Decision Report

Application for a licence

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

Licence Number	L9275/2020/1
Applicant	Eagle Bay Brewing Co Pty Ltd
ACN	124 209 794
File number	DER2020/000613
Premises	Eagle Bay Brewing Co 236 Eagle Bay Road NATURALISTE WA 6281
Date of report	03/08/2021
Proposed decision	Licence granted

1. Decision summary

This report documents the assessment of potential risks to the environment and public health from emissions and discharges during the operation of an existing brewery. As a result of this assessment, licence L9275/2020/1 has been granted.

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

2. Scope of assessment

2.1 Application summary and overview of premises

On 1 December 2020, Eagle Bay Brewery Co Pty Ltd (the applicant) submitted an application under section 57 of the *Environmental Protection Act 1986* (EP Act) to licence their existing brew house operation, located about 4 km northwest of Dunsborough.

The below table describes the prescribed premises category that the application is subject, as defined in Schedule 1 of the Environmental Protection Regulations 1987:

Prescribed premises category description (Schedule 1, Environmental Protection Regulations 1987)	**Assessed design capacity (from application)**
Category 25: Alcoholic beverage manufacturing: premises on which an alcoholic beverage is manufactured and from which liquid waste is to be discharged onto land or into waters.	1,000 kilolitres of beer and cider produced per annual period

Since opening in 2010, the production capacity of the premises has increased, with the brewery now significantly exceeding the prescribed threshold for category 25, which is 350 kL or more of alcoholic beverage produced per year. Based on the existing infrastructure at the premises, in particular the fermentation capacity, the maximum theoretical capacity for brewery operations is in the order of 1,000 kL of beer per year, which makes it one of the 5 largest craft beer breweries in Western Australia.

Initial construction of the premises, and subsequent increases in capacity, have not been authorised through works approvals under the EP Act.

Beer is brewed using rainwater collected on site (2,000 kL tank capacity), with scheme water used as wash down water, when required.

2.1.1 Current operational aspects

The processing brew house is a circuit comprising a mash tun, a kettle and a whirlpool. The water has contact with the malted barley in the mash tun. The spent grain is collected and fed to cows on the farm. The wort is transferred to the kettle where it is boiled, and hops are added. The wort is then transferred to the whirlpool, which is essentially a holding vessel that increases the efficiency of the brew house by allowing another brew to be transferred to the kettle. Hops can also be added in the whirlpool.

The wort is then transferred to one of 17 fermentation vessels (total capacity 51,600 L) for up to 30 days to allow fermentation and maturation to occur. Finished beer is then stored in a bright tank (supply tank) which services the fonts in the restaurant or sent to the packing shed for wholesale distribution.

A small amount of cider (approximately 4,000 L in the 2019/2020 financial year) is also made on the premises from apple juice (approximately 4,300 L in the 2019/2020 financial year) sourced from a juice processor in Manjimup. The amount of cider produced varies from year to year as the cider is made in batches on demand for sale in the onsite restaurant.

Wastewater treatment infrastructure

Despite increases in production since the commencement of operations the capacity of the brew house on-site wastewater treatment infrastructure has remained unchanged. The original approvals for the brew house wastewater system, issued by the Shire of Busselton in 2009 and Department of Health (DoH) in 2010, included 2 x 12 m fully inverted leach drains (alternating system) with an estimated wastewater discharge capacity of 1,000 L/d, which is based on the volume of wastewater generated from production of about 40 kL/yr of beer. Essentially, the DoH approval for wastewater discharged to the brewery leach drains is for up to 1,000 L/day.

According to the applicant, the brewery is currently producing about 550 kL/yr of beer. Based on the average industry standard of 3 litres of wastewater generated for every litre of beer produced, it is likely that actual wastewater volumes are in the order of 1,650 kL/yr, or about 4,520 L/d. The current system is very basic for a brewery of this size, comprising only of primary level treatment, with aeration, manual pH balancing (with sodium hydroxide) and disposal of wastewater to a sub-soil leach drain system. Samples of the wastewater indicate that very little treatment is occurring. The brewery wastewater system currently consists of the following:

- drains in the brewery floor contain bucket traps to catch larger solids, these bucket traps are manually emptied into the spent grain bin (which is fed to cows on the farm);
- wastewater flows via gravity from the brewery to a 5,000 L concrete settling tank located downgradient from the brewery. The settled solids in this tank are pumped out by a controlled waste contractor about every 6 months.
- the water flows via gravity from the concrete settling tank to an adjacent 20 kL poly aeration tank (it passes through a flow meter). The aerator runs 24 hours a day, however due to the lack of retention time, the water in this tank is often anaerobic); and
- the water then overflows via gravity downgradient to either the original 2 x 12 m leach drains or two small settling ponds about 250 m downgradient of the brewery. A valve is used to direct the wastewater in either direction, in which current management involves the brewery team manually directing wastewater to the leach drains Saturday to Tuesday, and to the ponds on Wednesday to Friday.

The applicant acknowledges the current system is inadequate for the size of the operation, with the original leach drain system often blocked by brewery solids, and two ‘ponds’ having to be excavated downgradient to contain the inevitable overland flow. Even with significant seepage, the ponds are inadequate to contain the required volume of wastewater, having overflowed into the nearby creek during the wetter months in previous years.

The applicant also acknowledges that current wastewater controls are not sufficient for present operations and require replacing with a system that is fit-for-purpose. A replacement wastewater treatment plant that includes above ground disposal via irrigation of adjacent farming land is concurrently being assessed under works approval W6491/2021/1.

The applicant advises sludge that accumulates at the bottom of the aeration tank is circulated through the system as it contains bacteria that is beneficial to the treatment of the wastewater. The sludge build-up is removed off-site about every 6 months via a controlled waste carrier.

Volume of wastewater produced

The applicant advises about 2.4 litres of wastewater is generated for every litre of beer produced, which is less than the average industry standard of 3 litres of wastewater generated per litre of beer produced.

Based on current beer production (550 kL/yr), a wastewater treatment system with the capacity to treat up to 1,320 kL/yr of wastewater is required. A system with the capacity to treat up to 2,400 kL/yr is required for the design capacity of the brewery (1,000 kL/yr).

Solid waste management

Spent grain from the brewing process is manually shovelled out of the mash tun, stored and sealed in 1 tonne tubs. When the tub approaches full capacity, it is taken by forklift to a truck with a tip tray on the farm and taken to various paddocks for cattle feed.

There is a small amount of trub (spent hops) that comes out of the kettle when the wort is transferred, which is captured and added to the spent grain tub before being transferred off-site.

2.1.2 Proposed irrigation of wastewater

The applicant is proposing to irrigate 10,000 L of wastewater per day to a 1.3 ha area located approximately 400 m west of the brewery.

A pump (pump 1) is proposed to be installed in the existing 20 kL poly aeration tank to pump wastewater to a proposed 50 kL poly tank which will be located on a gravel hardstand. Pump 1 is proposed to operate by a float switch which would engage below the overflow pipe to the leach drains. The applicant is proposing to use the leach drains as a contingency in case pump 1 fails.

An irrigation pump (pump 2) is proposed to be installed in the 50 kL poly tank and will be controlled by a timer. A new flow meter will be installed on the line to the irrigation area.

Wastewater will be irrigated via a k-line 2-pod irrigation system which will have 100 m reach from a central hydrant. There will be 2 sprinklers, each with a radius of at least 17 m. The applicant has advised that irrigation over the entire area is achieved by moving the irrigation line in a clockwise direction around the central hydrant every few days (within the 1.3 ha area) by dragging the pipeline with an all-terrain, or other, vehicle.

The applicant is proposing to plant a hay crop during winter which will be harvested during October or November.

During the summer months the applicant intends to direct most of the wastewater to a drip irrigation system that will irrigate perennial trees and shrubs proposed to be planted along the southern boundary of the irrigation area. No crop is intended to be grown during the summer months, although the applicant has indicated a summer crop may be trialed. The remaining wastewater, during the summer months, is proposed to irrigate pasture within the irrigation area via the k-line 2-pod irrigation system.

2.2 Assessed design capacity

According to the applicant, the brewery is currently producing about 550 kL/yr of beer, however based on the number and size of fermentation tanks (see below), the actual theoretical design capacity of the premises is 1,000 kL/yr of beer with the volume of the fermentation tanks being the limiting factor.

3. Infrastructure

The brewery facility infrastructure, as it relates to category 25 activities, is detailed in Table 1 and with reference to the premises layout in Schedule 1 of the Licence.

Table 1: Premises infrastructure

Infrastructure - Prescribed Activity Category 25	
The existing throughput of the brewery produces approximately 550 kL/yr of beer and discharges the generated 1,320 kL/yr of wastewater to 2 x unlined ponds and previously approved leach drains.	
Existing	
1	Brewery production • 2,000 kL capacity rainwater storage tanks • 1x Mash tun (1,200 L) • 1x Kettle (1,200 L) • 1x Whirlpool - holding vessel (1,200 L) • Fermentation vessels (51,600 kL) 4 x 1200 L

Infrastructure - Prescribed Activity Category 25	
	4x 2400 L 7x 3600 L 2x 6000 L • Bright tank (supply tank) • Packing shed (wholesale distribution)
2	Current WWTP • Brewery floor drainage • Bucket trap to remove solids • 5kL concrete settling tank • Gravity fed 20kL aeration tank (flow meter)
3	• 2 x unlined ponds (10 m x 4 m x 1 m) Overflow swale (six unlined attenuation pits)
4	• 2x 12 Leach drains (approved to discharge 1000 kL/day)
5	Proposed irrigation of wastewater • Pump 1 (to be installed in the existing 20 kL aeration tank) • 50 kL poly tank, with pump 2 to be installed within the tank. • Flow meter (installed on the irrigation line) • Irrigation piping (from 50 kL poly tank to central hydrant) • K-line 2-pod irrigation system (2 sprinklers each with a 17 m radius and 5 mm/hr application rate) • Drip irrigation line (application rate of 2 mm/hr with a dripper at least every 1 m)

4. Risk assessment

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

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

4.1 Environmental siting and receptors

4.1.1 Land use

The premises is zoned within agricultural and rural land on the eastern slopes of Cape Naturaliste, with the surrounding area comprising conservation estate and interspersed rural lifestyle developments.

4.1.2 Climate

Table 2: Average monthly rainfall and pan evaporation

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Rain (mm)[1]	11.1	7.5	23.8	33.8	101.6	127.7	142	113.2	75.3	35.5	26.3	12.2
Mean monthly pan evaporation (mm)[2]	254	198	156	105	67	65	58	80	109	154	178	244

[1] BOM station 9519, 1991 – 2020
[2] DPIRD, Wilyabrup (MR001), November 2018 – May 2021

4.1.3 Receptors

Table 3 below provides a summary of potential human and environmental receptors that may be impacted because of activities upon or emission and discharges from the prescribed premises *(Guideline: Environmental Siting* (DWER 2020).

Table 3: Sensitive human and environmental receptors

Human receptors	**Distance from brewery**
Closest residential receptor – single rural residential property	1km W
Eagle Bay residential area	1.5 km N
Dunsborough North residential area	1.5 km S

Environmental receptors	**Distance from brewery**
Surface water	The premises is within the Cape to Cape North Surface Water Area, proclaimed under the *Rights in Water and Irrigation Act 1914* (RIWI Act). The Jingarmup Brook is one of five waterways that are classified as intervention waterways within the *Vasse Wonnerup Wetlands and Geographe Bay – Water Quality Improvement Plan* (Geographe WQIP). Intervention waterways are classified as having winter median nutrient (nitrogen) values below the Geographe WQIP trigger values; therefore, the department's objective for the Jingarmup Brook is to improve the water quality (to reduce nitrogen to criteria levels in the document) within the Jingarmup Brook. Tributaries of Jingarmup Brook (winter only) are 250 m NW and 400 m S of brewery; and 280 m NE and 300 m NW of proposed irrigation area. Jingarmup Brook (non-perennial minor river) is 940 m and 1.5 km W of irrigation area and brewery respectively. Closest licence to take surface water is 500 m S of proposed irrigation area.
Groundwater	The premises in within the Busselton-Capel Groundwater Area proclaimed under the RIWI Act. Aquifer potential of the Leeuwin block is limited to the saprolitic zone (weathered interval between the granite and the overlying clay) and perched water between clay and any overlying sand interval. Maximum depth to groundwater (measured at 4 bores located within irrigation area on 22 July 2020) is approximately 1 to 2 mbgl.
Soil	Soils at the location of the unlined ponds comprise of sand – light grey, fine to coarse-grained, angular to sub-rounded quartz with some feldspar; moderately sorted, loose. (DAFAWA 1990). Soils at the leach drain area is silty gravelly sands – moderate brown to reddish brown, mottled, fine to coarse grained quartz. The applicant has provided a soil assessment of the proposed irrigation area (November 2019) which shows: • The soils at the irrigation area comprise of sand (1.5 to 2.5 m thick) overlying clayey sand to a depth of at least 3 m. • Results of sampling showed that exchangeable sodium percentage (0-40 cm and 40-100 cm), saturated hydraulic conductivity (0-100 cm) and soil pH (surface layer) had a moderate limitation for long-term irrigation with wastewater suggesting that there is the potential for structural degradation and waterlogging. • Results of sampling showed that effective cation exchange capacity (0-40 cm) and phosphorus sorption (0-100 cm) had a severe limitation for long-term irrigation with wastewater suggesting that the soils may be unable to hold plant nutrients and are unable to sorb excess phosphorus which may present a groundwater risk.

4.2 DWER technical review

4.2.1 Existing wastewater quality

The applicant has provided water quality results of samples taken from the downgradient ponds, which is taken to be indicative of the quality of wastewater that has been 'treated' and is currently leaching to soil and groundwater (Table 4).

It can be seen the quality is similar to that of raw brewery wastewater, and exceeds the ANZECC 2000 criteria for irrigation, which is expected given the basic and ineffective nature of the treatment system being used.

Table 4: Wastewater quality, final unlined pond tested in June and October of 2019

	BOD (mg/L)	TSS (mg/L)	TN (mg/L)	TP (mg/L)	TDS (mg/L)	SAR[5]
June 2019	2,480 2,350	601 206	63.9 61.4	27.6 28.4	1900 1500	-
October 2019	956 2,460	612 207	67.1 50.3	32.8 34.6	1590 1630	22.0 14.5
Typical range of raw brewery wastewater[1]	1,200 – 3,600	200 – 1,000	25 - 80	10 – 50	-	-
Typical effluent quality following nutrient removal treatment[2]	5 - 20	5 - 20	10 - 20	<2	-	-
ANZECC 2000 – Primary Industries[3]	<15	<40	25 – 125[4]	0.8 - 12[4]	3000	<8

[1]Kebede, T. B. 2018. *Wastewater treatment in brewery industry*, review. International Journal of Engineering Development and Research. Available at: https://www.ijedr.org/papers/IJEDR1801124.pdf

[2] Treatment process category D from Appendix 6 of ARMCANZ and ANZECC 1997. *National Water Quality Management Strategy – Australian Guidelines for Sewerage Systems – Effluent Management*. Commonwealth of Australia.

[3] National Water Quality Management Strategy Paper No. 4 – Australian and New Zealand Guidelines for Fresh and Marine Water Quality, Volume 3 Primary Industries, 2000, ANZECC and ARMCANZ (ANZECC 2000).

[4] ANZECC 2000, requires site specific assessment to determine actual value

[5] SAR means Sodium Absorption Ratio

Salinity values[1]

SAR provides an indication of the infiltration ability of water on soils. When SAR levels are high (8 mg/L or above) high sodium levels affect the soil behavior by increasing soil dispersibility, reducing water entry and reducing soil profile water availability. If water containing a high SAR is applied over or within a soil, over time the sodium in the water can displace the calcium and magnesium in the soil. This will cause a decrease in the ability of the soil to stabilise aggregates and a loss of soil structure. This will decrease infiltration and permeability of the soil, leading to waterlogging. The high SAR level in the October sample (June was not sampled for SAR) could indicate that the leach drain field has been subject to high salinity over many years. The infiltration capacity of the leach drain area may have been subject to waterlogging and reduced permeability for a number of years. Wastewater applied through the leach drains under these conditions could leach towards the creek due to a reduced groundwater infiltration capacity of the soil caused by the high SAR and TDS levels in the wastewater.

Where SAR is high it is likely that nitrogen and phosphorous will be leached through the soil without being bound within the soil or taken up by vegetation.

[1] Water quality classifications are from DoW 2017 *Understanding Salinity (https://www.water.wa.gov.au/water-topics/water-quality/managing-water-quality/understanding-salinity)*. Salinities above 1000mg/L will affect freshwater ground dependent ecosystems.

BOD levels
The National Water Quality Management Strategy guidelines for sewerage systems and effluent management recommends that for primary treatment systems (such as the system installed at Eagle Bay, typical BOD ranges for treated effluent should range between 120-250 mg/L. Wastewater from the existing treatment system at Eagle Bay is 10 times above this typical BOD range.

TSS levels
The June and October 2019 samples reported TSS results of over 200 and 600 mg/L. The above guideline recommends that typical TSS concentrations for primary treated effluent should range between 80-200 mg/L. Wastewater from the existing treatment system at Eagle Bay has shown levels 3 times above this typical TSS range.

4.2.2 Irrigation of wastewater

Hydraulic loading impact analysis
The preliminary assessment[1] of the wastewater hydraulic loading at the premises indicates that the size of the irrigation area (1.3 ha) is sufficient to enable wastewater and its dissolved constituents to be taken up by vegetation or retained within the soil profile without excessive seepage into groundwater.

[1] The calculation for the preliminary assessment of hydraulic loading can be calculated using the following equation (US EPA, 2006):

$$A = (3.65 \times Q) / (L \times T_{app})$$

Where:
A = land area (hectares)
Q = flow rate of wastewater (m^3/day) – proposed 10,000 L/day = 10 m^3/day
L = wastewater hydraulic loading to soil (cm/week) – assumed to be 4 cm/week (US EPA, 2006)
T_{app} = period of wastewater application each year (weeks) – the applicant has indicated that irrigation will occur 52 weeks of the year.

Using the above values in the equation gives a land area of approximately 0.2 ha.

However, the assessment does not consider that rainfall exceeds evaporation from May to August each year, in particular during the months of June and July when rainfall exceeds potential evaporation by about a factor of three (Table 2). Soils during these months are likely to be close to their field capacities, increasing the risk that wastewater applied during this time will infiltrate past any crop root zone into groundwater.

The applicant included a water balance calculation to assess the volume of wastewater proposed to be irrigated against the hydraulic output of the irrigation area and the volume of storage required. The applicant used the following tools and assumptions in undertaking the water balance (for the year 2019) to inform the Nutrient Irrigation Management Plan (NIMP) (AquaSol Water Treatment Solutions, version 2, February 2021):

- estimated effluent production of 6,600 L/day;
- land application area of 0.5 ha;
- mean monthly rainfall obtained from Bureau of Meterology (BoM) Cape Naturaliste Station (it appears only data from 2019 was used);
- monthly average pan evaporation data from Bureau of Meterology (BoM) (estimated from an Australia wide map);
- design irrigation rate of 5 mm/day for sand (determined from Table M1 of AS/NZS 1547:2012); and
- storage requirements calculated to ensure that irrigation does not occur on days exceeding 1 mm of rainfall.

The water storage requirements were calculated by adding storage requirements for each day when irrigation could not occur. The calculations provided determined that a maximum of 72,600 kL of storage would be required during the year. However, it is noted that following periods of rainfall, the irrigation rate was increased to discharge the accumulated wastewater to land over the next non-raining days. I.e. it appears that 72,600 kL of wastewater is estimated to be irrigation over 4 days (18,150 L/day) during June following a period of 11 days

of rainfall.

The water balance calculations provided by the applicant have not considered:

- the proposed effluent production of 10,000 L/day (see Appendix 1);
- the proposed land application area of 1.3 ha (see Appendix 1);
- the maximum depth to groundwater, 1 to 2 mbgl, in late winter / early spring (see section 4.1.3). It is noted that Water Quality Protection Note (WQPN) 22 *Irrigation with nutrient-rich wastewater* (DoW, 2008) recommends a minimum 2 m vertical separation between the irrigated surface and the maximum groundwater table to maintain aerobic soils); and
- soil moisture following periods of rainfall.

Additionally, it is noted that only 2019 data was used for mean monthly rainfall data, in which there was considerably less rainfall in February, May, July and September compared to the average monthly rainfall for the same months using data from 1991 – 2020).

The applicant has also proposed that during the summer months most of the wastewater will be directed to a drip line along the southern boundary to irrigate perennial shrubs and trees. This will significantly reduce the area irrigated during the summer months.

Nutrient loading impact analysis – nitrogen

A preliminary assessment[2] of nutrient loading rates within the proposed irrigation area indicates that 1.3 ha is an insufficient land area for crops to remove all of the nitrogen that is applied in irrigated wastewater.

[2] The land area required to ensure that a particular crop takes up all of the nitrogen applied within a disposal area can be estimated using the following equation (NSW EPA, 1998):

$$A = (C \times Q) / L_N$$

Where:
A = land area (m^2)
C = concentration of N in wastewater (mg/L) – 60.68 mg/L (see Table 4)
Q = treated wastewater flow rate (L/d) – proposed 10,000 L/day
L_N = critical loading rate (uptake rate) for N for a specific crop ($mg/m^2/day$) – considered to be approximately 25 $mg/m^2/day$ (refer to appendix 6 in NSW EPA, 1998)

Using the above values in the equation gives a required land area of approximately 24,300 m^2 (2.43 ha). It is noted that if the treated wastewater flow rate is reduced to 5,350 L/day (1,953 kL/yr) the 1.3 ha may be sufficient. Alternatively, 1.3 ha may be sufficient for the proposed 10,000 L/day if the average nitrogen concentration in the wastewater were reduced to 32.5 mg/L. It is also noted that this preliminary assessment is based on results of only two sampling events in 2019 and may not accurately represent the current wastewater quality.

It should be noted that the above equations are used as an estimate only and may not accurately represent what may occur onsite; however, it does give an indication that there is potential for overloading of nitrogen at the premises if 10,000 L/day of wastewater is irrigated to the 1.3 ha area.

Additionally, it is noted that the quality of wastewater that is proposed to be irrigated is similar to that of raw brewery wastewater; of significantly poorer quality than is expected following nutrient removal treatment of wastewater; and does not meet the primary industries ANZECC guidelines (2000) for BOD, TSS or TP (see Table 4).

The applicant has provided a nutrient balance with their application and has made the following assumptions:

- irrigation area of 0.5 ha;
- total nitrogen concentration of 25 mg/L;
- daily wastewater flow rate of 6,600 L/day;
- average uptake rate of 49 $mg/m^2/day$.

The applicant's calculations, using the above assumptions, shows that the irrigation area is sufficient for nitrogen uptake from irrigation of the wastewater.

It is noted that the applicant has proposed an irrigation area of 1.3 ha; the current average nitrogen concentration in the wastewater is 60.68 mg/L (Table 4); the applicant has proposed a daily flow rate of 10,000 L/day.

Additionally, the applicant has indicated that a hay crop (specific crop type has not yet been determined by the applicant) will only be grown in winter, and harvested once a year, suggesting that the average uptake rate of 49 mg/m^2/day may be overestimated.

The applicant has also not considered the nutrient uptake rate of the proposed perennial shrubs and trees that are proposed to be drip irrigated during the summer months.

Nutrient loading impact analysis – phosphorus
Unlike nitrogen, phosphorus that is applied to crops in irrigation water is typically not directly taken up by vegetation. The operational life of a wastewater irrigation scheme is limited by the phosphorus storage capacity of the soil profile between the land surface and the water table.

The results of soil sampling at the irrigation site (Enpoint 2019) indicates that surface soils within the irrigation area have limited phosphorus sorption capacity. Therefore, there is potential that phosphorus could be mobilised and therefore infiltrate to groundwater with ongoing wastewater irrigation at the premises. It is noted that amending the soil with calcium carbonate ("Ag-lime") could greatly reduce the potential for phosphorus leaching, with the applicant proposing to apply Ag-lime at a rate of 2.5 tonnes per hectare over the proposed irrigation area.

Potential effects of irrigated wastewater on soil structure
Wastewater produced by breweries often contains high concentrations of salts and therefore irrigation needs to be managed to minimise the potential for adverse impacts on the structure of the soil. Of particular concern is the risk of soils becoming sodic and dispersive due to the disproportionally high concentration of sodium ions compared to calcium and magnesium ions in the wastewater. This may cause the infiltration capacity of the soil to air and water to be reduced, which may limit crop growth.

The applicant has not provided sodium, calcium or magnesium ion concentrations in the wastewater; therefore, there is insufficient information to determine whether there is potential for the soils to become sodic or dispersive at the irrigation site.

4.3 Risk ratings

Risk ratings have been assessed in accordance with the *Guideline: Risk Assessments* (DWER 2020) for each identified emission source and considers potential source-pathway and receptor linkages as identified in Table 5.

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

Additional regulatory controls may be imposed where the applicant's controls are not deemed sufficient. Where this is the case the need for additional controls will be documented and justified in Table 5.

Licence L9275/2020/1, that accompanies this report, authorises emissions associated with the operation of the premises i.e. alcoholic beverage manufacturing.

The conditions in the issued licence, as outlined in Table 5 have been determined in accordance with *Guideline: Setting Conditions* (DWER 2020).

Table 5: Risk assessment of potential emissions and discharges from the premises during operation

Risk Event				Risk Rating[1] C = consequence L = likelihood	Reasoning / justification	Additional regulatory controls (refer to conditions of the granted instrument)
Source/ Activities	**Potential emissions**	**Potential receptors, pathway, and impact**	**Applicant controls**			
Installation of irrigation infrastructure						
Installation of 50 kL poly tank, pumps, and irrigation infrastructure (piping and sprinklers)	Fugitive dust Noise	Unreasonable interference with the health, welfare, convenience, comfort or amenity of nearby sensitive receptors (1.5 km away)	No applicant controls proposed	C – **Slight**: Minimal onsite impact. L – **Unlikely**: the risk event will probably not occur in most circumstances. **Low Risk** Acceptable, generally not subject to regulatory controls.	The Delegated Officer considers that the separation distance from the proposed location of the tanks, pumps and irrigation infrastructure to the closest receptor is sufficiently large for there to be no adverse impact from noise or dust emissions from the installation of the infrastructure. Additionally, installation is expected to be of short duration. The Environmental Protection (Noise) Regulations 1997 apply to noise emissions.	N/A
Operation of brewery						
Beer manufacturing and packaging Storage of chemicals (acids, etc.)	Nutrient and sediment - laden wastewater (beer-contaminated, acidic wash water) generated during processing and packing	Overland runoff from brewery operations, direct infiltration causing contamination of shallow groundwater	All processing takes place within enclosed buildings with concrete flooring and drainage Drainage captures all spills and other washdown that is in turn sent to the wastewater treatment system	C – **Minor**: low level on-site impacts. L – Unlikely: Not likely to occur in most circumstances. **Medium Risk** Acceptable, generally subject to regulatory controls.	Brewery operations produce a range of wastewaters from wash down to accidental spills and leaks. All brewery operations are conducted within an enclosed building with sealed concrete floors. All wash waters and spills and leaks will be contained within the brewery building and directed to internal drains and sumps that are connected to the wastewater treatment system, thereby minimising the risk of wastewaters entering the environment. In order to ensure an acceptable level of risk is maintained during operations, controls will be imposed on the licence to specify infrastructure requirements for containing brewery wash waters.	<u>Infrastructure requirements:</u> • Brewery infrastructure to be installed and maintained on hardstand surface where drainage is contained; • All drainage and wastewater must be directed to wastewater system
Management of brewery wastewater	Odour from brewery wastewater	Unreasonable interference with the health, welfare, convenience, comfort or amenity of nearby sensitive receptors (1.5 km away)	All processing takes place within enclosed buildings All tanks are enclosed within the treatment system	C – **Minor**: Minimal off-site impacts to amenity on local scale. L – **Rare**: Likely to only occur under exceptional circumstances. **Low Risk** Acceptable, generally not subject to regulatory controls.	Due to the nature of brewery wastewater, there is an inherent risk of odour causing impacts to off-site receptors. The applicant acknowledges the system is not fit for purpose and the settling tank is often anaerobic, which is likely to lead to odour being generated. However, the delegated officer notes there have been no recorded complaints about odour from operations at the premises. Given the enclosed nature of the brewery wastewater system and distance to off-site receptors (1.5 km), the delegated officer does not reasonably foresee off-site receptors being impacted by odour from brewery operations.	N/A
	Nutrient-laden wastewater, discharged to leach drains	Seepage/infiltration causing contamination of shallow groundwater. Surface water (tributaries of Jingarmup Brook) are located 130 m N of leach drains, with unlined ponds located on the non-perennial tributary.	Discharge to leach drains as per DoH approval (up to 1000 L/day)	C – **Moderate**: Mid level on-site impacts, mid-level off-site impacts on local scale. L – **Possible**: Could occur at some time. **Medium Risk** Acceptable, generally subject to regulatory controls.	The delegated officer notes the current wastewater treatment system (drains, setting tank and aeration tank) is significantly undersized for the current volumes of wastewater being produced, resulting in ineffective treatment and poor-quality water being discharged to the environment. As a result, the existing discharge of brewery wastewater at the current volumes and quality and using the existing management system is not acceptable or sustainable and is likely causing contamination of shallow groundwater. The delegated officer considers it likely that a substantial percentage of wastewater discharged to the two unlined ponds (holes excavated into in-situ sandy soil) located downgradient of the leach drains is being lost to seepage and is likely to be discharging to the Jingarmup creek system. Ongoing discharge to the ponds is therefore not acceptable or sustainable. The delegated officer notes the applicant has submitted a separate works approval application to replace and upgrade the existing wastewater treatment system. Given there is an existing local government approval in place for the leach drains, the delegated officer has determined to authorise the discharge of wastewater to the leach drains for contingency purposes, with daily volumes restricted in line with the local government approval (1,000 L/day). Operational controls will be imposed on the licence to require the leach drains to be managed to ensure that overtopping does not occur in the event of blockages. Ongoing monitoring of wastewater volume and quality will also be required, and nutrient loadings calculated for seepages to ensure that appropriate discharge fees are payable. Sodium adsorption ratio has been included in the parameters to monitor the potential impact of the wastewater in the leach drains on soil profile water availability (see section 4.2.1). It is highly likely the discharge of near raw brewery wastewater to the ponds is resulting in contamination of shallow groundwater, and that ongoing discharge will further exacerbate this issue. The delegated officer has therefore determined there is an unacceptable risk of impacts to	<u>Infrastructure requirements:</u> • Wastewater treatment system must be replaced with a system that is capable of adequately treating 10 kL/d of brewery wastewater; • New system must be installed and operational within 3 months of the works approval being granted <u>Specified actions:</u> • Discharge of wastewater to existing leach drains, as per 2010 DoH approval (note that the existing discharge to the unlined ponds is not authorised under the licence); • Daily discharge limit to leach drains of <1,000 L/day; • Leach drains must be managed to ensure no overland flow at ground level. <u>Monitoring and reporting:</u>

Risk Event				Risk Rating[1] C = consequence L = likelihood	Reasoning / justification	Additional regulatory controls (refer to conditions of the granted instrument)
Source/ Activities	**Potential emissions**	**Potential receptors, pathway, and impact**	**Applicant controls**			
					groundwater from ongoing discharges to the ponds, and this activity is no longer authorised. The delegated officer expects the wastewater treatment system to be replaced and operational within 3 months of the issue date of the works approval. Assessment of the new system and subsequent disposal methods will be assessed as part of the works approval, and controls updated on the licence where warranted.	• Monitoring of wastewater volumes discharged to leach drains to be recorded. • Quarterly monitoring of wastewater quality being discharged, nutrients and major ions; • Monitoring of inputs and outputs
Management of brewery solid waste	Nutrient-laden leachate from storage of solids (spent grain and hops) prior to off-site disposal	Seepage/infiltration causing contamination of shallow groundwater	Spent grain and hops (majority grain) are collected and stored in a 1 tonne tub. Once full, they are then taken off-site to be used as cattle feed.	C – **Minor**: Low level impact to amenity. L – **Rare**: Likely to occur only in exceptional circumstances. **Low Risk** Acceptable, generally not subject to regulatory controls.	Solids are stored in sealed containers and taken off-site for disposal.	<u>Specified actions:</u> • Brewery solid wastes (spent grains and hops, sludge) must be taken off-site by licensed CW carrier
Onsite disposal of wastewater via irrigation to proposed area (1.3 ha)	Wastewater to land with excessive hydraulic loading	The discharge of wastewater (treated or untreated) to land through irrigation has the potential to contaminate surrounding land and adversely impact upon surface water, soil and groundwater. Surface water (tributaries of Jingarmup Brook) are located 280 m NE and 300 m NW of irrigation area. Closest licence to take surface water is 500 m S. Depth to groundwater is approximately 1 to 2 mbgl	Planting of a hay crop during winter to take up the nutrients in the wastewater. No additional fertiliser will be added to the crop. Hay will be harvested (usually during October or November). During the summer months, most of the wastewater will be directed to the drip irrigation system within the irrigation area to irrigate perennial trees and shrubs proposed to be planted inside the irrigation area. Some wastewater may be directed to a trial summer crop within the irrigation area to determine if a summer crop is an option in the future. Irrigation to occur via a K-line pod irrigation system which consists of low rate application sprinklers. Uniform irrigation is achieved by moving the irrigation line in a clockwise direction around the central hydrant every few days by dragging the pipeline with a vehicle or quadbike.	C – **Moderate**: Mid level onsite impacts. L – **Possible**: The risk event could occur at some time. **Medium Risk** Acceptable, generally subject to regulatory controls.	While the preliminary assessment of hydraulic loading (see section 4.2.2) has estimated that 1.3 ha is sufficient, the delegated officer notes the following: • rainfall exceeds pan evaporation for the months of May to August, including being 2 to 2.5 times higher during June and July (section 4.1.2); • soil at the irrigation area is comprised of sand (1.5 to 2.5 m deep) overlying clayey sand to a depth of at least 3 m (section 4.1.3); • groundwater depth in January 2020 has been measured to be 2.1 to 2.6 mbgl, and in July 2020 1 to 2 mbgl (WQPN 22 recommends a minimum water table depth of 2 m); • existing wastewater quality is similar to that of raw brewery wastewater and exceed the ANZECC primary industries guidelines for TP, TSS, BOD, TDS and SAR which indicates potential risk of impacts on vegetation health and soil structed (section 4.2.1); and • tributaries of Jingarmup Brook (which is classified as an intervention waterway with the department's objective to reduce median winter nitrogen concentrations to 1 mg/L) are located approximately 280 m NE and 300 m NW of the irrigation area (section 4.1.3) Given the above, soils during May to August, particularly June and July, are likely to be saturated, increasing the potential for wastewater applied during this time to infiltrate past any crop root zone into groundwater and adversely affect groundwater quality and surface water quality of nearby tributaries of Jingarmup Brook. Therefore, irrigation has been restricted such that no irrigation can occur during June and July each year. Additionally, irrigation should not be undertaken 12 hours before, during, or 24 hours immediately after a rainfall event as wastewater applied when the soil is saturated (or near saturation) may infiltrate past any crop root zone into groundwater. It is expected that the applicant will store excess wastewater during this time and/or remove excess wastewater offsite. A condition will be added to the licence for a rain gauge to be located on the premises to measure daily rainfall. As the applicant is proposing to use a transportable k-line 2-pod irrigation system, the applicant will be required to move the sprinklers on a regular basis, applying wastewater evenly, and ensuring that areas are dry for 24 hours between applications to prevent waterlogging, oversaturating of the soil and ensuring no run-off or soil erosion occurs.	<u>Specified actions:</u> • Restriction of irrigation during the months of June and July. • Restriction of irrigation 12 hours before, during and 24 hours after a rainfall event. • Restriction of irrigation to a maximum of 5,350 L/day. • pH and TDS limit for wastewater quality. • Wastewater is applied evenly over the entire irrigation area, with no run-off beyond the irrigation area and no soil erosion occurs. • Irrigation to occur on a rotational basis ensuring areas are dry for 24 hours between applications. • Vegetation in the irrigation area L2 is to be harvested at least once per annual period. • Installation of an additional up hydraulic gradient groundwater monitoring well. • Nutrient loading limits for TN, TP and BOD. <u>Monitoring and reporting:</u> • Volume/mass of harvested biomass. • Treated wastewater quality and volume/flow rate monitoring for wastewater irrigated to area L2. • Soil quality monitoring within the irrigation area. • Groundwater quality monitoring.
	Wastewater to land with excessive contaminants			C – **Major**: high level onsite impacts and mid level offsite impacts at a local scale. L – **Possible**: the risk event could occur at some time. **High Risk** May be acceptable subject to multiple regulatory controls.	The preliminary assessment of nutrient (nitrogen) loading (see section 4.2.2) has estimated that 1.3 ha is an insufficient land area for a crop to remove all the nitrogen that is applied in wastewater at a rate of 10,000 L/day. The applicant is proposing to irrigate a crop during the winter months (harvesting once) and irrigating perennial shrubs and trees (along the southern boundary). The nutrient uptake of the perennial shrubs and trees is unknown indicating that nutrients may not be sufficiently removed from the irrigation area throughout the year, particularly during the months when a crop is not grown. Additionally, results of soil sampling indicate that there is potential that phosphorus could be mobilised and therefore infiltrate to groundwater with ongoing wastewater irrigation at the premises. Existing wastewater quality, proposed to be irrigated, is similar to that of raw brewery wastewater and exceeds the ANZECC short term irrigation values for TP, TSS, BOD, TDS and SAR (see Table 4) which presents a risk of impacts on plant health and to soil structure. It is likely that the	

Risk Event				Risk Rating[1] C = consequence L = likelihood	Reasoning / justification	Additional regulatory controls (refer to conditions of the granted instrument)
Source/ Activities	**Potential emissions**	**Potential receptors, pathway, and impact**	**Applicant controls**			
			A hay crop will be planted in the area around the central hydrant. Irrigation area will be fenced to prevent livestock from entering the area.		application of nutrients in exceedance of vegetation growth needs will lead to loss of nutrients to the surrounding environment. Eutrophication can result from nutrients leaching through the soil profile contaminating groundwater or via surface water that flows over the soil washing nutrients into the receiving tributaries of Jingarmup Brook. Jingarmup Book is classified as an intervention waterway with the department's objective to reduce median winter nitrogen concentrations to 1 mg/L. Key goals of the department, through the *Revitalising Geographe Waterways* program, is to implement best practice agricultural fertiliser management and reducing nutrient loads from urban sources, including septic tank sources. Sustainable nitrogen removal by irrigated crops may be possible if either the production rate of wastewater from the brewery were to be reduced by approximately 50%, or the concentration of nitrogen in the wastewater were to be reduced by about 50% (see section 4.2.2). Using the nutrient loading calculation in section 4.2.2, 1.3 ha may be sufficient to irrigate wastewater at the existing quality, up to 5,350 L/day. Therefore, the delegated officer has limited the irrigation of wastewater to this amount. It is noted that the applicant is proposing to install a new wastewater treatment system, with the aim to improving wastewater quality. The applicant has not provided sufficient information to determine whether the proposed summer irrigation of perennial shrubs and trees would remove sufficient nitrogen during the summer months, therefore, the applicant will be required to irrigate, and maintain a healthy vegetation cover over, the entire irrigation area on a year-round basis, with the hay to be cropped at least once per year. The amount and crop type harvested (tonnes/ha) will be required to be reported so that nutrient removal rates can be estimated. Additionally, the following nutrient loading limits for irrigating have been included on the licence: • TN – 180 kg/ha/annual period; • TP – 20 kg/ha/annual period; and • BOD – 30 kg/ha/day. These loading limits are based on risk category B from Table 2 within WQPN 22; and are based on sandy soils within the irrigation area (see section 4.1.3) with a low eutrophication risk of surface waters within 500 m of the irrigation site. The applicant will be required to annually report on the monthly and annual loadings of TN, TP and BOD applied to irrigation area (L2), including an explanation for determining loading rates. Additionally, wastewater quality limit for pH and TDS has been included on the licence. To limit corrosion and fouling of pumping and irrigation systems, pH should be maintained between 6 and 9 and TDS <3,000 mg/L for surface water systems (ANZECC 2000). Conditions have been added to the licence to require the applicant to monitor the quality of treated wastewater used for irrigation on a quarterly basis. Monitoring is required to verify water quality parameters to confirm that the assessment of risk is accurate and to determine the effectiveness of the existing wastewater treatment infrastructure. Sodium, calcium and magnesium ions, and sodium adsorption ratio have been included to indicate whether there is a risk that soils within the irrigation area may become dispersive due to the effects of irrigation. The applicant has installed 4 groundwater monitoring wells, located in the centre, immediately south and immediately west of the irrigation area L2 and has indicated that groundwater flows in a southwesterly direction. An additional groundwater monitoring well will be required to be installed up hydraulic gradient of irrigation area L2. This additional well will be able to be sampled, and results compared with the existing wells, to monitor impacts on the groundwater from the irrigation of the wastewater. It is noted that none of the existing wells are located down hydraulic gradient of the entire irrigation area (MB02 is located down hydraulic gradient of part of the irrigation area, but not the dripper line. MB03 is located down hydraulic gradient of part of the irrigation area and dripper line.) Conditions have been included in the licence to ensure the monitoring well is appropriately installed and sited. The wells will be required to be sampled for a range of parameters on a quarterly basis. Arsenic has been included in the parameters as the metalloid can be released from soil minerals into groundwater when the irrigated wastewater contains high BOD concentration. Seasonal groundwater fluctuations will be determined through monthly standing water level monitoring. Annual soil monitoring within irrigation area L2 is required to indicate whether nutrients and other chemical constituents of potential concern are accumulating within soils in the irrigation area, and whether there are potential adverse impacts on soil structure. Parameters to be monitored are based on the recommended soil monitoring strategy found in the NSW DEC 2004 document. All results of monitoring will be required to be submitted to the department on an annual basis with the applicant required to conduct an assessment and interpretation of the data including comparison to historical trends and loading limits.	• Reporting of all results of monitoring on an annual basis.

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

5. Decision

The delegated officer has considered the application for a licence to operate the pre-existing and operational brewery, and notes the following:

- the current wastewater treatment system (drains, settling tank and aeration tank) and disposal infrastructure (leach drains and unlined ponds) are significantly undersized for the current volumes of wastewater being produced at the premises;
- due to the current wastewater treatment system (drains, settling tank and aeration tank) being significantly undersized, wastewater is not being adequately treated and the quality being discharged to the leach drains and unlined ponds is consistent with raw brewery wastewater;
- the discharge of wastewater to the leach drains has resulted in blockages due to them being hydraulically overloaded with wastewater that is high in total suspended solids (similar to that of raw brewery wastewater). This has resulted in overland flow of raw wastewater, in which emergency ponds have had to be excavated to contain the flow and prevent discharge to the nearby creek system;
- the ponds are basic holes in the ground, excavated into in-situ sand (fine to coarse grained). It is highly likely the majority of wastewater being discharged is being lost to groundwater through seepage, and is likely to be contaminating shallow groundwater; and
- despite the majority of wastewater being lost as seepage, the ponds have on occasion overtopped into the local creek system.

To address the potential for immediate impacts to surface water and groundwater from ongoing operations, and to enable proactive management to protect downgradient surface water and groundwater receptors, the following controls have been imposed on the licence:

- discharge volumes of brewery wastewater to the leach drains restricted to the approved capacity as per the DoH and Shire of Busselton's 2010 approval of 1,000 L/d; and
- the discharge of brewery wastewater to the unlined ponds must cease.

Justification of these, and additional, regulatory controls regarding the existing brewery operations are outlined in Table 5.

The delegated officer has determined, subject to regulatory controls outlined in Table 5, that the irrigation of wastewater to land does not present an unacceptable risk of impacts to the environment.

Wherever possible, nutrients and the applied wastewater should be utilised within the crop root-zone, and there should be minimal seepage of nutrients and other chemical constituents from the wastewater past the root-zone into groundwater. Applications of wastewater should not exceed the soil's capacity to provide suitable growing conditions for the irrigated plants or cause long-term changes to soil structure that may adversely affect the capacity of the soil to continue to support plant growth and a healthy soil-fauna.

Regulatory controls include the restriction of irrigation during June and July, and 12 hours before, during and 24 hours after a rainfall event to manage the risk of hydraulic overloading of the irrigation area. The volume of wastewater that can be irrigated to the irrigation area has been restricted to a maximum of 5,350 L/day, with nutrient loading limits for TN, TP and BOD to manage the risk of contaminants (nutrients) impacting on environmental receptors. Justification for these, and additional, regulatory controls are outlined in Table 5.

6. Consultation

Table 6 below provides a summary of the consultation undertaken by the department.

Table 6: Consultation

Consultation	Comments received
Application advertised on the department's website (12 January 2021)	No comments received.
Local Government Authority (City of Busselton) advised of proposal (13 January 2021)	Supportive of the licence generally and the works to install appropriate treatment systems.
Department of Primary Industries and Regional Development (DPIRD) advised of proposal (13 January 2021)	A response was received on 19 January 2021, with no specific comments provided on the licence application.
Applicant was provided with draft documents on 12 March 2021.	Comments on the draft documents were received on 12 April 2021. Refer to Appendix 1.
Applicant was provided with revised draft documents on 10 June 2021 for a further 21-day review period.	Comments on the revised draft documents were received on 7 and 14 July 2021. Refer to Appendix 1.

7. Conclusion

Based on this assessment, it has been determined to grant a licence for the existing brewery operation, subject to conditions commensurate with the determined controls and necessary for administration and reporting requirements.

8. References

1. ANZECC 2000, *National Water Quality Management Strategy Paper No. 4 – Australian and New Zealand Guidelines for Fresh and Marine Water Quality, Volume 3 Primary Industries*.
2. Department of Agriculture and Food Western Australia (DAFWA) 1990, *Busselton, Margaret River, Augusta: land capability study*, Perth, Western Australia
3. DoW 2008, *Water Quality Protection Note 22: Irrigation with nutrient-rich wastewater,* Perth, Western Australia.
4. DoW 2010, *A water quality improvement plan for the Vasse Wonnerup Wetlands and Geographe Bay,* Perth, Western Australia.
5. DoW 2017, *Understanding Salinity*, available at https://www.water.wa.gov.au/water-topics/water-quality/managing-water-quality/understanding-salinity.
6. Department of Water and Environmental Regulation (DWER) 2020, *Guideline: Environmental Siting*, Perth, Western Australia
7. DWER 2020, *Guideline: Decision making*, Perth, Western Australia
8. DWER 2020, *Guideline: Risk Assessments*, Perth, Western Australia
9. DWER 2015, *Guidance Statement: Setting Conditions*, Perth, Western Australia
10. Kebede, T. B. 2018. *Wastewater treatment in brewery industry, review*. International Journal of Engineering Development and Research
11. NSW EPA 1998, *Environmental & Health Protection Guidelines: On site sewerage management for single households,* NSW EPA Technical Guidelines.
12. US EPA, 2006, *Process design manual, land treatment of municipal wastewater effluent,* Report EPA/625/R-06/016.

Appendix 1

Summary of applicant's comments on risk assessment and draft conditions

Summary of applicant's comments	Department's response
Applicant comments received 12 April 2021	
Applicant notes that the draft licence does not mention that they make cider at the brewery. Cider is made on the premises, in batches to match the demand, to sell in the onsite restaurant. The amount of juice sourced and cider produced varies from year to year; however, last financial year approximately 4,000 L of cider was produced from 4,300 L of apple juice sourced from an orchard in Manjimup. The amount of cider produced is included within the 1,000 kL/year of alcoholic beverage manufactured on the premises.	The delegated officer notes this information. Cider has been included in the description of the assessed design capacity for category 25.
Applicant has advised that the flow meter (in a hollow downgradient from the outlet pipe) that is installed in the existing wastewater treatment system is no longer working. The flow meter became blocked causing wastewater to overflow from the sump which then flooded the flow meter. The applicant does not intend to replace this flow meter, as they believe that the type of flow meter (gravity flow with a narrow tube is not practical), but rather propose to install a new flow meter on the irrigation outlet. The new location will have the irrigation pump behind the flow meter and therefore will allow for a larger diameter flow meter to be installed.	As the applicant is currently discharging wastewater to the leach drains and intends to use the leach drains as a contingency for irrigation pump failure, the volume of water discharged to the leach drains must be able to be measured. Flow meter requirements in Table 1 of condition 1 of the licence will remain such that cumulative daily wastewater flows to the leach drains can be accurately measured. Additionally, a condition has been added to the licence that requires the applicant to maintain a flow meter to enable cumulative daily wastewater flows to the irrigation area to be accurately measured.
The applicant has commented that being restricted to discharging 1,000 L of wastewater per day is insufficient for their operations. The applicant has proposed to discharge 10,000 L/day to an irrigation area, rather than to the leach drains. The applicant has stated that the leach drains would be retained to capture any overflow in the event the irrigation pump stops working.	The applicant's proposal to discharge up to 10,000 L/day of treated wastewater to a 1.3 ha irrigation area has been considered within this decision report.
The applicant believes that the operational requirements in Table 1 relating to solids management are onerous and unnecessary. Currently the wet "spent" grain is stored in sealed plastic tubs on an impermeable sealed apron just outside the brewery door. There is no drainage installed in the hardstand, stormwater runs off the edge of the hardstand. The plastic tubs are built for the wine industry to transport grapes and are made of robust plastic and do not leak. A tub would only leak if it were involved in an accident that caused it to crack. If a tub were to crack the applicant has advised that they would discard it and replace it with a new tub as they are inexpensive to replace. The applicant has advised that they have only had to replace one tub (that was	Emissions of leachate and sediments from the storage of spent grain poses a risk to the environment (see section 4.3). Therefore, the spent grain should be suitably stored to contain any leachate or sediment. The delegated officer acknowledges that the hardstand area is existing. The requirement for stormwater/leachate to be directed to the concrete settling tank has been removed from the conditions; however, the requirement for stormwater/leachate to be contained within the hardstand area will remain in the licence.

Summary of applicant's comments	Department's response
accidentally pierced by a forklift) in the last 10 years. Additionally, the applicant has stated that the content of the tubs is wet grain and therefore do not agree that the hardstand area must be rebuilt to allow for drainage to the wastewater treatment system.	
Applicant comments received 7 July 2021	
The applicant objects to the following draft conditions within *Table 1: Infrastructure and equipment requirements* under the heading *Wastewater treatment and leach drain disposal system*: • *Wastewater to be gravity fed via pipelines from the concrete settling tank through a flow meter to the aeration tank.* • *Flow meter to be maintained to ensure that cumulative daily wastewater flows to the leach drains can be accurately measured.* The applicant has advised that following the installation of the new irrigation system, it is highly unlikely that the existing leach drains will ever be used. The existing flow meter no longer works and the applicant believes it is a financial burden to replace it. Therefore, the applicant would like to remove the option to dispose of wastewater to the leach drains; however, they would like to leave the leach drains in-situ in the event that an issue with the irrigation system occurs. The applicant has stated that they do not intend to use the leach drains once the new irrigation infrastructure is built (without notifying the department).	The discharge of wastewater to the leach drains is considered a discharge into the environment and needs to be accurately measured. Volumetric flows are also required to calculate annual discharge fees and demonstrate compliance with discharge limits. The delegated officer understands that the applicant intends to only use the leach drains as a contingency measure and understands the existing flow meter for the leach drains is no longer operational. Therefore, the delegated officer has removed the conditions relating to the flow meter within condition 1 (Table 1) of the licence; however, a condition has been added to condition 9 (Table 4) of the licence to require that wastewater discharged to the leach drains must be directed through a flow meter. The delegated officer notes that this flow meter can be installed at a later date but must be installed prior to wastewater being discharged to the leach drains.
Applicant has advised they would like to amend the design of the irrigation infrastructure. Changing from a k-line 4-pod irrigation system to a k-line 2-pod irrigation system as the applicant believes there will not be enough pressure to pump to all 4 sprinklers on the line. Applicant has clarified the following: • spray radius of each sprinkler is 17 m; • the application rate is approximately5 mm/hr; • dripper line to deliver wastewater at 2 mm/hr with a dripper at least every 1 m.	The decision report and licence conditions have been updated: • k-line 4-pod has been amended to k-line 2-pod • documents have been updated with spray radius and application rates.
The applicant objects to the draft condition within *Table 4: Authorised discharge of treated wastewater* that states *no irrigation occurs between 1 June and 31 July (inclusive)*. The applicant believes that the condition does not provide any additional environmental benefit to the site as the irrigation site was selected due to the sandy soils. The applicant states that water pooling and surface runoff do not occur on this soil type. Additionally, the amount of wastewater proposing to be irrigated is very small over a large area. Brewing is a batch production system that continues throughout the year. The	The delegated officer notes the following regarding irrigation of wastewater at the proposed irrigation area (L2): • groundwater has been measured in July 2020 to be 1 to 2 mbgl (section 4.1.3); • existing wastewater quality is similar to that of raw brewery wastewater and exceeds the ANZECC primary industries guidelines for TP, TSS, BOD, TDS and SAR which indicates potential risk of impacts on vegetation health and soil structure (section 4.2.1);

Summary of applicant's comments	Department's response
applicant believes that the requirement to store wastewater for 2 months will require additional tanks to be purchased at significant financial burden. If the water is stored, it will result in higher daily irrigation rates in August and September to irrigate the backlog of stored wastewater. The applicant believes the site is a significant distance from any sensitive receptors and as they are required to monitor the groundwater, they will be able to detect any changes in groundwater quality. The applicant considers that the draft condition *irrigation is not undertaken 12 hours before, during or 24 hours immediately after a rainfall event* is sufficient to manage the irrigation over the winter months and request that the condition to restrict the irrigation of wastewater during June and July is removed.	• rainfall exceeds pan evaporation for the months of May to August, including being 2 to 2.5 times higher during June and July (section 4.1.2); • soil at the irrigation area is comprised of sand (1.5 to 2.5 m deep) overlying clayey sand to a depth of at least 3 m (section 4.1.3); • tributaries of Jingarmup Brook (which is classified as an intervention waterway with the department's objective to reduce median winter nitrogen concentrations to 1 mg/L) are located approximately 280 m NE and 300 m NW of the irrigation area (section 4.1.3). Given the above, and as per the risk assessment (Table 5), soils during June and July are likely to be saturated, increasing the potential for wastewater applied during this time to infiltrate past any crop root zone into groundwater, adversely affecting groundwater quality and surface water quality of nearby tributaries of Jingarmup Brook. Therefore, the delegated officer considers that irrigation will remain restricted during the months of June and July. The delegated officer notes that daily irrigation rates in August and September are limited to 5,350 L/day as per condition 10 on the licence.
The applicant objects to the draft condition within *Table 4: Authorised discharge of treated wastewater* that states *no livestock is permitted to graze the irrigation area*. The applicant understands that this condition is to prevent additional nutrients (from manure) entering the irrigation area; however, they are concerned that from time to time they may need to allow grazing for a short period to manage any load for bushfire prevention. The applicant proposes this condition is amended to: *livestock are only permitted to graze the irrigation area for a maximum of 3 weeks per year to manage fire risk*.	The delegated officer notes the applicant's comments and considers it reasonable to allow livestock to graze the irrigation area for a maximum of 3 weeks per annual period. Condition 9 (Table 4) of the licence has been updated accordingly.
The applicant does not believe it is possible for them to satisfy the draft condition *healthy vegetation cover is maintained over the irrigation area* within *Table 4: Authorised discharge of treated wastewater*. The applicant believes that they do not have enough wastewater to irrigate the area to enable a crop to grow during the summer months and therefore, request that the condition be removed.	The delegated officer considers that the irrigation of wastewater onto healthy vegetation reduces the potential for soil erosion and enables nutrients in the wastewater to be taken up by the vegetation. If healthy vegetation cover is not maintained, particularly during summer, any rainfall or irrigation would be directly to the soil and therefore increases the potential for soil erosion (sediment runoff) and for nutrients to leach through the soil to groundwater, potentially adversely impacting groundwater quality. Therefore, the requirement to maintain healthy vegetation cover will remain on the licence.
The applicant advises that they will be applying Ag-lime at a rate of 2.5 tonnes per hectare over the irrigation area in the coming weeks. The applicant advises that this may impact the department's calculation of the volume of wastewater that can be applied to the irrigation area and requests that the department re-examines the volumetric flow rate limit of 5,350 L/day in the draft licence.	The delegated officer notes that amending the soil with Ag-lime (calcium carbonate) could reduce the potential for phosphorus leaching. However, the application of Ag-lime does not alter the preliminary assessment of nutrient (nitrogen) loading rates (section 4.2.2) that was used to estimate the amount of wastewater that can be applied to the irrigation area (L2). The calculation is based on the size of the irrigation area, existing wastewater quality (which is similar to raw brewery

Summary of applicant's comments	Department's response
	wastewater), and relevant critical loading rate (uptake rate) of N (estimated from relevant guidelines). The applicant has not provided any additional information to alter this calculation. Therefore, as per section 4.2.2, the delegated officer has determined that the volumetric flow rate limit of 5,350 L/day for the irrigation of wastewater to the proposed 1.3 ha area will remain on the licence. It is noted that sustainable nitrogen removal by irrigated crops may be possible, for up to 10,000 L/day, if the concentration of nitrogen in the wastewater were to be reduced by about 50% (an average of approximately 32.5 mg/L). It is also noted that the applicant is proposing to install a new wastewater treatment system, with the aim to improving wastewater quality. Following installation of the new WWTP and evidence that the wastewater quality has improved, the volume of wastewater able to be irrigated to the irrigation area may be able to increase.
The applicant believes that some of the monitoring requirements are onerous and are not required to understand any impacts that may be occurring on the site. These include: Applicant requests to remove the requirement to monitor activity associated with the leach drains as they are intending to install the irrigation equipment in the coming weeks and subsequently do not intend to discharge wastewater to the leach drains any more. The applicant has stated that brewing is a repetitive process in which batches of the same product are created over and over again. Consequently, brewery wastewater is very uniform. The applicant believes that monitoring the wastewater quality on a monthly basis is unnecessary and requests that the monitoring be changed from monthly to quarterly.	The applicant has indicated that they intend to use the leach drains as a contingency in the event there is an issue with the irrigation infrastructure. If wastewater is discharged to the leach drains, the quantity and quality of the wastewater must be monitored to ensure compliance with condition 10 (volumetric flow rate limit) and for the calculation of annual licence discharge to land fees. Condition 12 (Table 7) has been amended to clarify that quarterly monitoring of the wastewater quality discharged to the leach drains only needs to occur during the quarterly periods where any amount of wastewater has been discharged to the leach drains. Quarterly is defined in the licence. The current wastewater treatment system is very basic comprising only of primary level treatment with aeration and manual pH balancing (with sodium hydroxide); subsequently the existing 'treated' wastewater quality is similar to raw brewery wastewater (see section 4.2.1). The applicant has provided results of two sampling events in June and October 2019; however, have provided no evidence that the brewery wastewater is uniform throughout the year. The delegated officer has determined that monthly monitoring of the wastewater quality will remain on the licence due to the existing basic wastewater treatment system and the potential for wastewater quality to fluctuate. Monthly monitoring of the wastewater quality will enable the licence holder to determine compliance with condition 10 (total dissolved solids and loading rate limits) and to calculate annual licence discharge to land fees. It is noted that following installation of the proposed WWTP, and monthly monitoring showing a consistent quality of wastewater, the frequency of the wastewater quality monitoring may be able to be reduced.

Summary of applicant's comments	Department's response
The applicant believes that it is unnecessary to monitoring standing water level in the groundwater monitoring bores on a monthly basis and requests that the frequency of the monitoring is changed from monthly to quarterly.	Monthly monitoring of standing water level in the groundwater monitoring bores will enable a better understanding of fluctuations in the water table throughout the year. WQPN 22 recommends a minimum water table depth of 2 m and monthly monitoring of the standing water level, for at least 12 months, will enable a better understanding of the fluctuations in the depth to groundwater at the irrigation area. The delegated officer has considered the applicant's comments and has amended the condition to state that standing water level is measured on a monthly basis for 12 consecutive months, following which monitoring will reduce to quarterly. The delegated officer notes that this requires 12 consecutive months of standing water level monitoring within each bore.
The applicant has provided the correct proposed location of the 50 kL poly tank.	Figure 2 has been updated with the correct location.
Additional comments on groundwater monitoring received 14 July 2021	
Provided location for up hydraulic gradient groundwater monitoring bore MB05.	Relevant maps and conditions have been updated accordingly.
The applicant would like to only sample MB01, MB02 and MB05 in regard to groundwater quality, and not MB04 and MB03. However, the applicant has stated that MB04 and MB03 will be kept for standing water level measurements to confirm groundwater gradient and flow direction.	The delegated officer notes that MB05 is located up hydraulic gradient of the proposed irrigation area (L2). MB01 is located within the irrigation area and MB02 is located down hydraulic gradient of L2. The results of monitoring from both MB02 and MB01 will be able to be compared to MB05 (once installed) to determine whether the irrigation of wastewater is impacting on groundwater quality. However, MB02 may not capture potential impacts from the irrigation of vegetation via the dripper line, as it does not appear to be down hydraulic gradient of the dripper line. Therefore, the delegated officer has determined that MB03 (down hydraulic gradient of part of the irrigation area and dripper line) will remain on the licence for quarterly groundwater quality sampling. Results from MB03 will be able to be compared to MB05. The delegated officer has considered the applicant's comments and has determined that as MB04 is also situated within the irrigation area, similar to MB01, MB04 will not be required to be monitored for groundwater quality but will remain on the licence for monitoring of standing water levels. Condition 13 (Table 8) of the licence has been amended accordingly.