt, copper, iron and zinc. Concentrations of metals were higher in background locations compared to those closest to the TWW discharge pipe, although concentrations further downstream (SW05 and SW06) tended to resemble background. Both sample locations exceeded ANZECC 2000 FW EILs within the D1 drain for copper and chromium.
- For PFAS there were no exceedances of the NPUG or REC for PFAS at any sample locations in the M1 Channel or within the D1 drain. All sample locations exceeded the FW 99% species protection EIL but were below the 95% protection levels for PFOS. PFOS concentrations were slightly higher downstream of the TWW discharge pipe compared to background and comparable between eastern and western banks. PFOS concentrations in the D1 drain were similar to those downstream of the TW discharge pipe (SW02, SW03, SW04, SW05 and SW06).

8.6.7 Key findings

The Delegated Officer has reviewed the information regarding discharges to surface water in the Wet Season non-irrigation period and has found:

- Six sampling events for TWW across all flow regimes is not considered representative of the contaminant loadings of TWW across long term WWTP operations and is not considered comprehensive to inform decision making as to whether TWW discharges to the M1 channel are having health and environmental impacts..

- Two sampling events for each flow regime is not considered sufficiently rigorous to clearly identify the potential contribution of the KWWTP to groundwater/surface water contamination in the area.
- The WSWQA asserts that TWW does not reach the Lower Ord River during the Wet Season non-irrigation period. No information has been submitted under the Assessment to identify the pathway / receptors for this TWW, which is assumed to dissipate via infiltration and evaporation within the D1 Drain. The ESA indicates that the direction of groundwater flow is northwest, indicating that TWW may interact with shallow water during the Wet Season which may then discharge into the Lower Ord River. Currently there is no understanding of the fate of this discharge stream.
- It is difficult to distinguish where increased contaminant loadings within surface water samples are directly attributable to the impacts of the TWW discharge given the similarity of the contaminant profile to inputs from surrounding agricultural industry.
- There is no significant difference between concentrations of samples taken at the eastern bank compared to the western bank of the M1. This is consistent under all three flow regimes.
- Noting that six sample events may not be representative of the longer-term operations and discharges from the WWTP, there is a need to validate assumptions made within the ESA and WQWSA submitted by the Licence Holder through additional monitoring. Additional monitoring will also address data gaps relating to the migration of contaminants through the D1 channel to the lower Ord River, given no data has been submitted to date surrounding this.
- Additional evidence is required to clearly indicate whether or not the WWTP is a significant source of elevated concentrations of chemical constituents in surface water at downstream receptors, including the potential for infiltration into the Lower Ord River via the groundwater beneath the D1. A suite of specific chemical constituents in the surface water monitoring program would clearly indicate if the WWTP is a significant source of contamination would have increased the level of confidence in the results that were obtained from the Senversa investigations. Specific chemical constituents in surface water that could be used to “fingerprint” the WWTP as a distinct source of contamination were recommended as boron, sucralose and caffeine.

8.6.8 Consequence

Environment

The Delegated Officer has determined that the potential adverse environmental consequence of discharges to the M1 Channel in the wet season will be minimal off-site impacts local scale. Therefore, the Delegated Officer considers the consequence to be **Minor**.

Public Health

The Delegated Officer has determined that the potential adverse health consequence of discharges to the M1 Channel in the wet season will be minimal impacts to amenity on a local scale. Therefore, the Delegated Officer considers the consequence to be **Slight**.

8.6.9 Likelihood of Risk Event

Environment

The Delegated Officer has determined that potential adverse environmental effects to receptors from discharges to the M1 Channel in the wet season will only occur in exceptional circumstances. Therefore, the Delegated Officer considers the likelihood of the Risk Event occurring to be **Rare**.

Public Health

The Delegated Officer has determined that potential adverse health effects to receptors from discharges to the M1 Channel in the wet season will only occur in exceptional circumstances. Therefore, the Delegated Officer considers the likelihood of the Risk Event occurring to be **Rare**.

8.6.10 Overall rating of discharges to surface water in the Wet Season non-irrigation period

Environment

The Delegated Officer has compared the consequence and likelihood ratings described above with the risk rating matrix (Table 25) and determined that the overall rating for the environmental risk of discharges of TWW to the M1 Channel in the wet season period is **Low**.

Public Health

The Delegated Officer has compared the consequence and likelihood ratings described above with the risk rating matrix (Table 25) and determined that the overall rating for the health risk of discharges of TWW to the M1 Channel in the wet season period is **Low**.

8.7 Risk Assessment – Overtopping

8.7.1 Description of Overtopping

Discharge of raw, partially treated and/or treated sewage may occur from the KWWTP ponds, sludge drying hardstand and/or pipes via overtopping or structural failure (e.g. pipeline failure or pond wall collapse). The discharges will contain contaminants including TN and TP nutrients, pathogens and other contaminants of potential concern. Contaminants could impact terrestrial ecosystem functions, enter groundwater or discharge to surface water within M1 Channel and Lower Ord River directly. Overtopping has occurred in the past typically as a result of monsoonal troughs in the Wet Season.

Metals, PFAS and contaminants of potential concern are not suspected as representing significant components of the waste stream as indicated in the Report.

8.7.2 Identification and general characterisation of emission

The Premises receives a continuous inflow loading of sewage up to 2.0 MLD subject to seasonal fluctuations. As sewage proceeds through the treatment ponds concentration of contaminants decreases. The quantity and quality of sewage, raw or treated, discharge via overtopping will vary depending on the nature of the containment overtopping at the time, location of failure within the sewage facility, hydraulic load being placed on the sewage facility, effectiveness of the sewage facility treatment process, capacity to direct wastewater away, ambient meteorological conditions including potential infiltration of stormwater within the sewage conveyance network and response time to resolve the overtopping.

Previous rainfall events have caused overtopping at the KWWTP, indicating there are limitations on containment capacity at the Premises and the isolated overtopping events are foreseeable and will likely coincide with significant dilution from high volumes of rainfall runoff.

8.7.3 Description of potential adverse impact from the emission

The KWWTP and surrounding arboretum contain suitable soil types/habitat known to support the Threatened Flora *Typhonium* sp. Kununurra (Typhonium). The presence of Typhonium on site has been confirmed from previous targeted survey.

Soil contamination may inhibit vegetation growth or directly harm vegetation and cause health impacts to fauna.

Groundwater contamination may directly impact or inhibit the growth of groundwater dependant ecosystems and may impact the P1 public drinking water area 200m to the south.

There is a potential for overtopping events involving untreated or partially treated wastewater to discharge to the M1 Channel and Lower Ord River via a surface water pathway. Impacts may result from contamination with nutrients, pathogens, metals and other contaminants resulting in bioaccumulation through aquatic food chain associated with human consumption of fish and potential eutrophication of the freshwater in the Lower Ord River and irrigation water under the ORIA for irrigation purposes.

8.7.4 Criteria for assessment

Relevant surface water quality criteria are provided in Table 8 and includes:

- ANZECC & ARMCANZ (2000) – Chapter 4 Primary Industries Table 4.2.2 Trigger values for *E. coli* (1000 CFU/100mL);
- ANZECC & ARMCANZ (2000) – Chapter 4 Primary Industries Table 4.2.10 Trigger values for heavy metals and metalloids;
- ANZECC & ARMCANZ (2000) – Chapter 4 Primary Industries LTGV (Table 4.2.11) TN (5mg/L) and TP (0.05mg/L) respectively as the KWWTP been operational since 1969 (over 50 years);
- ANZECC 2000 95% species protection for freshwater (ANZG 2018) for recognition of the long-term irrigation activities in the ORIA;
- PFAS HEPA (2020) criteria ANZG (2018) 99% species protection;
- NPUG – DoH (2014) and HEPA (2020).
- DoW (2013) - locally derived reference values of TN (0.29mg/L) and TP (0.018mg/L); and
- DoH (2014), HEPA (2020) and NHMRC (2008) for Recreational users.

8.7.5 Licence Holder controls

Licence Holder controls for overtopping are provided in Table 31.

Table 31: Licence Holder's proposed controls for Overtopping

Risk Event infrastructure controls	Risk Event operational controls
The KWWTP treats wastewater to a secondary standard operating a facultative pond system using two series (A and B) of primary, secondary, tertiary and quaternary ponds in parallel.	• A Freeboard of 200 mm is to be maintained during WWTP operations. • The WWTP ponds have emergency overflow weirs to aid the integrity of the pond walls. • Internal stormwater drains to direct stormwater away from the WWTP. • Existing Quarterly monitoring of TWW. • Existing Surface water Quarterly monitoring of surface water at 50 m upstream, 225 m, 1 km and 6 km downstream from discharge point into M1 Channel. • Chlorination of TWW prior to discharging TWW to the D1 Drain and Lower Ord River.

8.7.6 Key findings

The Delegated Officer has reviewed the information regarding Overtopping and has found:

- The KWWTP and surrounding arboretum contain suitable soil types/habitat known to support the Threatened Flora Typhonium. The presence of Typhonium on site has been confirmed from previous targeted survey.
- Stormwater catch drains and external spillways have been designed to discharge directly into the M1 Channel from the KWWTP pond system without overtopping back into the pond embankments during extreme rainfall events.
- The Delegated Officer considers that there will be foreseeable overtopping, but these will most likely be in exceptional circumstances (only extreme rainfall events) and will likely be diluted by high volumes of rainfall runoff.
- Wastewater that enters the M1 Channel during Wet Season (including where an overtopping event has occurred) will not generally be required for irrigation purposes.
- The Licence Holder has submitted a groundwater analysis for the Premises which includes data on background and environmental and human health trigger levels.

8.7.7 Consequence

Environment

If overtopping occurs, then the Delegated Officer has determined that the environmental consequence will be medium on-site impacts primarily to threatened *Typhonium spp* and habitat. Therefore, the Delegated Officer considers the environmental consequence of overtopping to be **Moderate**.

Human Health

If overtopping occurs, then the Delegated Officer has determined that the health impact of overtopping will be minimal impacts to amenity on a local scale. Therefore, the Delegated Officer considers the health consequence of overtopping to be **Slight**.

8.7.8 Likelihood of Risk Event

Environment

The Delegated Officer has determined that adverse environmental impacts from overtopping may occur at some time. Therefore, the Delegated Officer considers the likelihood of adverse environmental impacts from overtopping to be **Possible**.

Human Health

The Delegated Officer has determined that adverse health impacts from overtopping will only occur in exceptional circumstances. Therefore, the Delegated Officer considers the likelihood of adverse health impacts from overtopping to be **Rare**.

8.7.9 Overall rating of Overtopping

Environment

The Delegated Officer has compared the consequence and likelihood ratings described above with the risk rating matrix (Table 25) and determined that the overall rating for the environmental risk from overtopping is **Medium**.

Human Health

The Delegated Officer has compared the consequence and likelihood ratings described above with the risk rating matrix (Table 25) and determined that the overall rating for the public health risk from overtopping is **Low**.

8.8 Risk Assessment – Seepage

8.8.1 Description of Seepage

The KWWTP receives a continuous inflow loading of sewage up to 2.0 MLD, subject to seasonal fluctuations.

The WWTP ponds are clay-lined. As with all clay-liners, slight seepage from the ponds at the KWWTP is expected to occur continuously. The rate of seepage at the WWTP will be subject to the hydraulic load within the ponds, permeability of the pond liner and nature of the surrounding geology (clayey soils as indicated in section 8.6 of the Decision Report).

There is no information on pond liner quality or permeability for any of the WWTP ponds. To date, no information has been submitted to quantify the suitability or integrity of the existing liner permeability of the ponds by the Licence Holder. The clayey soils in and around the WWTP can impact the direction of vertical and parallel seepage profiles. During the Dry Season October 2020 GME, groundwater in the shallow bore network was between 2.845 mbgl and 5.7 mbgl.

During the Wet Season April 2020 GME, groundwater in the shallow bore network was between 1.632 mbgl and 4.373 mbgl. Groundwater elevations were consistently higher in the (post) Wet Season GME when compared to the Dry Season GME with differences ranging between 0.137 m and 1.73 m.

The inferred groundwater contours indicate a northwesterly groundwater flow direction towards the M1 Channel. This is consistent with regional groundwater mapping.

8.8.2 Identification and general characterisation of emission

Generally, as the sewage proceeds through the treatment ponds, the concentration of contaminants decreases. There is potential for seepage at all treatment stages including from raw sewage.

With any clay liner, seepage is expected to occur at low levels occur continuously whilst the WWTP contains wastewater. Abnormal operating conditions may give rise to higher frequency and duration seepage emission events.

Sewage and sewage sludge wastes could contain metals, nutrients and other contaminants that may be mobilised within seepage generated from ponds containing sewage wastes. The nature of the containments within the seepage and interaction with the soil profile and hydraulic and biogeochemical processes will affect the distribution of containments within the unsaturated and saturated soils beneath the ponds and in groundwater.

8.8.3 Description of potential adverse impact from the emission

Groundwater near WWTP ponds is often contaminated with elevated concentrations of compounds in the form of ammonium-nitrogen. The risk of seepage also increases with the age of the WWTP.

The KWWTP and surrounding arboretum contain suitable soil types/habitat known to support the Threatened Flora Typhonium. The presence of Typhonium on site has been confirmed from previous targeted survey.

Soil contamination may inhibit vegetation growth or directly harm vegetation and cause health impacts to fauna.

Groundwater contamination may directly impact or inhibit the growth of groundwater dependant ecosystems and may impact the P1 public drinking water area 200m to the south.

The ESA groundwater investigation has identified seepage from the WWTP is occurring. The surrounding soils contain clayey sediments, which will reduce transmission rates of contaminants through soils and mitigate some contamination through sorption of ions on to clay

mineral surfaces.

The slow rate of groundwater flow in the area is likely to have limited the extent to which a contamination has migrated in groundwater at the WWTP. Noting the KWWTP is sited in an agricultural area where there is probably existing contamination of groundwater by nitrogen compounds due to fertilizer use the environmental risks associated with groundwater contamination from the KWWTP are likely to be low in a regional context.

8.8.4 Criteria for assessment

Relevant surface water quality criteria are provided in Table 8 and includes:

- ANZECC & ARMCANZ (2000) – Chapter 4 Primary Industries LTGV (Table 4.2.11) TN (5mg/L) and TP (0.05mg/L) respectively as the KWWTP been operational since 1969 (over 50 years);
- ANZECC 2000 95% species protection for freshwater (ANZG 2018) for recognition of the long-term irrigation activities in the ORIA;
- NPUG – DoH (2014) and HEPA (2020) and
- PFAS HEPA (2020) criteria ANZG (2018) 99% species protection.

8.8.5 Licence Holder controls

The Licence Holder has undertaken a site-specific groundwater assessment that included a monitoring programme utilising 10 groundwater monitoring bores (seven shallow, three deep). Two groundwater sample events have been undertaken in October 2020 and April 2021 to represent the (post) Dry and Wet Season, respectively. No previous groundwater monitoring had occurred at the premises.

The Licence Holder samples treated effluent from a sampling point within the Premises boundary either monthly or quarterly as required under Existing Licence conditions 3.2.1 Table 3.2.1, and prior to discharging to the M1 Channel.

A review of the previous 11 years submitted monitoring results is provided in Table 10 of the Decision Report. Section 6.7 of the Decision Report provides a detailed review of TWW monitoring including a review of the analytical data from the Reports.

This assessment has reviewed the controls set out in Table 32 below.

Table 32: Licence Holder's proposed controls for Seepage

Risk Event infrastructure controls	Risk Event operational controls
The KWWTP treats wastewater to a secondary standard operating a facultative pond system using two series (A and B) of primary, secondary, tertiary and quaternary ponds in parallel. The WWTP ponds are clay lined.	• Existing Quarterly monitoring of TWW. • Existing Surface water Quarterly monitoring of surface water at 50 m upstream, 225 m, 1 km and 6 km downstream from discharge point into M1 Channel. • Site-specific groundwater investigations and identification of contaminants of potential concern.

8.8.6 Summary review information for Seepage

Summary review information regarding Seepage is as follows:

- During the Dry Season October 2020 GME, groundwater in the shallow bore network was between 2.845 mbgl and 5.7 mbgl. During the Wet Season April 2020 GME, groundwater in the shallow bore network was between 1.632 mbgl and 4.373 mbgl.

Groundwater elevations were consistently higher in the (post) Wet Season GME when compared to the Dry Season GME with differences ranging between 0.137 m and 1.73 m. The inferred groundwater contours indicate a north-westerly groundwater flow direction towards the M1 Channel. This is consistent with regional groundwater mapping.

- For Nitrogen, TN exceeded the ANZECC 2000 LTGV at down-hydraulic gradient bore 05/20 and 06/20 by up to 4-fold across the seasonal range.
- For Phosphorus, TP marginally exceeded the ANZECC 2000 LTGV at bore 06/20 in the Dry Season GME only. TP and FRP variably exceeded the ANZECC 2000 FW across the seasonal range at the bores, except down-hydraulic gradient bore 03/20 and cross-hydraulic gradient bore 2/99.
- Ammonium nitrogen (NH3-N) exceeded the aesthetic EIL at cross-hydraulic bore 3/99 and down gradient bores 05/20 and 06/20 across the seasonal range. The greatest nutrient concentrations were consistently recorded in bore 05/20 and 06/20 which are adjacent to the secondary, tertiary and quaternary ponds.
- Nutrient concentrations within the deep and shallow bores showed some variability between the GMEs across the Seasons, however, there was no discernible trend.
- For Dissolved Metals no dissolved metal concentrations were detected above NPUG EILs except for aesthetic value for iron at bore 05/20 and 06/20 down-hydraulic gradient of the secondary, tertiary and quaternary ponds and 01D/20 up-hydraulic gradient of the WWTP. Zinc and copper variably exceeded the ANZECC 2000 FW EIL across the seasonal range, noting exceedances were not detected in background bore 01S/20. Iron concentrations exceeded the NPUG and ANZECC 2000 LTGV at bore 01D/20, 05/20 and 06/20. Manganese exceeded the ANZECC 2000 LTGV at bore 04/20, 05/20, 06/20 and 01D/20 by up to three-fold.
- For Major ions no major ions exceeded EILs, other than chloride. Chloride concentrations exceeded the aesthetic-based NPUG EIL at deep up-gradient bore 4/99 and deep cross-gradient bore 2/99.
- Enterococci concentrations ranged from below the LOR (1 orgs/100mL) to 21 orgs/mL at cross-hydraulic gradient bore 02/20. Enterococci concentrations were not compared with NPUG guidelines as the salinity across the bore network was <1% and therefore E. coli is a more appropriate indicator. E. coli concentrations in groundwater were generally at or below LOR (1 CFU/100 mL). E. coli concentrations were higher in the Dry Season October 2020 compared to the Wet Season April 2021. The highest concentrations were recorded at bore 02/20 and 03/20 in the western portion of the premises. E. coli exceeded the NPUG and ANZECC 2000 LTGV in the Dry Season GME only at bore 02/20 and 03/20. It is noted that E. coli was detected above the LOR and the EILs at the up-gradient bores 01S/20 and 01D/20 – both the deep and shallow bores.
- For PFAS, there were no health guideline exceedances in groundwater for PFAS during either GME. The FW 99% protection guideline was exceeded at all bores across the seasonal range for PFOA. No bore locations exceeded the guideline for 95% species protection.
- Nutrients concentrations of nitrogen species in down-hydraulic gradient bores where generally greater than background bore 1S/20 and particularly along the northern premises boundary (5/20 and 6/20) where concentrations of ammonia, ammonium and TN were comparable to those recorded in TWW. This indicates that although nitrogen species are present in ambient background conditions, it is possible the wastewater and TWW is leaking at some point in the treatment process train and contributing to down-hydraulic nitrogen concentrations.
- No consideration has been given to any potential groundwater mounding beneath the

WWTP, which is considered likely given there is evidence that the ponds are seeping.

- Like Nutrients, dissolved metal concentrations were greatest in the northern portion of the premises – bores 5/20 and 6/20, down-hydraulic gradient of the KWWTP.

8.8.7 Key findings

The Delegated Officer has reviewed the information regarding Seepage and has found:

- KWWTP pond infrastructure has not been upgraded since 1988 and DWER has not been made of any works relating to pond integrity or pond embankment.
- No information has been submitted regarding quality nor permeability of the existing clay pond liners. The WWTP was most likely constructed using in-situ soils, but no permeability coefficient has ever been provided or subsequently evaluated for the ponds.
- Concentrations of contaminants within bores immediately down hydraulic gradient of the KWWTP are comparable to concentrations of contaminants within TWW samples taken within the treatment ponds. This indicates that the ponds are seeping into underlying groundwater.
- The groundwater monitoring network does not extend beyond the premises boundary down hydraulic gradient of the WWTP ponds. This indicates that there is no information available regarding how potential contaminants will migrate through groundwater.
- The KWWTP and surrounding arboretum contain suitable soil types/habitat known to support the Threatened Flora Typhonium. The presence of Typhonium on site has been confirmed from previous targeted survey.
- Local soils are typically 'Black Soils' which are generally low permeability soils, but the permeability is highly variable.
- The KWWTP falls within 200 m of a Priority 1 Public Drinking Water Source Area (P1 area) and RIWI Groundwater area, Canning – Kimberley Groundwater area and RIWI Surface Water Area and Irrigation Districts – Ord Irrigation Area. Depth to groundwater in the P1 area is 6m.
- At the Kununurra town water supply bore field within the P1 area the groundwater system is comprised of an unconfined alluvial aquifer. The main source of recharge to the alluvial aquifer is from Lake Kununurra and minor recharge from the M1 Channel.
- Two sampling events have been undertaken in October 2020 and April 2021 to represent the (post) Dry and Wet Season respectively. Two sampling events are not considered to provide sufficient information to draw accurate conclusions as to the WWTP's potential impact to groundwater contamination.
- Given that only who groundwater sampling events have ever been undertaken at the premises, there is a need to continue groundwater monitoring to quantify assumptions made as to groundwater contamination at the premises. The groundwater monitoring bore network will also need to be sufficient to adequately track groundwater contamination down hydraulic gradient of the premises.

8.8.8 Consequence

Environment

The Delegated Officer has determined that the environmental consequence of seepage will be mid-level onsite impacts, most notably to onsite/adjacent Typhonium plants and habitat. Therefore, the Delegated Officer considers the consequence of seepage to be **Moderate.**

Human Health

The Delegated Officer has determined that the public health consequence of seepage will be minimal impacts to amenity at a local scale. Therefore, the Delegated Officer considers the consequence of seepage to be **Slight.**

8.8.9 Likelihood of Risk Event

Environment

The Delegated Officer has determined that adverse environmental impacts from seepage could occur. Therefore, the Delegated Officer considers the likelihood of adverse impacts from seepage to be **Possible.**

Human Health

The Delegated Officer has determined that adverse public health impacts from seepage will probably not occur in most circumstances. Therefore, the Delegated Officer considers the likelihood of adverse impacts from seepage to be **Unlikely.**

8.8.10 Overall rating of Seepage

Environment

The Delegated Officer has compared the consequence and likelihood ratings described above with the risk rating matrix (Table 25) and determined that the overall rating for the environmental risk of seepage is **Medium**.

Human Health

The Delegated Officer has compared the consequence and likelihood ratings described above with the risk rating matrix (Table 25) and determined that the overall rating for the risk of seepage is **Low**.

8.9 Summary of acceptability and treatment of Risk Events

A summary of the risk assessment and the acceptability or unacceptability of the risk events set out above, with the appropriate treatment and control, are set out in Table 33 below. Controls are described further in section 11.

Table 33: Risk assessment summary

	Description of Risk Event			Applicant controls	Risk rating	Acceptability with controls (conditions on instrument)
	Emission	Source	Pathway/ Receptor (Impact)			
1.	Odour	Treatment ponds	Air / wind dispersion Amenity impacts causing nuisance	Sitting and Infrastructure Controls – refer to Table 28.	Slight consequence Unlikely likelihood **Low Risk**	Acceptable subject to Licence Holder controls.

	Description of Risk Event			Applicant controls	Risk rating	Acceptability with controls (conditions on instrument)
	Emission	**Source**	**Pathway/ Receptor (Impact)**			
2.	Discharge to Surface Water M1 Channel Dry and Intermediate Season irrigation period	Treatment ponds	Direct discharge to surface waters. Surface water contamination (nutrient loading, metals, heavy metals and PFAS) inhibiting vegetation growth and survival. Human health.	Operation, monitoring and Infrastructure Controls – refer to Table 29.	Environment Minor consequence Unlikely likelihood **Medium Risk** Human Health Minor consequence Unlikely likelihood **Medium Risk**	Acceptable subject to proponent controls conditioned / outcomes-based controls
3.	Discharge to Surface Water Wet Season Lower Ord River non-irrigation period	Treatment ponds	Surface water contamination (nutrient loading, metals, heavy metals and PFAS) inhibiting vegetation growth and survival	Operation, monitoring and Infrastructure Controls – refer to Table 30	Environment Minor consequence Rare likelihood **Low Risk** Human Health Slight consequence Rare likelihood **Low Risk**	Acceptable subject to Licence Holder controls.
4.	Overtopping of Ponds	Treatment ponds	Direct discharge to Surface water and soils. Indirect seepage to groundwater. Contamination (nutrient loading, metals, heavy metals and PFAS) inhibiting vegetation growth and survival and aquatic ecosystems.	Operation, monitoring and Infrastructure Controls – refer to Table 31	Environment Moderate consequence Possible likelihood **Medium Risk**	Acceptable subject to proponent controls conditioned / outcomes-based controls
					Human Health Slight consequence Rare likelihood **Low Risk**	Acceptable subject to Licence Holder controls.

	Description of Risk Event			Applicant controls	Risk rating	Acceptability with controls (conditions on instrument)
	Emission	**Source**	**Pathway/ Receptor (Impact)**			
5.	Seepage from Ponds	Treatment ponds	Seepage: lateral and vertical subsurface migration of leachate to groundwater. Groundwater contamination (nutrient loading metals, heavy metals and PFAS) inhibiting vegetation growth and survival.	Operation, monitoring and Infrastructure Controls – refer to Table 32	Environment Moderate consequence Possible likelihood **Medium Risk** Human Health Slight consequence Likely likelihood **Medium Risk**	Acceptable subject to Licence Holder controls conditioned / outcomes-based controls.

9. Regulatory controls

A summary of regulatory controls determined to be appropriate for the Risk Event is set out in Table 34. The risks are set out in the assessment in section 10 and the controls are detailed in this section. DWER will determine controls having regard to the adequacy of controls proposed by the Licence Holder. The conditions of the Proposed Licence will be set to give effect to the determined regulatory controls.

Table 34: Summary of regulatory controls to be applied

		Controls (references are to sections below, setting out details of controls)						
		10.1.1 Waste Acceptance	**10.1.2 Waste Processing**	**10.1.3 Infrastructure and equipment**	**10.1.4 Emissions and discharges**	**10.1.5 Monitoring**	**10.1.6 specified action**	**10.1.7 Reports**
Risk Items (see risk analysis in section 8)	**Odour**	●	●	●	●	●		●
	Surface water M1 Channel Dry Season irrigation period	●	●	●	●	●		●
	Surface water M1 Channel Intermediate period	●	●	●	●	●		●
	Surface water M1 Channel Dry Season irrigation period	●	●	●	●	●		●
	Overtopping	●	●	●	●	●		●
	Seepage	●	●	●	●	●	●	●

9.1.1 Additional controls

The Delegated Officer has determined that the following controls will be incorporated into Licence conditions as a result of the detailed risk assessment:

- The frequency of monitoring of the TWW discharges to the M1 channel has increased from quarterly to monthly. This will ensure that a larger quantity of data is obtained from sampling, with data having a greater capacity to account for seasonal variability.
- Boron, Sucralose and Caffeine have been added to the surface water parameter monitoring schedule for the TWW discharge to the M1 channel, as these parameters are specific to TWW waste streams and will act as ‘fingerprint’ markers to track TWW as it moves through the M1 channel post discharge. The inclusion of these parameters will also assist in validating whether the mixing zone determined in the WSWQA is appropriate.

- The ambient surface water monitoring schedule has been updated to incorporate 11 new surface water sampling locations, including sampling locations along the D1 channel and within the Lower Ord River. This expansion of the ambient surface water monitoring requirements will provide more robust data for determining how contaminants from TWW will migrate through the M1 channel.
- Boron, Sucralose and Caffeine have been added to the ambient surface water parameter monitoring schedule for the TWW discharge to the M1 channel, as these parameters are specific to TWW waste streams and will act as 'fingerprint' markers to track TWW as it moves through the M1 channel post discharge. The inclusion of these parameters will also assist in validating whether the mixing zone determined in the WSWQA is appropriate.
- Loading rate calculations for Boron, Sucralose and Caffeine will be required to be submitted to DWER in the Annual Environmental Report for TWW discharges to the M1 channel. As these parameters are specific to TWW, the submission of this data will allow DWER to compare:
    - Concentrations of Boron, Sucralose and Caffeine initially discharged to the M1 channel to concentrations of other contaminants of potential concern initially discharged to the M1 channel, with:
    - Concentrations of Boron, Sucralose and Caffeine within surface water samples taken along the M1 and D1 channels to other contaminants of potential concern within surface water samples taken along the M1 and D1 channels; and
    - How the concentrations of all contaminants changes with distance.

  This will allow DWER to use Boron, Sucralose and Caffeine as a de-facto measure of what would be an acceptable degree of dilution of the WWTP discharges to ensure protection of downstream environmental receptors.
- One (1) additional groundwater bore will be required to be installed down hydraulic gradient from the Premises to complement the existing bore network. The placement of this bore will assist in understanding how contaminants from the premises are migrating through groundwater. Additionally, the bore should be placed an adequate distance from the premises to not be impacted by groundwater mounding, which is assumed to be occurring due to the ponds seeping.
- New groundwater monitoring conditions have been incorporated into to the licence to sample, assess and understand groundwater contamination.
- Boron, Sucralose and Caffeine have been included within groundwater monitoring conditions, as these parameters will act as 'fingerprint' markers to track contamination from TWW within the WWTP as it moves through the groundwater pathway.
- A surface and groundwater monitoring report will be required to be submitted to provide an overview of the results obtained from the expanded surface and groundwater monitoring programs.
- As the surface and groundwater monitoring report will be required to be informed by several years monitoring data, the licence duration will be extended by two years to 31 October 2028 so that this monitoring can be undertaken.
- A seepage rate test and subsequent report will be required to be undertaken and submitted. The report will require an assessment of seepage and estimations of TN and TP emissions from the WWTP ponds, and estimation of separation distance from the base of the ponds to groundwater and relevant data as required by the condition. The report will also require the Licence holder to identify any corrective actions to rectify seepage from specific ponds.

10.1 General Licence controls within conditions

10.1.1 Licence Duration

The Licence duration has been extended by two years until 31 October 2028 to ensure monitoring can be undertaken to inform the submission of reports.

10.1.2 Waste Acceptance

Licence condition 1 requires that all wastewater acceptance is through the sewer inflow only.

10.1.3 Waste processing

Licence condition 2 subjects the Licence Holder to treatment of sewage and septage waste at or below 2000 m^3/day (2 MLD).

Any sludge that is generated at the WWTP must be processes at per Table 2.

10.1.4 Infrastructure and equipment

Licence condition 3 requires that all waste at the Premises is managed in accordance with the containment infrastructure as outlined in Table 3.

Licence condition 4 requires the licence holder to maintain and operate all ponds to ensure there is no overtopping unless in an extreme rainfall event which is defined in the Licence Definitions. A freeboard of 200 mm must be maintained for all ponds. At the KWWTP duckweed is allowed within the ponds.

Licence condition 5 ensure the Licence Holder maintains adequate security measures at the Premises.

10.1.5 Emissions and discharges

Licence condition 6 ensures TWW is discharged to surface water within the M1 Channel in accordance with Table 4.

10.1.6 Monitoring requirements

Licence condition 7 requires the Licence Holder to collect and analysis water and wastewater samples in accordance with respective Australian Standards and submitted to a NATA accredited laboratory.

Licence condition 8 defines monitoring frequency as required under the licence.

Licence condition 9 sets requirements for monitoring equipment calibrations.

Licence condition 10 must report to the CEO any issues with calibration.

Licence condition 11 outlines monitoring of point source emissions to surface water as listed in Table 5 and provides respective emission points, locations, parameters and method. Frequency has been amended to monthly to collect data representative of the Flow Regimes. Additional parameters (Boron, Sucralose and Caffeine) have been added to the Parameters as these parameters are uniquely representative (Fingerprints) of WWTP discharges that can aid in tracking pathway movements and thus likely impacts upon receptors in the environment.

Licence condition 12 outlines monitoring of inputs and outputs.

Licence condition 13 outlines ambient surface water monitoring as required under Table 7. New

surface water sample locations are provided in line with the Review recommendations.

Licence condition 14 outlines the requirement to construct one (1) new groundwater bores down-gradient as part of the new ambient groundwater monitoring as required in Table 8.

Licence condition 15 requires the submission of a monitoring well construction report to be submitted with 60 days of being constructed.

Licence condition 16 outlines the new ambient groundwater monitoring regime as listed under Table 9.

10.1.7 Specified actions

Licence condition 17 is a new condition which outlines the requirement for a specified action to assess WWTP pond seepage. The Licence Holder has not been able to submit permeability data for the WWTP ponds and the data suggests there is seepage from the WWTP ponds as outlined in section 9.9 Risk assessment.

Licence condition 18 requires the submission of a seepage rate report within one month of completion of seepage rate testing as required under condition 17.

10.1.8 Reports

Licence condition 19 requires that all records must be legible and retained for 6 years.

Licence condition 20 requires the Licence Holder to submit an Annual Audit Compliance Report in the approved manner.

Licence condition 21 outlines the requirement of complaints management.

Licence condition 22 outlines the requirement of the submission of an AER. Table 11 outlines all the information required to be submitted in the AER in line with the new licence conditions drafted onto the Licence under the Review.

Licence condition 23 requires the Licence Holder to submit a surface water and groundwater Report after three years of monitoring. The Report will contain monthly data from the specified monitoring locations and parameters throughout the three (3) Flow regimes as outlined in section 6.1 of the DR (Wet Season non-irrigation period, Dry Season irrigation period and Intermediate period) which can then be collated to form a more comprehensive understanding of contaminant discharges, pathways and receptors in relation to TWW discharges to the environment and human health - which should address the outstanding Data Gaps. Following review of the Report, and depending on the results, the Licence may be amended to reflect the WWTP operations.

Licence condition 24 requires the AER report must contain an assessment of the information against previous monitoring results.

Licence condition 25 outlines non-annual reporting requirements as required under Table 12.

Licence condition 26 outlines notification requirements as required under Table 13.

10.2 Revised Licence L6270/1991/10

During the assessment of this Licence Reivew, the Licence Holder submitted a subsequent Licence Amendment Application on 30 June 2023 to amend the AER and AACR submission dates. The licence amendment was granted by DWER on 29 August 2023. Under this amendment the Licence was converted to the current format in use by DWER .Section 4.1 Table 2 of theAmendment Report accompanying the Amended Licence granted on 29 August 2024 outlines the conversion of the licence into the new format and the amendment of licence conditions in detail.

Table 35 below outlines the amendments proposed as a result of the Licence Review. A copy

of the Existing Licence is provided in Attachment 2 of this Decision Report.

Table 35: Amendment Table

New Conditions	Proposed Licence Conditions
11	Addition of Boron, Sucralose and Caffeine to the point source emissions
13	New Ambient surface water monitoring replaces existing surface water monitoring.
14	Ambient groundwater monitoring -construction of one (1) new groundwater monitoring bore – one down-hydraulic gradient.
15	Monitoring bore construction report for the new down-hydraulic gradient bore
16	Ambient groundwater monitoring
17	Specified actions – Seepage testing of the WWTP ponds
18	Specified actions – Seepage rate report
22	Addition of monitoring data within the Annual Report
23	Surface water and groundwater monitoring report submitted 2027
Schedule 1 Maps	New: • Surface water map; and • Groundwater and additional Bore Map

10. Determination of Revised Licence conditions

The conditions in the issued Proposed Licence in have been determined in accordance with the *Guidance Statement: Setting Conditions*.

The *Guidance Statement: Licence Duration* has been applied and the Proposed Licence expires on 31 October 2026.

Table 36 provides a summary of the conditions to be applied to this Proposed Licence.

Table 36: Summary of conditions to be applied

Condition Ref	Grounds
Waste Acceptance Condition 1	This condition is valid, risk-based and consistent with the EP Act.
Waste Processing Condition 2	These conditions are valid, risk-based and enable flexibility in operations.
Infrastructure and Equipment Conditions 3, 4 and 5	These conditions are valid, risk-based and contain appropriate controls.
Emissions and discharges Conditions 6	These conditions are valid, risk-based and consistent with the EP Act.
Monitoring Conditions 7, 8, 9, 10, 11, 12, 13, 14, 15 and 16	These conditions are valid, risk-based and consistent with the EP Act.
Specified actions Conditions 17 and 18	These conditions are valid, risk-based and consistent with the EP Act.

Condition Ref	Grounds
Records and reporting 19, 20, 21, 22, 23, 24, 25 and 26	These conditions are valid and are necessary administration and reporting requirements to ensure compliance.

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

11. Applicant's comments

The Licence Holder was provided with the draft Decision Report and Proposed Licence on 12 December 2023. Comments were due 12 January 2024, but the Licence Holder requested an extension until 8 March 2024. The Licence Holder provided comments on the draft documents on 8 March 2024 which are summarised, along with DWER's response, in Appendix 3 Table 37.

DWER subsequently sent the Licence Holder a second Draft decision Report and Proposed Licence on 4 April 2024. Comments were due 29 April 2024. The Licence Holder requested an extension until 28 June 2024 and then a further extension until 5 July 2024. The Licence Holder provided comments on the draft documents on 5 July 2024 which are summarised, along with DWER's response, in Appendix 3 Table 38

DWER attended the Premises on Thursday 8 August 2024 to validate the groundwater bore network.Subsequently, DWER sent the Licence Holder an email on 15 August 2024 requesting minor additional information. The Licence Holder provided this informationon 23 August 2024. Appendix 3 Table 39 outlines the Licence Holder final comments and DWER response.

12. Conclusion

This assessment of the risks of activities on the Premises has been undertaken with due consideration of a number of factors, including the documents and policies specified in this DR (summarised in Appendix 1).

Based on this assessment, it has been determined that the Issued Licence will be granted subject to conditions commensurate with the determined controls and necessary for administration and reporting requirements.

Grace Heydon

Digitally signed by Grace Heydon
Date: 2024.11.27 15:19:02 +08'00'

Grace Heydon
Delegated Officer
under section 20 of the *Environmental Protection Act 1986*

Appendix 1: Key documents

	Document title	In text ref	Availability
1.	Licence L6270/1991/10 – Kununurra Wastewater Treatment Plant	L6270/1991/10	accessed via https://www.der.wa.gov.au/our-work/licences-and-works-approvals/current-licences
2.	Wastewater and Surface Water Quality Assessment – Kununurra Wastewater Treatment Plant (Senversa 2022b)	W&SWQA	DWER records (DWERDT600255)
3.	Environmental Site Assessment – Water Corporation Kununurra Treatment Plant (Senversa 2022a)	Environmental Site Assessment	DWER records (DWERDT600155)
4.	DER, October 2015. *Guidance Statement: Setting conditions*, Perth.	DER 2015b	accessed via https://www.dwer.wa.gov.au/regulatory-documents
5.	DER, August 2016. *Guidance Statement: Licence duration*, Perth.	DER 2016a	
6.	DWER, October 2019, *Procedure: Prescribed premises works approval and licence*, Perth, Western Australia	DWER 2019	
7.	DWER, December 2020, *Guideline: Decision Making*, Perth, Western Australia.	DWER 2020a	
8.	DWER, December 2020, *Guideline: Environmental siting*, Perth, Western Australia.	DWER 2020b	
9.	DWER, December 2020. *Guideline: Regulatory principles*, Perth, Western Australia.	DWER 2020c	
10.	DWER, December 2020, *Guideline: Risk Assessments*, Perth, Western Australia.	DWER 2020d	

Appendix 2: Summary Stakeholder comments during consultation period

DWER consulted with the following Organisations or Government Departments in accordance with section 54 of the EP Act as DWER considered they may have a direct interest in the subject matter of the Review and invited comment on the proposal.

- DWER sent a letter dated 24 September 2020 to SWEK requesting advice / comment on the Review by 16 October 2020. A written submission from SWEK was received on 14 October 2020.
- DWER sent a letter dated 24 September 2020 to DoH requesting advice / comment on the Review by 16 October 2020. A written submission was provided on 13 November 2020. DWER requested additional advice/comments from DoH on 13 November 2021.
- DWER sent a letter dated 24 September 2020 to DPIRD requesting advice / comment on the Review by 16 October 2020. A written submission was provided on 13 October 2020. DWER request further clarification from DPIRD in relation to their comment dated 4 June 2021. No response was provided.
- DWER sent a letter dated 24 September 2020 to DBCA requesting advice / comment on the Review by 16 October 2020. DBCA requested an extension and subsequently provided a response on 28 October 2020.
- DWER sent a letter dated 24 September 2020 to OIC requesting advice / comment on the Review by 16 October 2020. OIC requested an extension on 1 October 2020 to provide comment and an extension was granted until 15 January 2021. OIC provided a written submission on 15 January 2021.

Concern	Submitter	Summary of comments	DWER response
DWER advertised the Review on 9 November 2020 seeking public comments. Submissions were open for 21 days and closed 30 November 2020. DWER received no public comments.			
General Advice	DoH	DoH comments submitted 13/11/2020: • DoH does not consider the discharge of treated wastewater from the Kununurra WWTP a reuse scheme. Downstream environmental discharge water is used by the Ord River Orchard for irrigation and therefore treated wastewater quality shall comply with ANZECC/ARMCANZ 2018 irrigation guidelines before discharge to the M1 channel.	Whilst DWER encourages Water Corporation to consider upgrades to water treatment quantity at the premises, the EP Act licensing review process is an evidence-based assessment on public health and environmental risks presented to receptors. In that context, DWER is required to consider risks and impacts associated with water quality at the receptor location rather than at the point of discharge.

Concern	Submitter	Summary of comments	DWER response
		• It is also recommended that an Operational and Maintenance agreement between the Water Corporation and the Ord Irrigation Cooperative to ensure adequate wastewater dilution on the M1 channel at all times in order to achieve consistent fit for purpose water quality for irrigation.	
General Objection/Concern	DPIRD	DPIRD is concerned about the risk to agricultural production from the Ord irrigation Area due to diluted wastewater being used to irrigate food crops and provides the following points for the licence review: • The KWWTP currently releases treated wastewater into the M1 irrigation supply channel in the Ord Irrigation Area. • The Water Corporation (WC) owns and operates the WWTP and the M1 irrigation channel. DPIRD understands that WC treats the outflow from WWTP with chlorine before its release into the channel. • Outflow from the WWTP is discharged all year round. This can be more of a problem in the wet season when channel is empty. • The OIC supplies water to farms in the irrigation (dry) season and maintains the supply infrastructure. During the wet season, OIC flushes the channel to remove discharged wastewater. • DPIRD understands that the OIC has previously advised your department of its concerns that pathogens and nutrients in the irrigation channel are due to treated wastewater discharge and that this practice poses a health risk to farmers, contamination risks to crops, and reputational risks to production on the ORIA. • DPIRD is concerned about the reputation and risks to domestic and possible export market access for agricultural production from the ORIA due to diluted wastewater being used to irrigate food crops. • The ORIA has an established horticultural production of $30 million per year. • Australia's five leading grocery retailers (ALDI, Coles, Costco, Metcash (IGA) and Woolworths) have had different food safety system requirements of their vendors. These retailers have	DWER has assessed risk to human health and agricultural production from Treated Wastewater Discharges to the M1 channel in this report. DWER's assessment Is an evidence-based assessment on risks to public health and the environment from emissions and discharges. As such, reputational and perceived risks are not able to be considered under the EP Act licensing processes. Independent of the licence, it is anticipated that DPIRD and other stakeholders will continue to engage directly with Water Corporation towards a resolution of any concerns outside the remit of the EP Act. Given the similarity of the contaminant profile from TWW to inputs from surrounding agricultural industry DWER has included additional 'fingerprinting' contaminant monitoring in surface and groundwater to better identify the degree that TWW may be contributing to contamination in irrigation and discharged water past the mixing zone. DWER requested further clarification from DPIRD in relation to their comment dated 4 June 2021, including further information on the Freshcare standard. No response was provided.

Concern	Submitter	Summary of comments	DWER response
		committed to the Harmonised Australian Retailer Produce Scheme (HARPS). The Scheme is voluntary and open to those who perform the following activities: ▪ Grow produce for retail sale ▪ Pack produce for retail sale ▪ Operate as an aggregator, distributor, broker or agent supplying produce for retail sale ▪ Are a direct supplier, a subcontract supplier or a co-packer. • The grocery retailers have all agreed to accept a suite of standards, including the Freshcare Food Safety and Quality Code of Practice, which specifies good agricultural practice on-farm. • The Freshcare Food Safety and Quality Standard – Edition 4.1 (FSQ4.1) was released in July 2019 and businesses have been required to transition to FSQ4.1 from January 2020. • FSQ4.1 includes compliance standards for pre-harvest water to minimise the risk of contaminating produce (F6.2) which refers to the 2008 Australian Guidelines for Water Recycling: Augmentation of drinking water supplies. • Safe food is essential for human health. There have been disease issues in other areas on Australia with horticulture crops for example the March 2018 outbreak of listeria in rockmelons in NSW. Demand for the product decreased 90% across the country including from the ORIA. Food safety experts say it may take years for consumers to regain confidence in the rockmelon industry after the listeria outbreak.	
General advice	DBCA	• The wastewater treatment plant (WWTP) and surrounding arboretum contain suitable soil types/habitat known to support the Threatened Flora *Typhonium* sp. Kununurra (Typhonium). Furthermore, the presence of Typhonium on site has been confirmed from previous targeted survey. However, the overall distribution, extent and location of both the soil types/habitat and Typhonium in this area are	DWER has included Typhonium as a potential sensitive receptor and considered impacts to onsite and adjacent Typhonium and species in assessing impacts from seepage to groundwater and from overtopping events.

Concern	Submitter	Summary of comments	DWER response
		poorly known. Any proposed works that may impact this soil type/habitat will need to be assessed and quantified, considering both direct and indirect impacts, in order to determine whether they may proceed with written consent of the Minister. • Please note that a strategic review is currently being undertaken for this species in the East Kimberley with the objective to secure the long-term survival of Typhonium and de-risk future agricultural and associated infrastructure development in the East Kimberley. • As per our letter to you in February 2016, it was noted in the works approval application that the M1 Channel is not a natural environment and that it is a man-made irrigation channel used for irrigation purposes and as such, the Water Corporation does not consider its operations as discharging directly to natural surface waters. Furthermore, the Hydrobiology Environmental Assessment states comparison to water quality guidelines for aquatic ecosystem protection are not relevant under these conditions and that aquatic ecosystem guidelines are referenced for information purposes only and are not recommended for management targets within the M1. The Department, however, is concerned with the water quality entering the M1 channel as it ultimately enters the lower Ord River and consequently flows downstream to the Ord River Floodplain, a Ramsar listed site of international importance under the EPBC Act. • The Ord River Floodplain Ramsar site meets seven of the nine Ramsar criteria by having the following attributes: ▪ The best representative of wetlands associated with the floodplain and estuary of a major tropical river system in Western Australia. ▪ Supports nationally listed threatened species – Freshwater Sawfish (*Pristis microdon*), Green Sawfish (*Pristis zijsron*), Northern River Shark (*Glyphis garricki*) and Australian Painted Snipe (*Rostratula australis*). ▪ The site includes the most biologically diverse, contiguous floodplain and mangroves system in Western Australia.	Advice on the contamination and bioaccumulation from agricultural chemicals and pesticides is noted. DWER has added additional surface water monitoring of the Lower Ord to better differentiate likely impacts of TWW contaminant to the ecosystems of the Lower Ord River as opposed to contamination from agricultural and other sources. DWER has also added groundwater monitoring conditions to the licence and an additional 'downstream' bore to the monitoring bore location. This new groundwater monitoring requirement will provide more data and understanding on groundwater impacts in the environment surrounding the WTP and M1 Channel. DWER has added a new licence condition requiring a surface water and groundwater monitoring report which is due to be submitted in 2027. The report will provide data on surface water and groundwater which will then be required to be assessed against relevant assessments levels for water.

Concern	Submitter	Summary of comments	DWER response
		▪ Supports species and communities during critical life stages including 32 bird species listed as migratory under the EPBC Act, fish migrating between salt and freshwater, species seeking drought refuge and breeding species (birds, crocodiles and fish). In good rainfall years, Parry Lagoons and other seasonal wetlands constitute one of the major breeding areas for waterbirds in the Kimberley region. ▪ Regularly supports greater than 20,000 waterbirds. ▪ Maximum counts for at least two bird species (Plumed Whistling Duck (*Dendrocygna eytoni*) and Little Curlew (*Numenius minutus*)) exceed the 1% population thresholds. ▪ Nursery, breeding and feeding ground for at least 50 species of fish as well as being a migratory route for 15 fish species. • The existing irrigation around Kununurra and other sources of flow into the Ord River, including water and the associated compounds from the M1 channel, have already had impacts to the water quality found downstream. There is a moderate to high risk from increased levels of nutrients and pesticides from irrigation drainage to the ecology of the lower Ord River (Ecological Character Description of the Ord River Floodplain Ramsar site, Hale 2008). There are already records of concentrations of two agricultural chemicals exceeding guideline levels. In addition, fish kills have been observed and there is evidence of bioaccumulation of pesticides in Barramundi (Lates calcarifer) and Freshwater Crocodiles (Crocodylus johnstoni). Nutrient leaching may also cause eutrophication. • The Department therefore recommends that given the connectivity of the M1 channel it is treated as natural surface water with ANZECC & ARMCANZ (2000) water quality guidelines being used as a measure for water entering the M1 channel. • The works approval application and Hydrobiology Environmental Assessment also state: ▪ During no-flow and “flushing” periods the water quality in the M1 can deteriorate with high nutrient levels, low dissolved oxygen, bacterial growth and a range of other parameters being of	

Concern	Submitter	Summary of comments	DWER response
		concern with respect to aquatic ecology and potentially human health. The practice of flushing the system after periods of no-flow in the M1 is likely to cause periodic discharges of low-quality water to the Ord River downstream of the ORIS where ecological values need to be considered. In this case management of M1 flows to allow a constant minimum dilution and constant discharge and/or direct WWTP discharge to the Ord River would promote a better environmental outcome than the present system of storage and flushing. • The Department supports the option of a more constant M1 flow to avoid discharges of highly contaminated water into the Ord River.	
General objection	SWEK	• The residents of Kununurra are extremely concerned that the Water Corporation is 'licensed' to discharge wastewater from the Kununurra Wastewater Treatment Plant directly into the Ord Irrigation Area's M1 irrigation channel. On many fronts this is unacceptable and should not be allowed to continue. • As background I would like to point out that following a study on the impact of the management and operation practices in the Ord River Irrigation Area (which included a close scrutiny of the impact of the discharge from the Kununurra wastewater treatment plant and the CSR sugar mill on water quality), undertaken by the Edith Cowan University's Centre for Ecosystem Management, the then Water Minister Hon Kim Hames stated on 1 May 1998: "…the Water Corporation accepted the report's finding that the discharge of wastewater from the Kununurra wastewater treatment plant into the M1 supply channel was contributing to pollution in the channel.' • The Minister further stated "…(the Corporation) hopes to stop discharging to the channel within the next two years." • It beggar's belief that the Water Corporation, having acknowledged that such discharge into the irrigation channel were to stop some 20 years ago, is still being 'allowed' to continue this discharge. Surely, the environmental regulations now are more stringent than it was some 20 years ago. It is therefore about time the Regulator took a	DWER's assessment is an evidence-based assessment on risks to public health and the environment from emissions and discharges. The review has considered a comprehensive analysis of all available and current information. Perceived and economic risks are not able to be considered under the EP Act licensing processes. Independent of the licence, it is anticipated that SWEK and other stakeholders will continue to engage directly with Water Corporation towards the resolution of any concerns outside the remit of EP Act Whilst this licence review is predicated on an assessment of the acceptability of TWW discharge to the M1, DWER has no role in directing any agency regarding the reuse of treated wastewater. It is also noted that some of the proposed reuse areas are proximal to Priority 1 Public Drinking Water Source Areas which may require additional consideration in terms of risk and acceptability. DWER would be able to assist the Licence Holder and SWEK in discussing appropriate reuse options and approval pathways.

Concern	Submitter	Summary of comments	DWER response
		firm stand on this issue. • The Shire has engaged constructively with Water Corporation staff on numerous occasions over the last few years to encourage the Corporation to divert the discharge on to the Lake Kununurra Golf Course and to watering the road verges from the airport into the town. However, these discussions have been fruitless, due to Water Corporation's often stated view that they are complying with their "licence conditions". Their view is that they will only remove the discharge into the channel if: 1. The Corporation is directed to do so by the Regulator; and/or 2. The Government directs them to do so. • The Shire has also pointed out the severe impact on the economy of the region, should it be known to the region's markets/customers that wastewater is being discharged into the irrigation channel. Such impacts could include: ▪ Loss of access to markets. It could take many years to recover such markets/customers. The worst-case scenario would be that we never regain such markets ▪ Devastation of the East Kimberley economy, and ▪ Reputational damage to Australia's 'clean, green' image. • We would also like to point out that irrespective of the licence conditions, should, for example, an outbreak of listeria were to occur, the wastewater will be blamed for such an outbreak. It is a perception issue that could also lead to market loss. • The consequences of any market loss/reputational damage on our local economy could result in businesses seeking legal redress through, for example, class actions(s). Such legal actions many have implications not only for the Water Corporation, but for the WA Government and the Regulator. • The Shire has also tried to discuss with the Corporation its 'social licence' obligations. However, it is apparent that the Corporation	

Concern	Submitter	Summary of comments	DWER response
		neither understands nor cares about its "social" obligations. Its view always has been, and more recently emphatically delivered to the Shire, is that "it is operating within its licence conditions". It should be remembered that the recent destruction of Aboriginal heritage in WA, although legally compliant, has not protected the company responsible for the destruction from adverse outcomes due to its "social licence" obligations. • The Shire wishes to lodge a very strong objection to the Water Corporation's licence to discharge wastewater into the M1 channel. The Shire understands that while it is unreasonable to expect the Water Corporation to immediately stop discharges into the channel, the Shire believes that the Water Corporation be given no more than eighteen (18) months to cease discharging wastewater from the Kununurra Treatment Plant into the M1 channel. The Shire believes this is more than ample time for the Corporation to identify and develop alternative wastewater discharge areas – particularly when the discharge into the channel was to cease in 2000.	
General Objection/Concern	OIC	OIC employed a consultant to review the Existing Licence L6270/1991/10 to respond to the Review. OIC provided six key issues with DWER outlined as a Summary of Recommendations as detailed below: 1. DWER, during their risk assessment, include consideration that WWTP discharges meets industry standards for food safety certification that apply to downstream; 2. That appropriate consideration is given to the required controls to mitigate the potential for discharge of potentially contaminated M1 Channel water directly to the lower Ord River, in line with acceptable industry standards such as ANZECC guidelines; 3. That any modelling of dilution presented by the Water Corporation, to assess pollution risk, should consider flow regimes under various scenarios, including the scenario that the OIC does not actively dilute the Channel;	DWER has conducted a detailed risk assessment under this Review and considered all environmental emissions, receptors and potential adverse effects in accordance with DWERs Risk Assessments Guidance Statement (refer to Appendix 1 Key Documents). It is noted that due to the comparison of fully mixed TWW in the M1 channel and downstream water quality in the D1, contamination from agricultural and other inputs is likely occurring prior to discharge to the Lower Ord. DWER has added additional surface water 'fingerprinting' parameter monitoring of the M1, D1 and Lower Ord to quantify potential significance of TWW contaminants in downstream discharges and to differentiate TWW inputs from agricultural inputs. DWER has also added groundwater monitoring

Concern	Submitter	Summary of comments	DWER response
		4. The analysis of alternatives to discharge to the M1 Channel are appropriately assessed; 5. Apply appropriate licence discharge limits and trigger values for action that protect the interests of downstream water users and the environment; and 6. Review WWTP performance and include appropriate performance limits on WWTP discharge such that identified standards for discharges can be met.	conditions to the licence and an additional 'downstream' bore to the monitoring bore location. This new groundwater monitoring requirement will provide more data and understanding on groundwater impacts in the environment surrounding the WWTP and M1 Channel. DWER has added a new licence condition requiring a surface water and groundwater monitoring report which is due to be submitted in 2026. The report will provide data on surface water and groundwater which will then be required to be assessed against relevant assessments levels for water.

Appendix 3: Summary of Licence Holder comments on risk assessment and draft conditions

The Licence Holder was provided with the draft Decision R and draft Licence on 12 December 2023. Comments were due 12 January 2024, but the Licence Holder requested an extension until 8 March 2024. The Licence Holder did provide comments on the draft documents on 8 March 2024. Table 37 outlines the Licence Holder comments and DWER response.

Table 37 Licence Holder original comment

Condition	Summary of Licence Holder comment	DWER response
Licence		
Condition 2 Table 2	Table 2 Waste processing. • *Water Corporation request the word targeted is removed.* • *Water Corporation request the words septage wastes are removed.* • *Water Corporation request Waste type: Sewage sludge area is removed.* No provision to accept tankered waste at the premises. Licensed for category 54 only: not Category 61. No provision for sewage sludge storage on site.	Noted. DWER has kept the word 'targeted' in the condition wording. Targeted allows for any emergency / seasonal high inflow (such as that experienced in the Dry Season Tourist time) capacity to be accepted at the WWTP. These are not normal operations above the P&DC of the WWTP but exceptions. The word 'targeted' allows for some flexibility of acceptance volumes at the WWTP noting occasional circumstances where this happens. Wording 'septage wastes' and 'Waste type: Sewage sludge' has been deleted from the Condition.
Condition 3 Table 3	**Vessel or compound** *Inlet ~~works~~ chamber – delete works, add chamber.* **Material** *Grit and screening Wastewater – delete grit and screenings, add wastewater.* **Requirements** *~~Stored in a sealed bin which us surrounded by a bunded hardstand area which returns sludge leachate to the start of the~~*	Noted. **Vessel or compound** Deleted works and added Chamber. **Material** Deleted grit and screening and added Wastewater. **Requirements** Deleted -Stored in a sealed bin which us surrounded by a bunded hardstand area which returns sludge leachate to

Condition	Summary of Licence Holder comment	DWER response
	~~*treatment process*~~ Concrete inlet chamber **Vessel or Compound** ~~*Sewage sludge compound*~~ – delete. The request is based on the following: • The facility does not incorporate influent pre-treatment nor screens to remove solid material as described on page 9 of the decision report. • Solid material/rags carryover into treatment ponds are manually removed by operators and placed in sealed bins. • Remove line for sewage sludge compound. The site does not have onsite storage for sludge. This line item add confusion in the licence.	the start of the treatment process- and added Concrete inlet chamber. **Vessel or Compound** Deleted Sewage Sludge Compound Row from Table 3.
Condition 6 Table 4	The Corporation request an additional emission point row for emergency discharges in the event of an extreme weather in Table 4 to read: *Emission point reference and location on Map of monitoring locations: M1 Channel* *Monitoring point and reference on Map of monitoring locations: Emergency outlet pipes from Pond 1A and 3A as illustrated in Schedule 1- Figure Kununurra PCT (S043001003)* *Description: Discharge to M1 Channel via Emergency outlet pipes* *Source including abatement: Emergency outlet pipes and emergency chlorination ports (baskets) from wastewater treatment plant.* The request is based on the following:	Noted. Schedule 1 Map of monitoring locations at the WWTP identifies the emission points for Table 4 (and 5) of the Licence. DWER has accepted a new Map from the Licence Holder and amend the Schedule 1 Map to Map of emission and monitoring locations at KWWTP from the map provided in Attachment A. This map represents emissions and monitoring locations identified in Table 4 and 5 from the Licence. DWER is amicable to conditioning emergency discharges in extreme rainfall events but would like to understand the Design specifications for this condition. WWTP ponds generally have engineered emergency spillways to allow for overflow in extreme rainfall events to maintain the pond integrity. How will the requested emergency discharge

Condition	Summary of Licence Holder comment	DWER response
	• There is no reference to “emission points” on the Schedule 1 maps. • Refer updated Schedule 1 process and emission point map at Attachment A	pipes facilitate an outflow that is comparable or better than an engineered spillway overflow. No information has been provided as justification of this request. DWER has included an additional row in Table 4 for Emergency discharges as requested but finalisation of the condition will be dependent on the Licence Holder clarification and justification of the condition.
Condition 7(c)	(c) all surface water sampling is conducted in accordance with ~~AS/NZS 5667.4,~~ AS/NZS 5667.6 or ~~AS/NZS 5667.9~~ as relevant.	Noted. The condition wording ‘or’ and ‘as relevant’ allows any of the three AS/NZS standards to be used as relevant to the sampling. It does not imply all three must be used. No changes.
Condition 8	Add ‘unless in an extreme weather event’. Water Corporation request this condition is amended to include the clause “unless in an extreme weather event, as unsafe conditions persist prior to and post events which would make compliance with this condition difficult as Water Corporation would prioritise the safety of employees over the need to obtain regulatory samples.	Noted. Condition 8 is a Standard licence condition. No definition of an ‘extreme weather event’ has been offered by the Licence Holder. While Kununurra and the Lower Ord River does experience high water flows from rainfall, it is not a regular annual occurrence or generally prolonged for months. The condition definitions of Monthly and Quarterly under condition 8 allow flexibility in the timeframes for monitoring – they are not set monitoring dates. Any compliance matters include the ‘reasonableness’ test. No changes.
Condition 11 Table 5	The licence holder must undertake the monitoring in Table 5 *[and identified on the map of emission points in Schedule 1]* according to the specifications in that table.	Noted. **Units**

Condition	Summary of Licence Holder comment	DWER response
	Units Requesting Volumetric flow rate to be measured in m^3/day to align with assessed production / design capacity. **Parameter** • Requesting updated wording for Nitrate/Nitrite and Ammonia/Ammonium and switching frequency from Quarterly to Monthly. • *Requesting change to Escherichia coli*[2] new Note 2 - *Note 2: Actual units are to be reported except where the result is greater than the highest detectable level of 24,000 cfu/100mL. In this case the reporting of the highest detectable level is permitted.* **Monitoring point reference and location column** Requesting addition of (M12), (S2) and (S3) for the Magflow SP Kununurra WWTP Env. Discharge, Treatment Plant Outlet Pipe and the Post Chlorination Sample Point respectively. The request is based on the following: **Units** Volumetric flow rate to be measured in m^3/day to algin with assessed production / design capacity. **Parameter** Updated wording for Nitrate/Nitrite and Ammonia/Ammonium and switching frequency from Quarterly to Monthly	Units and Parameter amended in the Licence as requested. **Parameter** Parameters Nitrate/Nitrite and Ammonia/Ammonium are Monthly monitoring. Accepted Note 2. Table 5 is identified in the Map in Schedule 1. **Monitoring point reference and location column** DWER has accepted a new Map from the Licence Holder and amended the Schedule 1 Map to Map of emission and monitoring locations at KWWTP, from the map provided in Attachment A. This map represents emissions and monitoring locations identified in Table 4 and 5 from the Licence.
Condition 12 Table 6	The licence holder must undertake the monitoring in Table 5 *[and identified on the map of emission points in Schedule 1]* according to the specifications in that table.	Noted. **Monitoring point reference** Monitoring point reference amended as requested as

Condition	Summary of Licence Holder comment	DWER response
	The request is based on the following: **Monitoring point reference** Requesting updated to align with monitoring point reference in condition 11 Table 5. **Averaging period** Requesting (monthly) included to align with condition 2 Table 2 process limits. **Frequency** Requesting Change from Monthly to Continuous.	identified in the new Schedule 1 Map. **Averaging period** Averaging period column was deleted from the condition Table in the Draft Licence. **Frequency** Frequency was changed from Monthly to Continuous in the condition Table in the Draft Licence.
Condition 13 Table 7	**Sample Location column** Requesting updated Figure provided at Attachment B. Changes include: • SW4, SW5 & SW6 all moved closer to TWW discharge point to better assess attenuation of TWW within M1 (refer to figure provided). • SW8 relocated to M1/D1 gate so sample can be taken on WC owned land. Will provide the same information as DWER proposed location. • Proposed SW10 unable to be accessed safely. WC operators have investigated this location, and the operator was unable to get safely further west along the D1 Drain than SW9 (photo provided). • SW11 not able to be access safely. Drone footage (will supply) captured by WC shows there is no safe access to this location. **Parameter column** • Requesting deletion of Biochemical oxygen demand as it is not a contaminant of potential concern and is not	Noted. **Sample Location column** Accepted SW4, SW5 and SW6 locations. Accepted SW8 location. No photo has been provided for SW10. SW10 location is a critical monitoring point to understand where TWW disseminates into the D1 Drain to understand the emission-pathway-receptor model as outlined in section 9.6.7 Key Finding 4 and 7 of the DR. DWER proposed two monitoring points at the D1 Drain – SW9 and SW10 – to close this data gap but the Licence Holder is now proposing one at SW9. One monitoring point will not provide sufficient data to understand the pathway of TWW from the M1 Channel down the D1 Drain and where it enters the environment. It is noted that no date has been provided for the attempt to access the D1 Drain (or photo) and that under the Flow Regimes outlined in section 6.1 of the DR during the Wet Season TWW flows down the D1 Drain – the Wet Season is November to April and rainfall is highly variable so access is definitely possible during the Wet Season. Not accepted.

Condition	Summary of Licence Holder comment	DWER response
	listed within the Guideline, Assessment and Management of Contaminated Sites (DWER 2021) Appendix B pp 149. Additionally, analysis of these parameters does not reduce the interpretive value of the monitoring data set or increase risk to the environment. • Requesting updated wording for TKN, NH4-N and NOx-N. • Requesting inclusion of *Escherichia coli*[2] new Note 2 - Note 2: Actual units are to be reported except where the result is greater than the highest detectable level of 24,000 cfu/100mL. In this case the reporting of the highest detectable level is permitted. **Frequency column** • Requesting additional requirement to be added to the frequency that allows for a sample to not be taken if it is not safe to do so. For example, if the drainage network roads are flooded and dangerous. **Method column** • Requesting AS/NZS reference updated to reflect surface water sampling.	SW11 - No drone footage has been supplied. The Licence holder contacted DWER Regional Services North West Measurement Team in October 2023 for information on accessing the Lower Ord during the Wet Season as DWER staff do themselves. Advice was provided by DWER that it is possible to access the Lower Ord River at this location. The Licence Holder has not proposed an alternate monitoring location. Not accepted. **Parameter column** Biochemical oxygen demand. BOD is an indicator of the amount of oxygen required or consumed by microbial decomposition or organic material in water. It is therefore an indicator of the amount of microbes / organic material present and is considered to be beneficial informing results. This parameter should remain on the Licence. It should be noted that contaminants required in groundwater monitoring on licences will not mirror the contaminants listed within the Guideline, Assessment and Management of Contaminated Sites as the intent of monitoring requirements on Licences is not to undertake a full contaminated sites investigation. Accepted updated wording for TKN, NH4-N and NOx-N. Accepted Note 2. **Frequency column** Frequency request may be accepted based on finalisation of D1 Drain monitoring locations.

Condition	Summary of Licence Holder comment	DWER response
		Method column Accepted Method AS/NZS change.
Condition 14 Table 8	Request Condition 14 deleted from the Licence. Water Corporation requests the condition to install and monitor an additional groundwater monitoring well be deleted from the licence. The request is based on the following: • Senversa (2022) Environmental Site Assessment (ESA) assessed the risk of seepage of WW through treatment ponds to groundwater following the SPR linkage methodology. Section 10.2 of the ESA provides detailed assessment of the SPR linkage evaluation. • The SPR linkage evaluation of impacted groundwater to off-site intrusive maintenance workers, terrestrial flora and off-site groundwater bore users were all found to be incomplete. • The SPR linkage evaluation of impacted groundwater discharging to the M1 channel followed by surface water abstraction for irrigation from the M1 was assessed as potentially complete but following DWER (2020) risk assessment guideline was assessed as low risk. • There is no current evidence-based risks to public health or the environment from seepage from the WWTP. • As stated in the Decision Report (Section 9.8.7); only two sampling events have been undertaken at the WWTP. Making decisions to invest in the construction of an additional groundwater bore off limited data may result in the bore not being placed in the correct position to understand impacts to receptors or may not even be required to determine risk to receptors.	Noted. As outlined in the Executive Summary Key Findings: • The groundwater monitoring network for the Premises does not extend beyond the premises boundary down hydraulic gradient of the WWTP ponds and there is limited information available regarding how potential contaminants will migrate through groundwater. • Groundwater monitoring indicates the KWWTP is responsible for at least localised groundwater contamination and that a leak in the pond lining system may be occurring. The Premises Risk Assessment for Seepage is Medium and thus likely to be subject to regulatory controls. The Data Gaps as outlined for 1 and 2, particularly noting Data Gap 2 are: • Further groundwater monitoring results are required to determine potential contribution of the WWTP operations to groundwater contamination. • The groundwater monitoring bore network is insufficient, with bore placement down hydraulic gradient of KWWTP lacking, meaning the migration of contaminants through groundwater towards the M1 channel cannot be tracked. Section 5.9 of the DR outlines monitoring of discharges to groundwater with information provided from the Senversa 2022 ERA. Groundwater flow indicates, as does the regional geological models, that groundwater flow at the

Condition	Summary of Licence Holder comment	DWER response
	As per condition 23 of the revised licence, the Corporation is required to submit a surface water and groundwater monitoring report by 1 September 2026. Water Corporation proposes the decision on whether to invest in the construction of additional monitoring bores is extended until after this report is delivered and the decision can be made on a robust data set and evidence-based risks.	premises is northwest. The proposed additional bore location is consummate to the flow of groundwater for all hydrogeological information and thus best represents a downstream bore location. The Delegated Officer considers that two sample events is not sufficient or representative, or provide full scientific certainty of the environment at and surrounding the Premises. More samples are required to understand the groundwater environment at and surrounding the Premises as seepage from the WWTP is confirmed. Seepage emissions are discussed in detail in section 8.8 of the DR, with key findings determining the need for an additional groundwater bore. The Senversa (2022) Report clearly identifies seepage and groundwater contamination from the WWTP. Condition 14 is directly linked to condition 17 and 18. If the seepage rate assessment determines no seepage from the WWTP ponds (i.e. no pond integrity issues) is occurring then that can be used as justification for no additional downstream bores. At this stage the data suggests the pond integrity is compromised so this data gap needs to be assessed further. Not accepted. Condition compliance timeframe has been amended to 1 September 2024.
Condition 15	Request Condition 15 deleted from licence	Noted. As above for Condition 14 Not Accepted.
Condition 16 Table 9	**Monitoring well location** • Request Bores 2/99, 4/99 and 01D/20 be deleted from	Noted **Monitoring well location**

Condition	Summary of Licence Holder comment	DWER response
	the monitoring requirements. • Request the monitoring of the additional bore under condition 14 be deleted - *Monitoring of additional groundwater monitoring bore required by Condition 14 to commence on completion of construction of bore*. **Parameters** • Request deletion of parameters Cu, Fe, Mn, Zn and Cl from monitoring requirements. • Requested updated wording for TKN, NH4-N and NOx-N. • Request inclusion of Note 1: In field, non-NATA accredited analysis permitted. • Request inclusion of Escherichia coli[2] new Note 2 - Note 2: Actual units are to be reported except where the result is greater than the highest detectable level of 24,000 cfu/199mL. In this case the reporting of the highest detectable level is permitted **Frequency** • Request change from Monthly to Quarterly. • Request additional wording - *(If groundwater is present and access to bores is safe)* The request is based on the following: **Monitoring Well Location** • Updated Figure provided at Attachment C. • Water Corporation has reviewed the onsite monitoring bore network and the following 7 bores allow for ongoing monitoring of groundwater quality down hydraulic gradient of all on-site sources.	Bores 2/99, 4/99 and 01D/20 are all deep bores and will not be deleted from the Licence. Both up-gradient and cross-gradient Shallow and Deep are required to be sampled to provide 'background' data to draw accurate conclusions on contamination pathways etc. As discussed in the DR: *Two sampling events have been undertaken in October 2020 and April 2021 to represent the (post) Dry and Wet Season respectively. This has not provided sufficient information to draw accurate conclusions as to the WWTPs potential impact to groundwater contamination.* Further groundwater monitoring of both shallow and deep bores is required to better understand the groundwater environment at and surrounding the Premises as two sample regimes is not sufficient to represent accurate conclusions. The addition of the three WWTP tracer contaminates boron, sucralose and caffeine into the sample parameters will provide direct data to the pathways of untreated and TWW from seepage of the WWTP into the environment and thus receptors. This data will aid in the existing Data Gaps outlined below from the Executive Summary. Executive Summary Outcomes include: • Additional monitoring of surface water and groundwater across the three distinguished flow regimes to provide more certainty in conclusions drawn from monitoring data. Additional groundwater and surface water conditions have been included in the Proposed Licence. This will address Date Gap 1. • Conditions include incorporating the requirement for a three (3) year surface water and groundwater monitoring program to be undertaken, with the intent that a minimum of 4 sampling events occur per flow regime, with the results of this sampling to

Condition	Summary of Licence Holder comment	DWER response
	• • 2/99, 4/99 and 01D/20 are all located up hydraulic or cross-hydraulic gradient of the treatment ponds. They are also considered 'deep' bores and thus are not considered required to be monitored to assess ongoing groundwater quality. Senversa (2022) ESA provides further information. **Parameters** • Updated wording for TKN, NH4-N and NOx-N. • Cu, Fe, Mn, Zn, Cl are not considered ongoing CoPC from the WWTP given they are not required to be sampled from the treatment plant outlet pipe or surface water. Senversa (2022) ESA found metals & chloride were not an ongoing risk from WW/TWW seepage to groundwater. **Frequency** • The Kununurra WWTP was constructed in 1967 and upgraded in 1988 indicating potential groundwater impacts from WW/TWW seepage to groundwater would be stable. The geology beneath the site was found to comprise alluvial clay/silt/sand mixtures with shallow superficial groundwater hosted in these soils with a very low hydraulic gradient measured across the site. Based on the hydrogeological setting beneath the site, this requested amendment does not reduce the Interpretive value of the groundwater monitoring data set or increase the risk to the environment. This requested amendment is consistent with other monitoring efforts at WWTPs across the state. • • Additional commentary that specifies that groundwater must be present in relation to the frequency of sample. This allows for seasonal fluctuation in groundwater levels without it being a non-compliance if bores are dry.	be summarised and a report prepared for submission and review by DWER. Conditions implemented to enforce this monitoring program would replace current surface water and groundwater monitoring conditions on the Licence. This will address Date Gap 1, 2, 3, 4, 5, and 6. Condition 14 will not be deleted from the licence. Licence Condition 23 requires the submission of a groundwater monitoring report by 1 September 2026. This will allow better environmental data representation of the groundwater at the Premises and any environmental interactions. The Licence can be amended after this time to add or reduce groundwater monitoring as specific to the outcomes of the groundwater assessment. At no time has the Licence Holder investigated groundwater at or surrounding the Premises although they did have some limited existing bores. It was not until DWER identified numerous data gaps based on previously withdrawn Water Corporation Works Approvals (from 2015) that groundwater issues were unknown and required further investigations. Not accepted. **Parameters** Parameters Cu, Fe, Mn, Zn and Cl will remain on the licence for monitoring requirements. The outcome of condition 23 groundwater assessment will provide further clarity on the future monitoring of these parameters. Updated wording for TKN, NH4-N and NOx-N as requested. Note 1: In field, non-NATA accredited analysis permitted is already in Condition 16 Table 9.

Condition	Summary of Licence Holder comment	DWER response
		Update Table 9 with the inclusion of *Escherichia coli*[2] Accepted Note 2. **Frequency** All environmental monitoring (groundwater and surface water) is Monthly (except Total Sodium in condition 11 Table 5 as applicable) due to limited data sets and thus understanding of emissions in respect to potential pathways and impacts. Monthly monitoring will provide a more detailed representation of the environment (and Flow Regimes). Licence Condition 23 requires the submission of a groundwater monitoring report by 1 September 2026. This will allow better environmental data representation of the groundwater at the Premises and any environmental interactions. The Licence can be amended after this time to add or reduce groundwater monitoring as specific to the outcomes of the groundwater assessment. Not accepted.
Condition 17	Request Condition 17 deleted from Licence. Water Corporation recommends that draft conditions 17 and 18 be reviewed to review seepage of the Kununurra Wastewater Treatment Plant (WWTP) in a staged approach. Proposed draft condition 17: *Conduct and submit a desktop water balance by 31 May 2024 using historic inflow and outflow data from Corporate systems, climate data and a review of infrastructure drawings to determine seepage from the KWWTP treatment ponds.* Justification and technical advice to support the proposed draft condition is included at Attachment D.	Noted. The Licence Holder (Water Corporation) was aware that the KWWTP ponds were leaking based on the evidence provided in the Senversa (2022) ESA report dated 28 April 2022 as outlined in the Executive Summary to this DR. To date the Licence Holder has taken no further action to understand seepage based on the Senversa (2022) ESA or in the past considering the WWTP was upgraded in 1988 and have not submitted any information to DWER after repeated requests as far back as 2015 for Works Approval W5927/2015/1 (Withdrawn) as to the integrity of the pond liner/permeability.

Condition	Summary of Licence Holder comment	DWER response
		DWER has a risk assessment Rating as Medium for Seepage as outlined in section 9.8 and 9.8.10 of the DR. Through a review of the ESA and WSWQA it was determined that concentrations of ammonia, ammonium and TN were comparable to those recorded in TWW within down gradient bores 5/20 and 6/20. As this could indicate a leak, the outcome was that the Licence Holder should be required to undertake integrity testing to ensure the migration of TWW to groundwater is occurring through pond infiltration only. The desktop water balance assessment proposed by WC as an alternative to pond integrity testing states that: *The principles of the water balance would demonstrate:* *Total inputs to the plant = Total outputs from the plant* *Ie. Inflow + Rainfall = Evaporation + Seepage +Outflow* *Seepage can then be determined by:* *Seepage = Inflow + Rainfall – Evaporation - Outflow* This methodology doesn't account for any damage to the ponds integrity which may be causing a leak. The intent of conditions 17 and 18 are to establish whether or not pond integrity is adequate, not to determine water balance. The Licence Holder states that '*If results suggest that the WWTP is seeping beyond the acceptable levels required by the licence requirements, Water Corporation can then develop a plan to complete seepage investigations on the individual ponds'.* Results obtained from the review of the ESA and W&SWQA have already determined that the ponds are suspected to be leaking, therefore doing an additional desktop review to confirm this is not required or warranted. The Licence Holder express concerns with having to take

Condition	Summary of Licence Holder comment	DWER response
		ponds offline or bypass ponds, however the Ham and Baum 2009 methodology specified in condition 17 does not require the ponds to be drained or bypassed and testing is typically completed overnight, so wastewater can continue to be discharged into the ponds during operational working hours. Additionally given the limited sampling nature undertaken to inform the Licence review, the level of uncertainty surrounding all Wastewater data results indicates that there is no justification to remove this requirement. Two sampling events have been undertaken in October 2020 and April 2021 to represent the (post) Dry and Wet Season respectively. This may not have provided sufficient information to draw accurate conclusions as to the WWTP's potential impact to groundwater contamination. Condition 17 and 18 is directly linked to condition 14. If the seepage rate assessment determines no seepage from the WWTP ponds (i.e. no pond integrity issues) is occurring, then that can be used as justification for no additional downstream bores as per condition 14. At this stage the data suggests the pond integrity is compromised so this data gap needs to be assessed further. Not accepted.
Condition 18	Request Condition 18 deleted from Licence. Refer justification for removal of condition 17 and 18 above.	Noted Not accepted as per Condition 17.
Condition 22 Table 11	Table 11 Environmental reporting requirements. Table 5 Contaminant loading (kg/day – monthly average) to surface water of parameters monitored in Table 5 (except pH, ~~and~~ *E. coli, boron, sucralose and caffeine*)	Noted. Loading rates for all parameters required as per Table 5 – including boron, sucralose and caffeine. In the submission of the AER the Licence Holder will have to submit the raw data for monitoring of boron, sucralose and caffeine of

Condition	Summary of Licence Holder comment	DWER response
	Table *7* ~~Monitoring of ambient environmental quality~~ ~~Contaminant loading (kg/day – monthly average) to surface water of the parameters listed in Table 8 (except pH and *E. coli*); and~~ ~~An assessment and interpretation of the data, including comparison to historical trends.~~ *An interpretive summary and assessment of the results against relevant assessment levels for surface water, as published in the Guideline Assessment and management of contaminates sites.* Table ~~8~~ *9* An interpretive summary and assessment of the results against relevant assessment levels for ~~surface water and~~ groundwater, as published in the *Guideline Assessment and management of contaminated sites.* The request is based on the following: • Updates to table to reflect amended condition requirements.	which DWER (or anyone) can calculate the applicable loading rates. No changes. Table 7 included and titled Monitoring of ambient surface water quality in row. Contaminant loading rates will not be deleted from the condition. No changes. An interpretive summary section has been included in the licence Table- this will also align the requirements of Table 9 reporting requirements. Table 8 should be Table 9 - Amended to Table 9. Table 9 includes wording ‘Ambient groundwater monitoring’ Removed ‘surface water and’ from the condition wording.
Schedule 1 Maps	Water Corporation request that the Process and Emission Point Map included at Attachment A is replaced in Schedule 1 instead of the “Map of monitoring locations at KWWTP” as it correctly defines process and references sample and monitoring points.	Noted. Accepted new Schedule 1 Map in Licence. Map is titled: *Map of emissions and monitoring locations at KWWTP* *The locations of the monitoring points defined in Table 4 and 5 are shown below.*
Schedule 1 Maps	Water Corporation request that the Surface Water Monitoring Locations figure included at Attachment B is replaced in Schedule 1 instead of the “Map of surface water monitoring locations” as it correctly defines references sample and proposed monitoring points.	Noted As per condition 13 above- some amendments to monitoring locations requested by the Licence Holder have not been accepted.

Condition	Summary of Licence Holder comment	DWER response
		Therefore, the Map will not be amended.
Schedule 1 Maps	Water Corporation request that the Groundwater Monitoring figure included at Attachment C is replaced in Schedule 1 instead of the “Groundwater monitoring network” as it correctly defines references sample and proposed monitoring points.	Noted As per condition 16 above – some amendments to monitoring bores requested by the Licence Holder have not been accepted. Therefore, the Map will not be amended.
Decision Report		
Executive Summary	Data Gaps (page V) 2. The groundwater monitoring bore network is insufficient, with bore placement down hydraulic gradient of KWWTP lacking, meaning the migration of contaminants through groundwater towards the M1 channel cannot be tracked. Please amend: The groundwater monitoring bore network is ~~insufficient~~ limited to bores located within the prescribed premises boundary, ~~with bore placement down hydraulic gradient of KWWTP lacking~~, meaning the migration of contaminants through groundwater towards the M1 channel cannot be tracked *is currently unknown*. The request is based on the following: The bore network is not insufficient to understand groundwater impacts. It is just limited in monitoring attenuation impacts through the groundwater towards the M1 channel.	Noted.
Executive Summary	Outcomes (page V) Installation requirements for at least one (1) additional down hydraulic gradient groundwater monitoring bores, likely located between 50m to 100m to the northwest of the premises boundary, to address Data Gap 2.	Noted. Condition 14 is discussed above, and the condition will not be deleted from the Licence.

Condition	Summary of Licence Holder comment	DWER response
	Please amend: Additional monitoring is required to acquire a robust data set to determine if additional installation requirements for at least one (1) additional down hydraulic gradient groundwater monitoring bores, ~~likely located between 50m to 100m to the northwest of the premises boundary,~~ is required to address Data Gap 2. The request is based on the following: Water Corporation requests the condition to install and monitor an additional groundwater monitoring well be deleted from the licence. The request is based on the following: · • Senversa (2022) Environmental Site Assessment (ESA) assessed the risk of seepage of WW through treatment ponds to groundwater following the SPR linkage methodology. Section 10.2 of the ESA provides detailed assessment of the SPR linkage evaluation. • The SPR linkage evaluation of impacted groundwater to off-site intrusive maintenance workers, terrestrial flora and off-site groundwater bore users were all found to be incomplete. • The SPR linkage evaluation of impacted groundwater discharging to the M1 channel followed by surface water abstraction for irrigation from the M1 was assessed as potentially complete but following DWER (2020) risk assessment guideline was assessed as low risk. • There is no current evidence-based risks to public health or the environment from seepage from the WWTP. • As stated in the Decision Report (Section 9.8.7); only two sampling events have been undertaken at the WWTP. Making decisions to invest in the construction of an additional groundwater bore off limited data may result in the bore not being placed in the correct position to understand impacts to receptors or may not even be	

Condition	Summary of Licence Holder comment	DWER response
	required to determine risk to receptors. • As per condition 23 of the revised licence, the Corporation is required to submit a surface water and groundwater monitoring report by 1 September 2026. Water Corporation proposes the decision on whether to invest in the construction of additional monitoring bores is extended until after this report is delivered and the decision can be made on a robust data set and evidence-based risks.	
Page 9 Table 4	1.Influent pre-treatment – screens to remove solid material. Delete ~~1.Influent pre-treatment – screens to remove solid material.~~ The facility does not incorporate influent pretreatment nor screens to remove solid material as described on page 9 of the decision report. Solid material/rags carryover into treatment ponds are manually removed by operators and placed in sealed bins.	Noted. Text has been deleted as requested/advised.
5.2.2	Department of Health (DoH) Approval – Licence Holder to provide details. DoH approval is not required. Discharge of treated wastewater from the Kununurra WWTP is not considered a reuse scheme and no DoH approval is required. As per DoH commentary (Appendix 2), this scheme is not considered a reuse scheme	Noted. DR wording amended as per Licence Holder advice.
6.6 Table 9	Table 9 Table 9 has typo, grammatical errors, please update.	Noted. Table 9 is data submitted by the Licence Holder.
6.9.4 Key Finding No.2	Key Finding No.2 The premises is adjacent to Typonium spp Kununurra habitat	Noted.

Condition	Summary of Licence Holder comment	DWER response
	which is undergoing Commonwealth threatened listing assessment, due 30-Oct-2025, which are considered a sensitive receptor for groundwater impacts. Please amend: The premises is adjacent to Typonium spp Kununurra habitat which is undergoing Commonwealth threatened listing assessment, due 30-Oct-2025, ~~which are considered a sensitive receptor for groundwater impacts~~. The request is based on the following: CSIRO (2009) Managed Aquifer Recharge – Risks to Groundwater Dependent Ecosystems – A Review. May 2009 indicates that adverse effects are unlikely to be caused to groundwater-dependent vegetation by elevated nutrients, inorganic contaminants (e.g. metals) and pathogens in groundwater.	1. Introduction of the CSIRO (2009) Managed Aquifer Recharge – Risks to Groundwater Dependent Ecosystems – A Review. May 2009 (CSIRO) states: Managed aquifer recharge (MAR) is the intentional recharge to aquifers for subsequent recovery or environmental benefit (Dillon et al, 2008). The KWWTP discharges TWW to surface water and is not an intentional recharge to aquifers and there are many more MAR variables that are not applicable to the Premises (for example, TWW quality is normally much better when discharged to a MAR), so the CSIRO is not relevant to the Premises.
7.0 page 106-109	Stakeholder Consultation (DBCA) Water Corporation has undertaken two surveys in the area (propose new location, pipeline routes and the existing plant site) using Environmental Consultants Ecological Australia. No Typhonium spp. was identified in the surveys, noting it is cryptic and difficult to find. It is not expected that the continued operations at Kununurra would impact this species as per CSIRO (2009).	Noted. The KWWTP is not an intentional recharge to aquifers, so the CSIRO is not relevant to the Premises.
9.8.3	Description of potential adverse impact from the emission. “Groundwater contamination may directly impact or inhibit the growth of groundwater dependant ecosystems and may impact the P1 public drinking water area 200m to the south.” Delete ~~“Groundwater contamination may directly impact or inhibit the growth of groundwater dependant ecosystems and may impact~~	Noted. The KWWTP is not an intentional recharge to aquifers, so the CSIRO is not relevant to the Premises.

Condition	Summary of Licence Holder comment	DWER response
	~~the P1 public drinking water area 200m to the south."~~ The request is based on the following: CSIRO (2009) Managed Aquifer Recharge – Risks to Groundwater Dependent Ecosystems – A Review. May 2009 indicates that adverse effects are unlikely to be caused to groundwater-dependent vegetation by elevated nutrients, inorganic contaminants (e.g. metals) and pathogens in groundwater. Site-specific and regional groundwater flow direction is to the north-west demonstrating the P1 public drinking water area will not be impacted from on-site groundwater impacts.	
9.8.7 Key Findings	10. An additional groundwater bore will be required to be installed downstream from the Premises to complement the existing bores and help in understanding the movement of groundwater and contaminants in the environment. The licence will also require the submission of a surface and groundwater monitoring report to review groundwater and surface water data and thus assess emissions and likely impacts from the Premises. Please amend: Additional monitoring is required to acquire a robust data set to determine if an additional groundwater bore will be required to be installed downstream from the Premises to complement the existing bores and help in understanding the movement of groundwater and contaminants in the environment. Determination of the requirement of the additional bore will be determined post the ~~licence will also require the~~ submission of a surface and groundwater monitoring report to review groundwater and surface water data and thus assess emissions and likely impacts from the Premises. The request is based on the following: Water Corporation requests the condition to install and monitor	Noted. Condition 14 is discussed above, and the condition will not be deleted from the Licence.

Condition	Summary of Licence Holder comment	DWER response
	an additional groundwater monitoring well be deleted from the licence. The request is based on the following: · • Senversa (2022) Environmental Site Assessment (ESA) assessed the risk of seepage of WW through treatment ponds to groundwater following the SPR linkage methodology. Section 10.2 of the ESA provides detailed assessment of the SPR linkage evaluation. • The SPR linkage evaluation of impacted groundwater to off-site intrusive maintenance workers, terrestrial flora and off-site groundwater bore users were all found to be incomplete. • The SPR linkage evaluation of impacted groundwater discharging to the M1 channel followed by surface water abstraction for irrigation from the M1 was assessed as potentially complete but following DWER (2020) risk assessment guideline was assessed as low risk. • There is no current evidence-based risks to public health or the environment from seepage from the WWTP. • As stated in the Decision Report (Section 9.8.7); only two sampling events have been undertaken at the WWTP. Making decisions to invest in the construction of an additional groundwater bore off limited data may result in the bore not being placed in the correct position to understand impacts to receptors or may not even be required to determine risk to receptors. • As per condition 23 of the revised licence, the Corporation is required to submit a surface water and groundwater monitoring report by 1 September 2026. Water Corporation proposes the decision on whether to invest in the construction of additional monitoring bores is extended until after this report is delivered and the decision can be made on a robust data set and	

Condition	Summary of Licence Holder comment	DWER response
	evidence-based risks.	
9.8.8	Consequence Environment The Delegated Officer has determined that the environmental consequence of seepage will be mid-level onsite impacts, most notably to onsite/adjacent Typhonium plants and habitat. Therefore, the Delegated Officer considers the consequence of seepage to be Moderate. Please amend: The Delegated Officer has determined that the environmental consequence of seepage will be mid-level onsite impacts, ~~most notably to onsite/adjacent Typhonium plants and habitat~~. Therefore, the Delegated Officer considers the consequence of seepage to be Moderate. The request is based on the following: CSIRO (2009) Managed Aquifer Recharge – Risks to Groundwater Dependent Ecosystems – A Review. May 2009 indicates that adverse effects are unlikely to be caused to groundwater-dependent vegetation by elevated nutrients, inorganic contaminants (e.g. metals) and pathogens in groundwater.	Noted. The KWWTP is not an intentional recharge to aquifers, so the CSIRO is not relevant to the Premises.

DWER subsequently sent the Licence Holder a second Draft Decision Report and Licence on 4 April 2024. Comments were due 29 April 2024. The Licence Holder requested an extension until 28 June 2024 and then a further extension until 5 July 2024. The Licence Holder did provide comments on the draft documents on 5 July 2024. Table 38 outlines the Licence Holder second comments and DWER response.

Table 38: Licence Holder second comment

Condition	Summary of Licence Holder comment	DWER response
Licence		
Condition 2 Table 2	Noted	Licence Holder has accepted the proposed DWER amendment as outlined in Table 37.
Condition 3 Table 3	Noted	Licence Holder has accepted the proposed DWER amendment as outlined in Table 37.
Condition 6 Table 4	Attachment E from Licence Holder Comments provides further information as required under Table 37: *Engineering as constructed site plan drawing (1993) AJ78-L-2-E (Figure 1) illustrates "existing outfall to be used as overflow" which indicates that this pipe was constructed and in use prior to 1993. Figure 2 illustrates the current location of the emergency outlet pipes, manholes, isolation valves and clean out points.* *Photographs included in figures 3, 4 and 5 detail the invert level of the emergency outlet pipes from the top of bank on ponds 1a and 3a. The outlets measure 900mm from top of bank, 150mm in diameter and are constructed of PVC.* *The as constructed drawings referenced in Figure 1 and 2 in conjunction with on-site verification from Water Corporation site operators, wastewater technical staff and Wastewater Engineers have concluded that current operations which utilise the emergency outlet pipes is the preferred method of wastewater discharge in high rainfall or extreme weather events. The use of the outlet pipes over spillways are preferred for the following reasons:*	Noted. DWER has reviewed the information submitted in Appendix E and will amend the Licence condition as requested.

Condition	Summary of Licence Holder comment	DWER response

	• *Manholes located along the emergency overflow pipes (Figure 2) provide an accessible point to add chlorine tablets to disinfect wastewater before the it reaches the M1. There is little opportunity to disinfect wastewater as it overtops a spillway.*
	• *Operational ability to control flow, volume and outlet location.*
	  ○ *Site operators have the ability to reduce flow and volume from either or both ponds depending on site and environmental conditions.*
	  ○ *Flow can be directed to the M1 rather than further inundating/pooling the surrounding low lying environment and thereby maintaining a safe level of access to the site and channel.*	

Condition 7(c)	Noted	Licence Holder has accepted the proposed DWER amendment as outlined in Table 37.
Condition 8	Noted	Licence Holder has accepted the proposed DWER amendment as outlined in Table 37.
Condition 11 Table 5	Error for *E. Coli* units 24,000 cfu/199mL.	Typo error corrected for E. Coli units 24,000 cfu/100mL.
Condition 12 Table 6	Noted	Licence Holder has accepted the proposed DWER amendment as outlined in Table 37.
Condition 13 Table 7	**Sample Location column** Sampling Location Water Corporation Operations (field staff) with local DWER officers visited the proposed SW10 and SW11 sample locations on 26/06/24. Water Corporation has a duty of care to its employees and proposed locations will only be	Surface water samples SW9, SW10 and SW11 are proposed in the original draft Licence as provided to the Licence Holder. Sample points SW9 and SW10 represent sample points within the D1 drain itself. Sample point SW11 is on the Lower Ord River.

Condition	Summary of Licence Holder comment	DWER response
	sampled when the Occupational Health & Safety risk from sampling is adequate and risk mitigation controls can be implemented. The following comments are provided for proposed sampling location SW10 and SW11. **SW10**: It was deemed by Water Corporation operations field staff there was no safe way to take a surface water grab sample from the D1 at the proposed location. The D1 at the proposed sampling location is approximately four metres from the bank to the bottom of the drain with extremely steep inclines on both sides of drain. Water Corporation policy applied identified that there is no adequate mitigation controls to implement to ensure the risk of personal injury acceptable. **SW11**: Water Corporation Operations field staff agreed with adequate mitigation controls (e.g. access track is dry and firm) a surface water grab sample can be taken from SW11. However, if the access track is not deemed safe to drive on risk of obtaining a sample is deemed unacceptably high and a sample will not be able to be collected. Water Corporation operations field staff deemed the risk of surface water sampling via a boat during the wet season as unacceptable and does not meet Water Corporation's duty of care to it employees. Surface water sampling via a boat will not be attempted during any sampling event. Please ensure flexibility in the licence as to mitigate non-compliance due to access.	The Licence Holder attended a Kununurra field trip with DWER staff to visit all these proposed samples sites on Wednesday 26 June 2024. **SW10:** Sample site SW10 is indicative of the sample site that represents where TWW discharges into the D1 drain in the presumed assumption by the Licence Holder that TWW does not reach the Lower Ord River as per section 6.8.2 Table 15 of the DR. Given this presumption has not been confirmed by the Licence Holder, SW10 is not prescriptive to an exact GPS point for compliance. During the field trip all the Licence Holder representatives and DWER officers reached this sample point. At this time the Licence Holder representatives did access the D1 drain at surface water level as there is viable access points. DWER discussed with the Licence Holder the ability to determine the location of the presumed diffusion of TWW into the D1 drain as being pivotal to the sample location and discussed the use of a drone to acquire this position. Granted, during the Wet Season access can become unavailable, but as discussed on the day, the Wet Season is highly variable from year to year and thus access is case by case. DWER has no intention of placing the Licence Holder in contravention of licence conditions during Wet Season if access is not possible. DWER understands the inherent Safety obligations under the Work Health and Safey Act 2020 (WHS Act) and that compliance with the WHS Act is the responsibility of the Licence Holder, but the Licence Holder representatives accessed the D1 Drain surface water at this point on the field trip. The Licence Holder also has options for collecting sample such as Consultants. As discussed in the DR, it is imperative that the pathway for TWW in the D1 Drain is understood to understand the emission-pathway-receptor model.

Condition	Summary of Licence Holder comment	DWER response
		DWER conducted another site visit on Wednesday 8th August at the KWWTP with Licence Holde representatives and along the D1 drain (without licence holder representatives). In consultation with Licence Holder representatives, it was determined that the SW10 sample point would be expanded to provide a safe option to undertake sampling. Accordingly, Condition 13 Table 7 has been amended to include wording - *SW10 sample must be obtained a minimum of 500 m from SW9 down the D1 channel and a minimum of 150 m from SW11 up the D1 channel.* The Schedule 1 Surface water map has been amended to include a larger point for SW10. Sample SW10 no changes. **SW11:** DWER has no intention of placing the Licence Holder in contravention of licence conditions due to safety matters. DWER will allow flexibility of the surface water sample noting Wet Season access issues. Noted advice regarding surface water sampling via boat – these will not be required when SW11 is sampled from land.
	Frequency: Sampling of location SW7 to occur when the M1/C1 gate is open. Sampling from SW8, SW9, SW10 and SW11 to occur when the M1/D1 gate is open.	Noted and condition 13 Table 7 amended to include Sampling of location SW7 to occur when the M1/C1 gate is open. SW8, SW9, SW10 and SW11 to occur when the D1/M1 gate is open is already in the condition.
	Error in table note. Error is Table 7, Note 2. Update 24,000 cfu/199mL to 24,000 cfu/100mL	Typo error corrected for E. Coli units 24,000 cfu/100mL.
Condition 14	Water Corporation request the timeframe be changed to 30 June 2025. This extended timeframe allows Water Corporation to gain	Noted. Condition compliance timeframe has been amended to 30

Condition	Summary of Licence Holder comment	DWER response
Table 8	heritage and land approvals, contractor availability and to avoid drilling the during the wet season when access to drilling sites will be restricted. Replace nested wells with clustered wells. As nested wells are not recommended for contaminant hydrogeology monitoring mainly because it is generally not possible to obtain enough monitoring intervals in a nested well without compromising the seals between intervals.	June 2025 from proposed date 1 September 2024. Amended nested to clustered as requested.
Condition 15	Noted	Licence Holder has accepted the proposed DWER amendment as outlined in Table 37.
Condition 16 Table 9	Water Corporation conducted a site visit on 26/06/24. During the site visit well 4/99 could not be located. Water Corporation requests 4/99 be removed from licence monitoring Table 9. Bore 3/99 provides groundwater quality data up-hydraulic gradient. Update Groundwater Network Figure provided.	DWER conducted another site visit on Wednesday 8th August at the KWWTP with Licence Holde representatives to review the groundwater bore locations and accessibility. Bore 4/99 was located and found to be serviceable. Bore 4/99 has not been removed from the condition and relevant groundwater map. When assessing what background groundwater quality is near the Premises, it is important that this is determined using data from bores that are located sufficiently distant up-gradient or cross-gradient of the premise so that the chemical composition of groundwater is not affected by activities at the site. This is particularly important when determining background groundwater quality near WWTP storage ponds, as high rates of leakage from a pond can cause significant groundwater mounding and can allow groundwater flow to take place for a short distance up-gradient from the pond. It appears the WWTP is leaking. For this reason, bore 3/99 is considered to be located too close to one of the WWTP storage ponds at the KWWTP to be confident that groundwater quality in this bore has not been affected by seepage from the pond. Bore 4/99 is

Condition	Summary of Licence Holder comment	DWER response
		considered to be located in a more suitable location to provide background groundwater quality data for the WWTP, however the Licence Holder cannot find bore 4/99. Therefore, presently, there is no suitable background bore for the KWWTP. In the absence of bore 4/99 no longer representing the WWTP background bore and bore 3/99 not being sufficient as a background bore, DWER has added a requirement for an additional monitoring bore to be drilled and installed at a location to the south of the wastewater ponds at the KWWTP as representative of the new background bore. Condition 14 Table 8 has been amended accordingly to include requirements for the installation of an additional groundwater bore up hydraulic gradient of the WWTP and Schedule 1 groundwater monitoring map has been amended to include the new background bore. Condition 15 will now require two (2) construction bore logs to be submitted to the CEO.
	Groundwater monitoring frequency to be quarterly. Water Corporation agrees with Condition 16 requiring ongoing groundwater monitoring; monthly frequency of monitoring is not practical and appropriate to the level of risk of medium for the environment and low risk for human health. As previously mentioned the proposed quarterly monitoring will provide seasonal groundwater quality and will not reduce the interpretative value of the groundwater monitoring data set.	Accepted and amended to Quarterly sampling.
Condition 17	Water Corporation request the timeframe be changed to 31 January 2025. Additional timeframe is requested to allow for: ○ Procurement of level sensors with required accuracy. ○ Permit for assessments to be completed at the end-of-dry season, which is optimal climate conditions, groundwater	Noted. Completion date amended to 31 January 2025.

Condition	Summary of Licence Holder comment	DWER response
	elevations are at their lowest, and inflows to WWTP are lower outside of peak tourist season.	
Condition 18	Requested timeframe update & seepage assessments to be delivered in one report. Request condition 18(f) be a standalone condition as Water Corporation cannot decide on how or when potential damaged liners will be rectified within the timeframes allotted. Proposed updated wording: The Licence Holder must, ~~within 1 month of the completion of the seepage rate testing for each pond specified in Condition 17~~, **by 31 March 2025** submit to the CEO a report which includes the following information: (a) the results of the seepage rate testing for that **all ponds**; (b) estimations of the total volume of seepage from ~~that~~ **each** pond per year based on: (i) the designed hydraulic conductivity of ~~the~~ **each** pond liner and the hydraulic head pressure; and (ii) the current condition of ~~the~~ **each** pond liner. (c) estimations of the total mass of nitrogen and phosphorus emitted from ~~that~~ **each** pond per year via seepage, based on the estimated annual seepage volume/s of the pond liner and the nitrogen and phosphorus concentrations measured within the treatment pond outlet pipe as per Condition 11; (d) an estimation of the separation distance between the base of ~~that~~ **each** pond and the groundwater level at the time of the seepage rate test, where a seepage rate test was completed, using the standing water levels within the groundwater bores at the Premises at that time; (e) a copy of the calculations/methods undertaken to produce the estimations required by parts (b), (c) and (d) of this	Noted. The Delegated Officer considers that the provision of one report covering the seepage testing for all ponds at the premises will be sufficient and permit the Licence Holder additional time to undertake the required testing. Condition 18 of the Licence has been amended as requested so that one report on seepage testing of all the ponds is required to be submitted by the Licence Holder's requested date. To determine how ponds identified to be seeping will be managed by the Licence Holder has added in new Condition 19 to the Licence, with the intent of this condition aligning with the Licence Holder's proposed alternative wording for a condition 18f.

Condition	Summary of Licence Holder comment	DWER response
	condition; and (f) ~~an upgrade plan for that pond to ensure all damage is repaired, where the results of the testing indicate that the liner of that pond is damaged.~~ Suggested wording for alternate Condition 18(f): *The licence holder must by 31 December 2025 prepare and submit to the CEO, a report that includes, but is not limited to:* • *A decision on whether damaged ponds will be repaired or decommissioned;* • *Specific actions to achieve the proposed decision; and* • *• A timeframe for the completion of the specified actions.*	
Condition 22 Table 11	N/A	In further consultation with DWER's Contaminated Sites Branch in response to the Licence Holders additional comments, boron and sucralose are considered to be suitable WWTP specific chemical tracers to track the mixing and dilution of discharges from the KWWTP through the M1 Channel and D1 drain. Caffeine is considered to be less suitable for this purpose, because it is likely that this chemical compound would be rapidly biodegraded in water flows under the tropical climate conditions that are present at the site. Accordingly, caffeine has been removed from the Licence and replaced with the pharmaceutical compound carbamazepine. This chemical compound is typically present in TWW discharges from WWTPs and is highly mobile and resistant to biodegradation. These properties make this compound an effective tracer of contamination of surface water and groundwater by WWTP discharges.
	Condition 11 Table 5 Boron, sucralose and caffeine are monitored as "tracer compounds" and are not contaminants of concern being discharged to the M1 channel. Loading rates to	The reason for using these tracers is to allow surface water mixing models to be developed that will enable concentrations and loads of specific contaminants of

Condition	Summary of Licence Holder comment	DWER response
	be calculated are not contaminants of concern. Please confirm scientific reasoning for the inclusion of these parameters. Alternatively, Water Corporation request boron, sucralose and caffeine are excluded from loading calculations.	concern from the WWTP to be tracked with distance downstream of this facility. In this way, concentrations of the tracers that are measured at various sampling points downstream of the facility can be used as a de-facto measure of what would be an acceptable degree of dilution of the WWTP discharges that would protect downstream environmental receptors. That is, the tracers would help define an acceptable "mixing zone" within the M1 Channel that would be protective of downstream receptors. The National Water Quality Australia website provides generic guidance on how to regulate mixing zones. From a data-gap point of view, DWER recommends that the point where the M1 / D1 drainage channel discharges to the Ord River is considered to be the lower boundary of the mixing zone for the KWWTP. At this point, it is recommended that ammonium and boron concentrations during each monitoring event are no higher than concentrations that are measured at the proposed monitoring site in the irrigation channel upstream of the WWTP. Ideally, concentrations of sucralose at the downstream boundary of the mixing zone should be below detection limit to ensure that treated effluent from the WWTP has been sufficiently diluted to ensure other contaminants of concern (especially pharmaceutical compounds) in the effluent will not cause downstream environmental impacts. Boron and sucralose to remain in the condition and caffeine will be replaced by carbamazepine. Conditions 11 Table 5, condition 13 Table 7 and condition 16 Table 9 have been amended accordingly to include carbamazepine and remove caffeine.
	Condition Table 7 Contaminant loading for surface water cannot be calculated as	Further internal consultation has been undertaken with DWER's Contaminated Sites Branch and North West

Condition	Summary of Licence Holder comment	DWER response
	surface water flow volumes are not calculated at each surface water sampling point, thus it is technically not possible to comply with this licence condition. As per original request, contaminant loading requirement be deleted for surface water monitoring.	Measurement branch in light of comments provided by the Licence Holder; • Contaminated Sites have advised that ideally, water flow rates in the irrigation channel should also be measured during each water quality sampling event, and there are a number of portable flow-rate measuring devices available that could be used to make these measurements. • The proposed monitoring schedule for the Kununurra WWTP is also considered suitable for monitoring potential contaminant migration. Measurement branch have advised there is an OIC serviceable DI gauging station which collects flow data. This OIC data is provided in their Annual Report for its Water Licence GWL156287 (3) which is submitted to DWER. DWER can therefore calculate respective flow rates from this Report. Accordingly, DWER has removed this requirement from the AER.
	Error in table. Format error in Table 11 (Error! Reference source not found.)	Error in Table (Table 7 row) corrected.
Schedule 1 Maps	Noted	Licence Holder has accepted the proposed DWER amendment as outlined in Table 37.
Schedule 1 Maps	Noted	Licence Holder has accepted the proposed DWER amendment as outlined in Table 37. As per condition 13 there are no proposed changes to the surface water sample points.
Schedule 1 Maps	Water Corporation propose “new monitoring bore location” be not prescribed on the Licence figure as exact location will be	Noted. As stated in Table 8 Monitoring well location(s) the location

Condition	Summary of Licence Holder comment	DWER response
	determine based on further data review and on-site logistical constraints. Map updated providing correct well locations and IDs as confirmed following site visit on 26/06/2024. Updated map provided.	as per Schedule 1 map is indicative and not exact. The additional Background bore proposed location has been added to the map.
Decision Report		
Executive Summary	Noted	Licence Holder has accepted the proposed DWER response comment as outlined in Table 37.
Executive Summary	Noted	Licence Holder has accepted the proposed DWER response comment as outlined in Table 37.
Page 9 Table 4	Noted	Licence Holder has accepted the proposed DWER response comment as outlined in Table 37.
5.2.2	Noted	Licence Holder has accepted the proposed DWER response comment as outlined in Table 37.
6.6 Table 9	Table 9 Table 9 has typo, grammatical errors, please update.	Noted. Table 9 is data submitted by the Licence Holder.
6.9.4 Key Finding No.2	Although the Kununurra WWTP is not a MAR scheme, the work conducted by CSIRO (2009) is still applicable as the research investigated how groundwater impacted by wastewater effects different ecosystem receptors. Typonium spp is a shallow rooted plant in which roots are unlikely to be in contact with groundwater surrounding the WWTP. Thus groundwater impacts surrounding the WWTP are unlikely to impact Typonium spp on the likely hood the roots are	As per the General Observations and Key Findings from the review are as follows: • The KWWTP premises and surrounding arboretum contain suitable soil types/habitat known to support the Threatened Flora Typhonium. The presence of Typhonium on site has been confirmed from previous targeted survey. • There are other sources of contamination for water in the

Condition	Summary of Licence Holder comment	DWER response
	not in contact with groundwater. Please confirm the scientific reasoning for the inclusion of the statement ‘ which are considered a sensitive receptor for groundwater impacts’ when Typonium spp is a shallow rooted plant. Alternatively, please remove statement.	M1/D1 drainage system, most notably from surrounding agricultural industry, runoff from which has a similar contaminant profile to treated wastewater in terms of nutrients. • The groundwater monitoring network for the Premises does not extend beyond the premises boundary down hydraulic gradient of the WWTP ponds and there is limited information available regarding how potential contaminants will migrate through groundwater. • Groundwater monitoring indicates the KWWTP is responsible for at least localised groundwater contamination and that a leak in the pond lining system may be occurring. As per the Data Gaps the following data gaps still remain regarding the operation of the WWTP: 1. Further groundwater monitoring results are required to determine potential contribution of the WWTP operations to groundwater contamination. 2. The groundwater monitoring bore network is insufficient, with bore placement down hydraulic gradient of KWWTP lacking, meaning the migration of contaminants through groundwater towards the M1 channel cannot be tracked. 3. Further sampling of TWW is required to be confident in representative contaminant loadings of TWW across long term KWWTP operations. 4. Further and expanded ground- and surface- water monitoring across all M1 channel flow regime are required to clearly identify the potential contribution of the WWTP to groundwater/surface water contamination in the area.

Condition	Summary of Licence Holder comment	DWER response
		6. It is difficult to distinguish where increased contaminant loadings within samples are directly attributable to the impacts of the TWW discharge given the similarity of the contaminant profile to inputs from surrounding agricultural industry. As per the Outcomes: Based on the outcomes of the Licence review and in consideration of outstanding data gaps, the following key requirements have been incorporated into the KWWTP Licence. • Additional monitoring of surface water and groundwater across the three distinguished flow regimes to provide more certainty in conclusions drawn from monitoring data. Additional groundwater and surface water conditions have been included in the Proposed Licence. This will address Date Gap 1. • Conditions include incorporating the requirement for a three (3) year surface water and groundwater monitoring program to be undertaken, with the intent that a minimum of 4 sampling events occur per flow regime, with the results of this sampling to be summarised and a report prepared for submission and review by DWER. Conditions implemented to enforce this monitoring program would replace current surface water and groundwater monitoring conditions on the Licence. This will address Date Gap 1, 2, 3, 4, 5, and 6. • Installation requirements for at least one (1) additional down hydraulic gradient groundwater monitoring bores, likely located between 50m to 100m to the northwest of the premises boundary, to address Data Gap 2.

Condition	Summary of Licence Holder comment	DWER response
		• Fingerprint WWTP contaminant parameters have been included into the surface water and groundwater monitoring program to identify the direct WWTP discharges from the Premises and thus can trace/track the emission, pathway and receptor model directly associated with the WWTP - therefore assisting in removing uncertainty from contributing contaminants from the surrounding environment and agricultural industry. The inclusion of these additional parameters will help address Data Gaps 5 and 6. The following 'fingerprint' parameter suite has been incorporated into all groundwater and surface water monitoring licence conditions through the Licence Review. The Licence Holder is required to submit a groundwater monitoring report in September 2027 as per condition 23 which will assess a more robust set of groundwater data noting the inclusion of tracker contaminants which is designed to track, understand and establish groundwater pathways to help understand, and possibly close, the existing data gaps. At this point this matter can be re-evaluated to determine if *Typonium spp* is a sensitive receptor - and wording changed as/if required. No changes.
7.0 page 106-109	Although the Kununurra WWTP is not a MAR scheme, the work conducted by CSIRO (2009) is still applicable as the research investigated how groundwater impacted by wastewater effects different ecosystem receptors. Typonium spp is a shallow rooted plant in which roots are unlikely to be in contact with groundwater surrounding the WWTP. Thus groundwater impacts surrounding the WWTP are	Noted. As per the above explanation this matter will be re-assessed post submission of the groundwater monitoring report required by condition 23.

Condition	Summary of Licence Holder comment	DWER response
	unlikely to impact Typonium spp on the likely hood the roots are not in contact with groundwater	
9.8.3	Although the Kununurra WWTP is not a MAR scheme, the work conducted by CSIRO (2009) is still applicable as the research investigated how groundwater impacted by wastewater effects different ecosystem receptors. Typonium spp is a shallow rooted plant in which roots are unlikely to be in contact with groundwater surrounding the WWTP. Thus groundwater impacts surrounding the WWTP are unlikely to impact Typonium spp on the likely hood the roots are not in contact with groundwater. Please confirm the scientific reasoning for the inclusion of the statement ' which are considered a sensitive receptor for groundwater impacts' when Typonium spp is a shallow rooted plant. Alternatively, please remove statement.	Noted. As per the above explanation this matter will be re-assessed post submission of the groundwater monitoring report required by condition 23.
9.8.7 Key Findings	Noted	Licence Holder has accepted the proposed DWER response comment as outlined in Table 37.
9.8.8	Although the Kununurra WWTP is not a MAR scheme, the work conducted by CSIRO (2009) is still applicable as the research investigated how groundwater impacted by wastewater effects different ecosystem receptors. Typonium spp is a shallow rooted plant in which roots are unlikely to be in contact with groundwater surrounding the WWTP. Thus groundwater impacts surrounding the WWTP are unlikely to impact Typonium spp on the likely hood the roots are not in contact with groundwater. Please confirm the scientific reasoning for the inclusion of the statement ' which are considered a sensitive receptor for groundwater impacts' when Typonium spp is a shallow rooted	Noted. As per the above explanation this matter will be re-assessed post submission of the groundwater monitoring report required by condition 23.

Condition	Summary of Licence Holder comment	DWER response
	plant. Alternatively, please remove statement.	

DWER attended the Premises on Thursday 8 August 2024 to validate the groundwater bore network and subsequently sent the Licence Holder an email on 15 August 2024 requesting minor additional information. The Licence Holder provided comments on 23 August 2024. Table 39 outlines the Licence Holder final comments and DWER response.

Table 39 Licence Holder Final comment

Condition	Summary of Licence Holder comment	DWER response
Licence		
Condition 11, 13 and 16. Caffeine will be removed as a surface and groundwater monitoring parameter and replaced with Carbamazepine. Our hydrogeologists have informed us that this is a better marker parameter for TWW as it does not degrade as readily as Caffeine within water samples or the environment.	Sucralose has been added to the Licence as a TWW tracer, as it is shown to be an effective TWW at Wagin and Kwinana WWTPs. Water Corporation understands tracers play an important role in understanding the fate of TWW. Prior to Carbamazepine being added to a Licence Water Corporation would like to discuss a more strategic approach to setting parameters of how wastewater can be monitored in the environment. Water Corporation is very keen to ensure parameters are selected in a considered, consistent and scientifically robust manner, which offers broader value to DWER and the Corporation. Whilst recognising cost should not be an inhibitor to monitoring, Carbamazepine is a new proposition adding $90,000 per year on top of a significantly expanded monitoring program for one site.	Noted. Carbamazepine is considered a more scientifically robust parameter to measure the TWW pathway as explained in the correspondence to the Licence Holder notifying of this change. Carbamazepine offers the better value than Caffeine in understanding the Data Gaps presented in the current surface water flow pathway model. However, given the Water Corporations concerns surrounding cost, the Delegated Officer will revert back to Caffeine, noting that Sucralose and Boron will also act as marker species to track TWW through the surface and groundwater pathways. Condition 24 requires a surface water and groundwater assessment in September 2027 and the results of this assessment will outline the future monitoring requirement for all tracer parameters. Should Caffiene not prove to be effective, the Delegated Officer will reconsider adding Carbamazepine to the monitoring schedules.

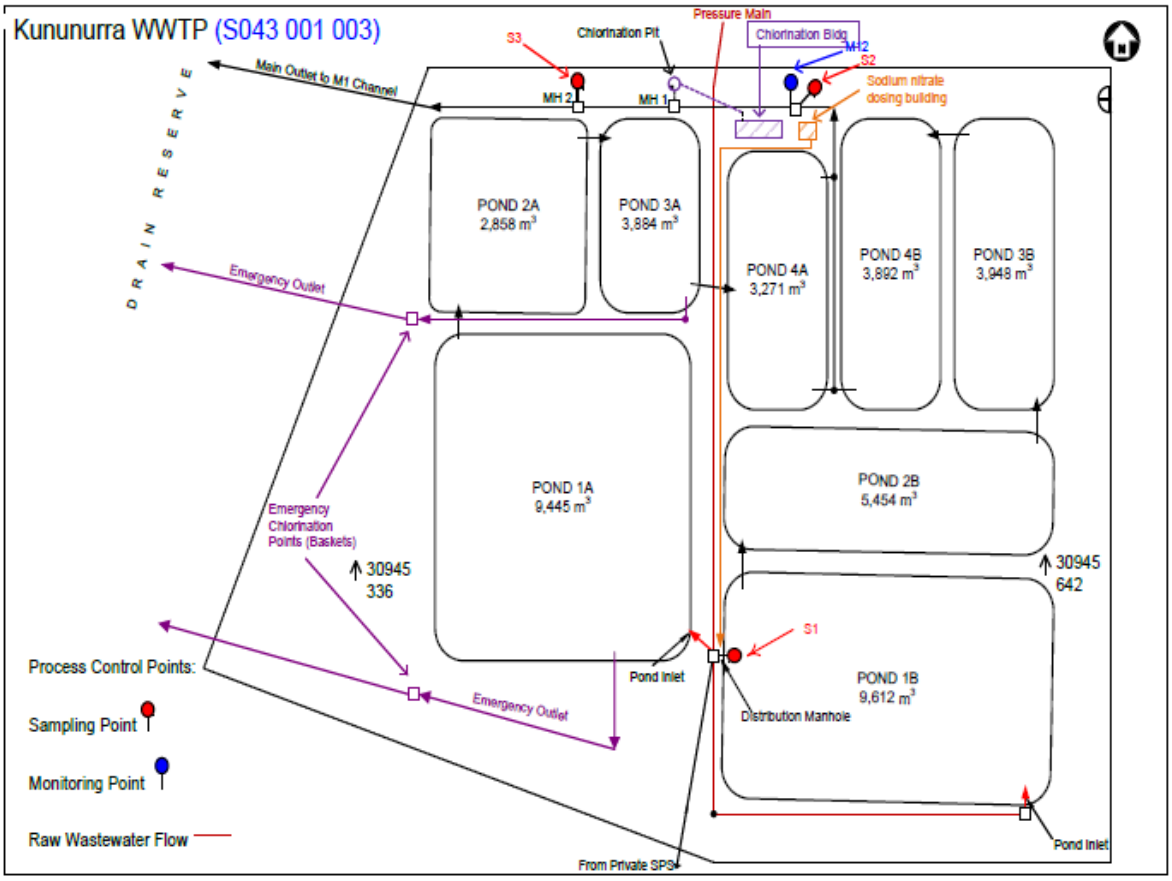
Condition	Summary of Licence Holder comment	DWER response
Condition 13 We will amend surface water sampling point SW10 to allow for a sample to be taken across an area of the D1 channel to permit the Water Corporation to select a spot which complies with internal safety regulations. The amendment of this sampling point will include the following specifications: 'SW10 sample must be obtained a minimum of 500 m from SW9 down the D1 channel and a minimum of 150 m from SW11 up the D1 channel'. The surface water sampling map has been updated accordingly and will be included in the final Licence.	Water Corporation has attached to this email a proposed surface water sampling map. Please note the following: • Additional surface water location proposed between SW3 and SW4 ~1km downstream of discharge point. Previous work has suggested full mixing occurs by the 1km downstream point, so this will allow Water Corporation to monitor this mixing. • SW6 proposed to be removed from sampling program and replaced with the ~1km downstream sampling point. The distance between SW6 and SW7 is only ~500m; based on previous work Water Corporation does not expect to see any difference in potential TWW impacts between these two locations. Thus, the sampling location is not adding value. • SW8 proposed to be moved ~300m east along the D1 channel to the gate of the M1/D1. This allows Water Corporation to sample from Water Corporation owned drain and not require OIC permission. • SW9 proposed to be moved ~300m west along the D1 channel. This is so the sample point aligns with the location WC and DWER went to which had a ladder, thus allowing safe access to the D1 to take a grab sample. • SW10 proposed location is free from overhanging canopy, to allow for sampling via drone. This	Noted. The Delegated Officer considered that the new locations proposed by the Licence Holder will not significantly alter the data that is required to be obtained to monitor surface water. Additionally, the new locatons appear to be easier for the Licence Holder to access, indicating there is less potential for data gaps due to access issues than within the previously proposed monitoring location schedule. Monitoring locations updated as requested and new surface water monitoring map included in the revised Licence.

Condition	Summary of Licence Holder comment	DWER response
	proposed location is >500m than proposed location SW9. • SW11 proposed to be sampled at the confluence of D1 drain and the Ord River. This is to allow the sampling to be conducted via drone sample, as Water Corporation considers this is the only way to sample surface water from this location safely. Water Corporation requests wording be added as a note beneath the ambient surface water monitoring table for SW10 & SW11 to ensure if sampling cannot be conducted due to unacceptable occupational health and safety risks. *"All reasonable attempts to complete surface water sampling from locations SW10 and SW11. Where sampling can't be completed due to Water Corporation occupational health and safety standards, and/or weather, missed samples from SW10 and SW11 will be reported in AERs"*	
Condition 22 Table 11 Loading rate calculations for Boron, Sucralose and Carbamazepine will be retained in Condition 22, Table 11 (as required by Condition 11, Table 5). This will allow us to develop surface water mixing models that will enable concentrations and loads of specific contaminants of concern from the WWTP to be tracked with distance downstream of this facility. In this way, concentrations of the tracers that are measured at various sampling points downstream of the facility can be used as a de-facto measure of what would	Noted	Please refer to Section 9.1.1.

Condition	Summary of Licence Holder comment	DWER response
be an acceptable degree of dilution of the WWTP discharges that would protect downstream environmental receptors. This will be explained in greater detail in the Decision Report response to your comments.		
Condition 22 Table 11 Contaminant loading throughout the M1 and D1 channels will be important to measure to help us understand how contaminants are traveling through surface water across the differing flow regimes. However, through discussions with our regional measurements team I understand that we may be able to obtain flow data from OIC. As such, we will remove the requirement for contaminant loading calculations to be provided for surface water monitoring samples as required by Condition 22, Table 11. Please note that we will calculate these ourselves when reviewing your submitted data.	Noted	Contaminant loading calculations removed from Condition 22 Table 11 (for Table 7).
Condition 24. We will amend the submission date for the surface water and groundwater monitoring report required by Condition 24 from 1 September 2026 to 1 September 2027, to ensure sufficient monitoring data is collected to inform the findings of that report.	Noted	Compliance date changed from 1 September 2026 to 1 September 2027.

Condition	Summary of Licence Holder comment	DWER response
Condition 16 Table 9 Groundwater Monitoring Locations.	Water Corporation has as attached to this email an updated Groundwater Monitoring Bore figure. Please note the following: • Bore 2/20 removed as this found to be destroyed on-site and was agreed to be not critical for ongoing monitoring. • Update bore names: Bores 2/99, 3/99 and 4/99 to be updated to B/99, C/99 and G/99. This is so the bore names match the names within the Water Corporation data system.	Noted. Bore numbers amended as requested and Map updated accordingly. Text in Condition 14 Table 8 amended to reflect New Bore as identified in the new Groundwater Map.

Attachment 1: Site Plan



Attachment 2: Existing Licence

Government of Western Australia
Department of Water and Environmental Regulation

Licence

Licence number	L6270/1991/10
Licence holder	Water Corporation
ABN	28 003 434 917
Registered business address	John Tonkin Water Centre 629 Newcastle St Leederville WA 6007
DWER file number	DER2013/000796-1
Duration	01/11/2013 to 31/10/2026
Date of issue	31/10/2013
Date of amendment	29/08/2023
Premises details	Kununurra Wastewater Treatment Plant Reserve 30945 Duncan Highway KUNUNURRA WA 6743 Legal description - Lot 3008 on Plan 48173 As defined by the premises map in Schedule 1

Prescribed premises category description (Schedule 1, *Environmental Protection Regulations 1987*)	Assessed production/ design capacity
Category 54 Sewage facility: premises – (a) on which sewage is treated (excluding septic tanks); or from which treated sewage is discharged onto land or into waters.	2000 m^3 per day

This licence is granted to the licence holder, subject to the attached conditions, on 29 August 2023, by:

Grace Campbell
Digitally signed by Grace Campbell
Date: 2023.08.29 12:19:13 +08'00'

Grace Campbell
A/Senior Environmental Officer – Industry Regulation
an officer delegated under section 20 of the *Environmental Protection Act 1986* (WA)

Licence history

Date	Reference number	Summary of changes
21/02/1992	3446	New application.
21/02/1993	4083	Licence re-issue.
01/10/1995	6270	Licence re-issue.
1/10/1998	6270/2	Licence re-issue.
7/10/1999	6270/3	Licence re-issue.
7/10/2000	6270/4	Licence re-issue.
7/10/2001	6270/4	Licence re-issue.
7/10/2002	6270/5	Licence re-issue.
7/10/2003	6270/6	Licence re-issue.
7/10/2004	6270/7	Licence re-issue.
1/11/2006	6270/8	Licence re-issue.
31/10/2008	L6270/1991/9	Licence re-issue.
31/10/2013	L6270/1991/10	Licence re-issue to REFIRE format.
26/03/2015	L6270/1991/10	Licence amendment to give effect to Minister for Environment Appeal determination 371/13.
11/06/2015	L6270/1991/10	Licence amendment to allow the presence of Duckweed in the treatment ponds.
29/04/2016	L6270/1991/10	Licence amendment to extend licence expiry date (Amendment Notice 1).
9/06/2016	L6270/1991/10	Licence amendment to allow the operation of the Sodium Nitrate Dosing Unit at the Treatment Plant.
29/08/2023	L6270/1991/10	Licence amendment to alter the reporting date for the Annual Audit Compliance Report and the environmental report to 1 October annually.

Interpretation

In this licence:

(a) the words 'including', 'includes' and 'include' in conditions mean "including but not limited to", and similar, as appropriate;

(b) where any word or phrase is given a defined meaning, any other part of speech or other grammatical form of that word or phrase has a corresponding meaning;

(c) where tables are used in a condition, each row in a table constitutes a separate condition;

(d) any reference to an Australian or other standard, guideline, or code of practice in this licence:

  (i) if dated, refers to that particular version; and

  (ii) if not dated, refers to the latest version and therefore may be subject to change over time;

(e) unless specified otherwise, any reference to a section of an Act refers to that section of the EP Act; and

(f) unless specified otherwise, all definitions are in accordance with the EP Act.

NOTE: This licence requires specific conditions to be met but does not provide any implied authorisation for other emissions, discharges, or activities not specified in this licence.

Licence conditions

The licence holder must ensure that the following conditions are complied with:

Waste Acceptance

1. The licence holder must only allow waste to be accepted onto the premises if:

(a) it is of a type listed in Table 1;

(b) the quantity accepted is below any limit listed in Table 1; and

(c) it meets any specification listed in Table 1.

Table 1: Waste acceptance

Waste	Quantity Limit	Specification
Sewage	None Specified	Accepted through sewer inflow(s) only

Waste Processing

2. The licence holder must ensure that the waste types accepted onto the premises are only subjected to the process(es) set out in Table 2 and in accordance with any process limits described in that table.

Table 2: Waste processing

Waste type	Process	Process limits and targets
Sewage	Biological, physical and chemical treatment	Treatment of sewage and septage waste must be targeted at or below the treatment capacity of 2000 m^3/day.
Sewage sludge area	Storage	None specified

Infrastructure and equipment

3. The licence holder must ensure that waste material is only stored and/or treated within vessels or compounds with the infrastructure detailed in Table 3.

Table 3: Containment infrastructure

Vessel or compound	Material	Requirements
Inlet works	Grit and screenings	Stored in a sealed bin which is surrounded by a bunded hardstand area which returns sludge leachate to the start of the treatment process
Facultative Treatment Ponds (1A and 1B)	Wastewater	Lined to achieve a permeability of less than 10^{-9} m/s or equivalent

Vessel or compound	Material	Requirements
Maturation Treatment Ponds (2A, 2B, 3A, 3B, 4A and 4B).	Wastewater	Lined with 25 cm clay liner
M1 Channel	Treated wastewater	In-situ clay lined
Sewage Sludge Compound	Sewage sludge	A bunded hardstand area capable of preventing surface run-off of leachate and sludge and which returns sludge leachate to the start of the treatment process

4. The licence holder must manage all wastewater treatment ponds such that:

(a) overtopping of the ponds does not occur except as a result of an extreme rainfall event;

(b) a freeboard at or below 200 mm is maintained;

(c) the integrity of the containment infrastructure is maintained;

(d) trapped overflows are maintained on the outlet of ponds to prevent carry-over of surface floating matter;

(e) vegetation and floating debris (emergent or otherwise) is prevented from encroaching onto pond surfaces or inner pond embankments with the exception of duckweed (*Lemna* sp.) on wastewater treatment ponds; and

(f) visual monitoring of duckweed coverage in conjunction with annual treatment efficiency monitoring is undertaken to ensure duckweed is not inhibiting the treatment efficiency of the plant.

5. The licence holder must:

(a) implement security measures at the site to prevent as far as is practical unauthorised access to the site;

(b) undertake regular inspections of all security measures and repair damage as soon as practicable; and

(c) ensure the entrance gates are closed and locked when the site is closed.

Emissions and discharges

Point source emissions to surface water

6. The licence holder must ensure that where waste is emitted to surface water from the emission points in Table 4 [and identified on the map of emission points in Schedule 1] it is done so in accordance with the conditions of this licence.

Table 4: Emission points to surface water

Emission point reference and location on Map of monitoring locations	Monitoring point and reference on Map of monitoring locations	Description	Source including abatement
M1 Channel	Treatment Plant Outlet Pipe	Discharge to M1 Channel via wastewater discharge point	Treated wastewater pipeline from wastewater treatment plant

Monitoring

General monitoring

7. The licence holder must ensure that:

(a) all water samples are collected and preserved in accordance with AS/NZS 5667.1 unless indicated otherwise in relevant table;

(b) all wastewater sampling is conducted in accordance with AS/NZS 5667.10;

(c) all surface water sampling is conducted in accordance with AS/NZS 5667.4, AS/NZS 5667.6 or AS/NZS 5667.9 as relevant;

(d) all microbiological samples are collected and preserved in accordance with AS/NZS 2031; and

(e) all laboratory samples are submitted to and tested by a laboratory with current NATA accreditation for the parameters being measured unless indicated otherwise in relevant table.

8. The licence holder must ensure that:

(a) monthly monitoring is undertaken at least 15 days apart; and

(b) quarterly monitoring is undertaken at least 45 days apart.

9. The licence holder must ensure that all monitoring equipment used on the premises to comply with the conditions of this licence is calibrated in accordance with the manufacturer's specifications and the requirements of the licence.

10. The licence holder must, where the requirements for calibration cannot be practicably met, or a discrepancy exists in the interpretation of the requirements, bring these issues to the attention of the CEO accompanied with a report comprising details of any modifications to the methods.

Monitoring of point source emissions to surface water

11. The licence holder must undertake the monitoring in Table 5 according to the specifications in that table.

Table 5: Monitoring of point source emissions to surface water.

Emission point reference	Monitoring point reference and location	Parameter	Units	Averaging period	Frequency
M1 Channel	Magflow Meter SP Kununurra WWTP Env. Discharge	Volumetric flow rate (cumulative)	L/s m^3/hr	Continuous	Weekly
	Treatment Plant Outlet Pipe	pH[1]	pH units	Spot sample	Quarterly
		5-day Biochemical Oxygen Demand	mg/L		
		Total Suspended Solids			
		Total Nitrogen			
		Total Phosphorus			
		Total Dissolved Solids			
		Nitrate/Nitrite			- Quarterly (when sodium dosing not in use - Monthly (when sodium dosing is in use)
		Ammonia/ Ammonium			
		Total Sodium			
	Post Chlorination Sample Point	*Escherichia coli*	Cfu/ 100 mL		Quarterly

Note 1: In-field non-NATA accredited analysis permitted.

Monitoring of inputs and outputs

12. The licence holder must undertake the monitoring in Table 6 according to the specifications in that table.

Table 6: Monitoring of inputs and outputs

Input/Output	Monitoring point reference	Parameter	Units	Averaging period	Frequency
Sewage – Inlet Flow Measurement (rising main)	None specified	Volumetric flow rate (cumulative)	m^3/d or ML/d	Monthly	Monthly

Ambient environmental quality monitoring

13. The licence holder must undertake the monitoring in Table 7 according to the specifications in that table.

Table 7: Monitoring of ambient environmental quality

Monitoring point reference and location	Parameter	Units	Averaging period	Frequency
M1 Channel sampling point approximately 50 metres upstream	Total Nitrogen; Total Phosphorus; and *Escherichia coli*	mg/L for Total Nitrogen and Total Phosphorus Cfu/100 mL for *Escherichia coli*	Spot sample	Quarterly
M1 Channel sampling point approximately 225 metres down stream				
M1 Channel sampling point approximately 1 kilometre down stream				
M1 Channel sampling point approximately 6 kilometres down stream				

Improvements

14. The Licence Holder must complete the improvements in Table 8 by the date specified.

Table 8: Improvement program

Improvement reference	Improvement	Date of completion
IR1	The Licence Holder must submit to the CEO a report that assesses the design, operation and emissions achieved at the Premises against industry standards for preventing or abating pollution or environmental harm for the discharges to water; M1 Channel.	30/11/14
IR2	Where the design, operation and emission levels at the Premises do not conform to industry standards for preventing or abating pollution or environmental harm the report shall contain commitments and actions to improve wastewater quality with an improvement timetable and establishing appropriate discharge limits for key contaminants to achieve these industry standards.	31/05/15
IR3	The Licence Holder must submit to the CEO a report which provides a review of all alternate wastewater re-use options and recommendations on any alternate disposal options.	30/11/14
IR4	The Licence Holder must submit to the CEO a report which provides a review, by a suitably qualified independent third party, of all current and previous scientific studies in relation to possible impacts from wastewater discharges into the M1 Channel. The report is to make appropriate recommendations on the feasibility of the continued discharge of treated wastewater to the M1 Channel.	30/11/14

Records and reporting

15. All information and records required by the licence must:

(a) be legible

(b) if amended, be amended in such a way that the original and subsequent amendments remain legible or are capable of retrieval;

(c) except for records listed in 15(d) be retained for at least 6 years from the date the records were made or until the expiry of the licence or any subsequent licence; and

(d) for those following records, be retained until the expiry of the licence and any subsequent licence:

(i) off-site environmental effects; or

(ii) matters which affect the condition of the land or waters.

16. The licence holder must:

(a) undertake an audit of their compliance with the conditions of this licence during the preceding annual period; and

(b) prepare and submit to the CEO an Annual Audit Compliance Report in the approved form by 1 October each year.

17. The licence holder must:

(a) implement a complaints management system that must record the following information (if known or provided) about complaints received at the premises concerning any environmental impact of the activities undertaken at the premises:

(i) name and address of the complainant(s) (if consented);

(ii) date and time of complaint;

(iii) date and time of alleged incident;

(iv) alleged source of the incident;

(v) general description of the alleged incident, including any environmental or health impacts reported by the complainant;

(vi) wind direction, wind speed and temperature at time of alleged incident; and

(vii) actions taken by licence holder to address complaints, including the outcome of any investigation(s) and action(s) to verify any impacts.

(b) complete an annual analysis and review of complaints recorded under 17(a) to identify any common factors and root cause of complaints and proposals to address these.

18. The licence holder must:

(a) prepare an environmental report that provides information in accordance with Table 9 for the preceding annual period, and

(b) submit the environmental report to the CEO by 1 October each year.

Table 9: Environmental reporting requirements

Condition or table	Requirement	Format or form[1]
-	Summary of any failure or malfunction of any pollution control equipment or any incidents that have occurred during the annual period and any action taken	None specified
Table 2	Summary of any treatment capacity target exceedances and any action taken	None specified
Condition 4	Summary of any freeboard target exceedances and any action taken.	None specified
Table 5	Monitoring of point source emissions to surface waters	None specified
	Contaminant loading (kg/day – monthly average) to	None specified

	surface water of parameters monitored in Table 5 (except pH and *E.coli*)	
Table 6	Monitoring of inputs and outputs	None specified
Table 7	Monitoring of ambient environmental quality	None specified
Condition 16	Compliance	Annual Audit Compliance Report (AACR)
Condition 17	Complaints summary	None specified

Note 1: Forms are on the Department's website.

19. The licence holder must ensure that the environmental report also contains an assessment of the information contained within the report against previous monitoring results and licence limits.

20. The licence holder must submit the information in Table 10 to the CEO at the Contact Address according to the specifications in that table.

Table 10: Non-annual reporting requirements

Parameter	Reporting period	Reporting date (after end of the reporting period)	Format or form
Copies of original monitoring reports submitted to the licence holder by third parties	Not Applicable	Within 14 days of the CEOs request	As received by the licence holder from third parties

21. The licence holder must ensure that the parameters listed in Table 11 are notified to the CEO in accordance with the notification requirements of the table.

Table 11: Notification requirements

Condition	Parameter	Notification requirement[1]	Format or form
Condition 6	Calibration report	As soon as practicable	None specified
-	Taking a process equipment offline for maintenance works that may result in increased odour emissions	No less than 72 hours in advance of works	None specified
-	Removal of sewage sludge from a treatment pond, sewage sludge	No less than 14 days in advance of works[2]	None specified

	storage pond or Geobag		

Note 1: No notification requirement in the licence shall negate the requirement to comply with s72 of the Act.

Note 2: The following information shall be included: (i) when desludging is proposed to occur, (ii) the desludging method, (iii) action to mitigate potential odour impacts, and (iv) the method by which the community will be advised of the desludging activities.

Definitions

In this licence, the terms in Table 12 have the meanings defined.

Table 12: Definitions

Term	Definition
ACN	Australian Company Number
Annual Audit Compliance Report (AACR)	means a report submitted in a format approved by the CEO (relevant guidelines and templates may be available on the Department's website).
annual period	a 12 month period commencing from 1 July until 30 June of the immediately following year.
approved form	means the Annual Audit Compliance Report (AACR) form template approved by the CEO for use and available via DWER's external website.
AS/NZS 2031	means the Australian Standard AS/NZS 2031 *Selection of containers and preservation of water samples for microbiological analysis.*
AS/NZS 5667.1	means the Australian Standard AS/NZS 5667.1 *Water Quality – Sampling – Guidance of the Design of sampling programs, sampling techniques and the preservation and handling of samples.*
AS/NZS 5667.4	means the Australian Standard AS/NZS 5667.4 *Water Quality – Sampling – Guidance on sampling from lakes, natural and man-made.*
AS/NZS 5667.6	means the Australian Standard AS/NZS 5667.6 *Water Quality – Sampling – Guidance on sampling of rivers and streams.*
AS/NZS 5667.10	means the Australian Standard AS/NZS 5667.10 *Water Quality – Sampling – Guidance on sampling of waste waters.*
averaging period	means the time over which a limit is measured or a monitoring result is obtained.
CEO	means Chief Executive Officer of the Department. "submit to / notify the CEO" (or similar), means either: Director General Department administering the *Environmental Protection Act 1986* Locked Bag 10 Joondalup DC WA 6919 or: info@dwer.wa.gov.au
condition	a condition to which the licence is subject under section 62 of the *Environmental Protection Act 1986*

Term	Definition
Department	means the department established under section 35 of the *Public Sector Management Act 1994* (WA) and designated as responsible for the administration of the EP Act, which includes Part V Division 3.
discharge	has the same meaning given to that term under the EP Act.
emission	has the same meaning given to that term under the EP Act.
EP Act	*Environmental Protection Act 1986* (WA)
EP Regulations	*Environmental Protection Regulations 1987* (WA)
extreme rainfall event	means a one in ten year rainfall event of 72 hours duration.
freeboard	means the distance between the maximum water surface elevations and the top of retaining banks or structures at their lowest point.
geobag	means a geotextile dewatering bag that allows solids to dewater over time while containing the solid component.
hardstand	means a surface with a permeability of 10^{-9} metres/second or less.
in-situ soils	means soils that are in place and have not been moved from their original place of deposition.
leachate	means liquid released by, or water that has percolated through, waste and which contains some of its constituents.
licence	refers to this document, which evidences the grant of a licence by the CEO under section 57 of the EP Act, subject to the specified conditions contained within.
licence holder	refers to the occupier of the premises, being the person specified on the front of the licence as the person to whom this licence has been granted.
M1 Channel	means the irrigation channel as depicted in Schedule 1: Premises map.
Magflow Meter SP Kununurra WWTP Env. Discharge	means the sample point as depicted in Schedule 1: Map of monitoring locations.
NATA	means the National Association of Testing Authorities, Australia.
NATA accredited	means in relation to the analysis of a sample that the laboratory is NATA accredited for the specified analysis at the time of the analysis.
Post Chlorination Sample Point	means the sample point as depicted in Schedule 1: Map of monitoring locations.

Term	Definition
premises	refers to the premises to which this licence applies, as specified at the front of this licence and as shown on the premises map (Figure 1) in Schedule 1 to this licence.
prescribed premises	has the same meaning given to that term under the EP Act.
process equipment	means any wastewater or sludge containment infrastructure or wastewater treatment vessel.
quarterly period	means the four inclusive periods from 1 April to 30 June, 1 July to 30 September, 1 October to 31 December and in the following year, 1 January to 31 March.
Schedule 1	means Schedule 1 of this licence unless otherwise stated.
spot sample	means a discrete sample representative at the time and place at which the sample is taken.
Treatment Plant Outlet Pipe	means the sample point as depicted in Schedule 1: Map of monitoring point locations (Figure 2).
waste	has the same meaning given to that term under the EP Act.

END OF CONDITIONS

Schedule 1: Maps

Premises map

The boundary of the prescribed premises is shown in the map below (pink). (Figure 1)

Figure 1: Map of the boundary of the prescribed premises

Map of monitoring locations

The locations of the monitoring points defined in Table 4 are shown below (Figure 2).

Figure 2: Map of monitoring point locations