

Amendment Report

Application for Licence Amendment

Part V Division 3 of the Environmental Protection Act 1986

Licence Number	L8983/2016/1	
Licence Holder	T & J.J Nominees Pty Ltd	
ACN	165 696 908	
File Number	DER2016/001332	
Premises	White Lakes Brewing 1441 Mandurah Rd, Baldivis WA 6171	
	Lot 71 on Diagram 90934 and section of road reserve as defined by coordinates in Schedule 1 of the Revised Licence	
Date of Report	26 October 2020	
Proposed Decision	Revised licence granted	

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1. Decision summary

Licence L8983/2016/1 (the existing licence) is held by T & J.J Nominees Pty Ltd (the licence holder) for White Lakes Brewing (the premises), located at 1441 Mandurah Rd, Baldivis, WA.

This Amendment Report documents the assessment of potential risks to the environment from proposed changes to the emissions and discharges during the operation of the premises. As a result of this assessment, revised licence L8983/2016/1 has been granted.

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

2. **Premises Overview**

The licence holder has been manufacturing alcoholic beverages since the existing licence was first issued on 6 December 2016. The premises is prescribed as a *Category 25: Alcoholic beverage manufacturing* premises that produces up to 1,000 kl of beer and cider (inclusive) per year. The maximum design capacity of the premises is slightly higher at 1,300 kl per year, based on fermentation tank capacity.

Wastewater generated from manufacturing activities is directed to an on-site wastewater treatment plant (WWTP). Treated wastewater is then discharged to land via a pop-up sprinkler irrigation system to grass covered areas within the premises boundary. Spent grain generated from the manufacturing process is stored prior to disposal off-site for use as a livestock feed supplement.

3. Scope of assessment

3.1 Regulatory framework

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

3.2 **Proposed amendments**

On 7 February 2020, the licence holder submitted an application to the department to amend Licence L8983/2016/1 under section 59 and 59B of the *Environmental Protection Act 1986* (EP Act). The amendments sought by the licence holder are described in Table 1.

In addition, the CEO has initiated several amendments to existing licence conditions that improve clarity and remove redundant conditions, while other changes reflect a transition of the format to the current DWER licence template. These CEO initiated changes are described and justified in Section 6.

Table 1.	Liconco	holder	nronoso	amondmonts
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Proposed amendment	Rationale
Revision of Condition 8 to allow any grass species to be grown in	Condition 8 currently specifies a requirement to establish and maintain Kikuyu grass (<i>Pennisetum clandestinum</i>) and White Clover (<i>Trifolium repens L.</i>) as the only species in irrigation area L2.
authorised irrigation	An Environmental Inspection undertaken by the department in November 2019 identified that the licence holder has found it difficult to maintain Kikuyu and White Clover exclusively in irrigation areas. The licence holder also states that other established species are utilising nutrients contained in the treated wastewater. Therefore, the licence holder proposes to allow for miscellaneous grass species to grow in irrigation areas.
Revision of Condition 9 to expand the authorised irrigation area (L2) to include the two areas labelled L1a and L1b on Figure 1.	Condition 9 restricts the long-term discharge of treated wastewater to irrigation area L2 (Figure 1), which is 1,025 m ² in size and primarily road reserve land under City of Rockingham control. Long-term irrigation was restricted to area L2 given the licence holder originally wanted to develop a car park in area L1a and all other potential irrigation areas within the premises boundary were not considered suitable for ongoing irrigation.
	The Decision Report (DER 2016) prepared for L8983/2016/1 noted that the nutrient loading and concentration limits set in the licence may be reached in area L2 prior to the brewery operating at maximum production (1,000 kl alcoholic beverage per year). Further, the licence holder estimated that area L2 would only be able to accommodate approximately 25% of treated wastewater generated at maximum production without exceeding the licence nutrient limits, meaning additional disposal options would be required as the brewery increased throughput.
	During the first three years of operation the licence holder did not operate at maximum production as the brewery was still becoming established in the market. In 2019, throughput volume was 101 kl, or approximately 10% of the maximum production throughput. Due to the low volumes of treated wastewater generated at the premises to date, the licence holder has remained in compliance with nutrient loading limits for area L2.
	The licence holder is now planning to transition to maximum production, which the Licence holder states will increase the volume of treated wastewater generated by the WWTP to its maximum design capacity of 15 kl/day. Consequently, the licence holder predicts in the application form that the irrigation rate will gradually increase from 3 kl/day to up to 15 kl/day, presuming all treated wastewater is disposed via irrigation.
	The increased irrigation rate from 3 kl/day to up to 15 kl/day will increase the hydraulic and nutrient loading applied to area L2. Given area L2 is likely to be insufficient to accommodate the increased nutrient and hydraulic loading, the licence holder has requested the authorised irrigation area be expanded to allow the nutrient and hydraulic load to be applied over a greater area, which will support the licence holder in remaining compliant with nutrient limits set in the L8983/2016/1. The licence holder has advised that they no longer plan to develop area L1a and therefore request the irrigation area is increased from 0.1025 ha to 0.3985 ha by incorporating areas L1a and L1b in Figure 1.



Figure 1: Proposed irrigation areas

3.3 Exclusions to the premises

This Amendment Report does not consider any noise, light or water emissions associated with the operation of the tavern or from traffic movements. The toilet facilities, underground septic tank beneath area L1a and leach drain system that supports the ablutions associated with the brewery operation are also excluded from the assessment.

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 *Guidance Statement: Risk Assessments* (DER 2017).

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 Source-pathways and receptors

4.1.1 Emissions and controls

The key emissions and associated actual or likely pathway during premises operation which have been considered in this Amendment Report are detailed in Table 2. Control measures proposed by the licence holder relevant to the changing emission are also listed in Table 2.

Emission	Sources	Potential pathways	Licence holder proposed controls
Increase in volume of treated wastewater irrigated to land from 3 kl/day to up to 15 kl/day, resulting in an increased nutrient and hydraulic loading	Wastewater treatment system with maximum treatment capacity of 15 kl/day of wastewater	Direct discharge to land Infiltration to soil and groundwater Overland surface water runoff	 Infrastructure and equipment related to the irrigation area and WWTP will continue to comply with requirements specified in Conditions 5 and 6 of L8983/2016/1; Treated wastewater storage and disposal will continue to be managed in accordance with requirements specified in Conditions 7 and 11 of L8983/2016/1; Treated wastewater limits and monitoring will continue as specified in Condition 12 and Condition 13, respectively; Monitoring of groundwater, soils and emissions will continue to be undertaken in accordance with requirements specified in Conditions 15 to 17; and Management, information, and reporting of the licence will continue to comply with Conditions 18 to 25 of L8983/2016/1.

Table 2: Change in emissions and licence holder controls (from Application)

4.1.2 Receptors

Table 3 provides a summary of environmental receptors that may be impacted as a result of activities upon or emission and discharges from the prescribed premises *(Guidance Statement: Environmental Siting* (DER 2016)).

Environmental receptors	Distance from prescribed activity
Lake Walyungup (salt lake) - Conservation category wetland, located within the boundary of a threatened ecological sites buffer	Eastern edge of lake bed is approximately 100 m west of proposed irrigation area Remnant wetland fringing vegetation is approximately 30 m west of the proposed irrigation area L1b.
Groundwater	Monitoring of the premises two groundwater bores on 9 December 2019 recorded standing water levels of 2.16 metres below ground level (mbgl) along the western perimeter (bore MB2) and 9.46 mbgl along the eastern perimeter (bore MB1), indicating a groundwater flow west toward Lake Walyungup .
Rights in Water and Irrigation Act 1914 (RIWI Act) proclaimed Rockingham - Stakehill	The premises is located within the defined Outridge subarea, immediately adjacent to the Cooloongup subarea, of the proclaimed Rockingham - Stakehill groundwater area. These subareas include several large lakes and other swamps and wetlands, including Lake Walyungup. The

Table 3: Sensi	tive environmental	receptors and	distance from	prescribed	activity
	live environmental	receptors and	uistance nom	presented	αστινιτί

groundwater area	Department of Water Rockingham - Stakehill groundwater management plan (DoW 2008a) aims to sustainably manage the water resource primarily through controls over groundwater abstraction. The management plan includes historical water quality information on groundwater and surface water features.
Soils	Site investigations have identified fine to medium grained sands up to 1.5 mbgl with a high infiltration rate and strong to moderate phosphorus- adsorbing capacity (DER, 2016). The bore log for MB1 reported sand from $0 - 6$ mbgl and tamala limestone from $6 - 14$ mbgl, while the bore log for MB2 identified fine sand to 4 mbgl with grey clay from $1 - 4$ mbgl and limestone from 4 mbgl.
	The licence holder has previously commissioned soil testing to identify phosphorus retention index (PRI) values and in-situ soil permeability tests to investigate the ability of the soils to limit leaching of phosphorus to groundwater. The results indicated that soils beneath the irrigation area in the northwest portion of the premises (area L2 and L1a) are 'strongly absorbing' (PRI values from 15 to 29 mL/g) and soils beneath the southwest corner (area L1b) are 'moderately absorbing' (Environmental Engineers International 2016). Infiltration was calculated to be 1.53 m/day which may result in water reaching the groundwater table in less than two days along the western area of the premises.

4.2 Licence monitoring data summary

A summary of annual volumes of wastewater generated at the premises relative to the volumes of beer produced in the first three annual reporting periods is provided in Table 4. The data indicates that water usage efficiency is improving with increased production. As production increases to the maximum authorised throughput volume of 1,000 kl of beverage produced per year, it is expected that the ratio of wastewater generated per unit of alcohol produced will decrease further, to approximately 2 to 5 l of wastewater to 1 l of alcoholic beverage, in line with industry standards for craft breweries. Approximately 2,500 – 5,000 kl of wastewater is therefore expected to be generated annually once the premises is producing 1,000 kl of alcoholic beverage per year, which equates to an average of 6.8 to 13.7 kl/day.

Reporting period	Annual volume of wastewater generated (kl)	Annual volume of alcoholic beverage produced (kl)	Ratio of wastewater generated to alcohol produced
Dec 2016 - June 2017	1,506	78.7	19 : 1
July 2017 – June 2018	940	105	9:1
July 2018 – June 2019	744	101	7 : 1

Table 4: Historical v	volumes of alcohol	and wastewater	produced at the	premises

The existing licence also requires the licence holder to monitor treated wastewater applied to authorised irrigation area L2, as well as soil within area L2 and groundwater up and down hydraulic gradient. Monthly treated wastewater sampling for the annual period July 2018 to June 2019 recorded an average discharge volume of 2 kl/day (744 kl per annum) with an average BOD concentration of 5 mg/L, TN concentration of 1.11 mg/L and TP concentration of 0.39 mg/L. These values equate to a BOD loading rate of 0.15 kg/ha/day, TN loading rate of 8 kg/ha/year and TP loading rate of 2.8 kg/ha/year applied to area L2.

The data indicates that current concentrations are well within the limits set under Condition 12 of the existing licence (Table 5). Nutrient loading rates are also low as a result of the low parameter concentrations and low volume of beer and treated wastewater produced at the premises in 2018 – 2019. The data also provides evidence that the WWTP is sufficiently maintained to achieve the high treatment quality standards required to allow for the treated wastewater to be irrigated to the relatively small irrigation area.

The neutralisation of pH and restriction of total dissolved solids (TDS) in wastewater also presents a challenge in brewery wastewater treatment. In the 2018 - 2019 reporting period, the pH level in sampled wastewater ranged from 7.2 to 8.2, which is within the recommended pH range of 5.5 - 9.0 for freshwater systems (ANZECC 2000). The average TDS concentration in the reporting period was 452 mg/L, which indicates a low salinity rating.

Table 5: Compliance with	n existing licence	annual loading a	and concentration	limits for
emissions to land				

Irrigation Area	Parameter	Limit	2018 – 2019 data	
L1a ¹	Total nitrogen 180 kg/ha/year		8 kg/ha/year	
L2	Total phosphorus	20 kg/ha/year	2.8 kg/ha/year	
	BOD	30 kg/ha/day	0.01 kg/ha/day	
L2	Inorganic nitrogen	11 mg/L	0.21 mg/l (average)	
	Reactive phosphorus	1.2 mg/L	0.33 mg/l (average)	

Groundwater sampling results were reported during the 2018-2019 annual period from the upgradient monitoring bore MB1 and down-gradient bore MB2 (Preston Consulting 2019). The standing water level in the down-gradient bore MB2 was less than 2 mbgl in September 2018, March 2019 and June 2019, indicating that the water table beneath area L2 may rise to less than 2 mbgl during months of higher rainfall.

The 2018/2019 groundwater data indicates that total nitrogen (TN) and total phosphorus (TP) concentrations did not exceed relevant environmental health criteria and are consistent with historical results at the premises. TN concentrations in the 2018/2019 period indicate that irrigation has had no impact on nitrogen levels in groundwater, with the down-gradient bore MB2 consistently reporting lower TN concentrations than the up-gradient bore MB1. Further, TP was not detected throughout 2018/2019 at concentrations exceeding the laboratory limit of reporting.

Soil results reported the 2018/2019 period indicate that nitrogen and phosphorus were retained in the upper soil profile (0-30 cm), with concentrations comparable to results from the 2017/2018 period. Hydraulic conductivity testing in area L2 in 2019 indicates an infiltration rate of approximately 1 m/day.

¹ Discharge in area L1a ceased 120 days after the issue date of the existing licence.

4.3 Risk ratings

Risk ratings have been assessed in accordance with the *Guidance Statement: Risk Assessments* (DER 2017) for those emission sources which are proposed to change and takes into account potential source-pathway and receptor linkages as identified in Section 4.1. Where linkages are in-complete they have not been considered further in the risk assessment.

Where the licence holder has proposed mitigation measures/controls (as detailed in Section 4.1.1), these have been considered when determining the final risk rating. Where the Delegated Officer considers the licence holder's proposed controls to be critical to maintaining an acceptable level of risk, these will be incorporated into the licence as regulatory controls.

Additional regulatory controls may be imposed where the licence holder's controls are not deemed sufficient. Where this is the case the need for additional controls will be documented and justified in Table 6.

The revised licence L8983/2016/1 that accompanies this Amendment Report authorises emissions associated with the operation of the premises (i.e. manufacture of alcoholic beverages).

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

Risk Event					Risk rating ¹ Lic	Licence	Licence New or												
Source/ Activities	Potential emission	Potential pathways and impact	Receptors	Licence holder's controls	C = consequence L = likelihood	holder's controls sufficient?	revised conditions ² of licence	Justification for additional or revised regulatory controls											
								Condition 2 - Inclusion of irrigation areas L1a and L1b as authorised emission points											
Increased volume of wastewater treated by the on-site WWTP intervention irrigated to lawn	Direct discharge to land: • Excessive hydraulic loading causing seepage of wastewater past the root zone to groundwater • Excessive nutrient loading causing soil and groundwater contaminated groundwater off-site causing adverse impacts to ecosystem health at Lake	Groundwater (approximately 2 m bgl beneath area L1b and L2) Lake Walyungup (fringing vegetation 30 m west of irrigation area)		C = Moderate			Areas L1a and L1b included to ensure that treated wastewater from the WWTP is only discharged within the specified irrigation areas.												
							Condition 3 and 4 – Development of a Winter Irrigation Management Plan:												
							The development of a Winter Irrigation Management Plan is required in order to demonstrate the risk of wastewater seepage to groundwater during winter is acceptable with the current and anticipated increase in irrigation rate (up to 15 kl/day), particularly in areas L1b and L2 where the water table is less than 2 mbgl for significant periods each year.												
			area L1b and L2)	area L1b and L2)	area L1b and L2)	area L1b and L2)	area L1b and L2)	area L1b and L2) Ref	area L1b and L2)	²⁾ Refer to Section	Refer to Section	rea L1b and L2) Refer to Section	L = Possible Medium Risk No	No	Condition 2	Condition 5 and 6 - Inclusion of emission points L1a and L1b			
			(refer to Section 4.4)		<u>3. 4. 5. 6. 7.</u> <u>8. 9</u>	Areas L1a and L1b have been added to ensure annual loading limits and concentration limits are applied to these irrigation areas and wastewater discharged in each irrigation area is monitored for parameters specified in Condition 6.													
							Condition 7 and 8 – Installation and monitoring of new groundwater bore MB3:												
		vvaiyungup					Groundwater monitoring down hydraulic gradient to area L1b is necessary to ensure there are no impacts to groundwater resulting from the application of nutrients to the area, which is only 30 m from fringing vegetation surrounding Lake Walyungup.												
								Condition 9 – Revised soil testing:											
								Soil testing is to be expanded to include new irrigation areas L1a and L1b to ensure the risk											

Table 6: Risk assessment of potential discharges from the premises during operation

Licence: L8983/2016/1

Risk Event				Risk rating ¹ Licence	New or			
Source/ Activities	Potential emission	Potential pathways and impact	Receptors	Licence holder's controls	C = consequence L = likelihood	holder's controls sufficient?	revised conditions ² of licence	Justification for additional or revised regulatory controls
								of nutrient loading impacts to soil and groundwater from irrigation activities is acceptable. Ongoing soil monitoring will also enable assessment on whether the increased in irrigation rates are acceptable.
								The soil strategy will also be revised, as per the department's best practice recommendation, in alignment with the soil monitoring strategy provided in the NSW Department of Environment and Conservation's <i>Technical Guideline Effluent for</i> <i>Irrigation</i> (NSW DEC 2003).
								The requirement to undertake annual hydraulic testing is to be removed given the treated wastewater has low salt content and is unlikely to impact permeability. Any changes in permeability can be checked by noting uncharacteristic waterlogging within the irrigation area.
		Direct discharge to land resulting in overland runoff into nearby surface water features (excessive hydraulic loading)	Lake Walyungup (fringing vegetation 30 m west of irrigation area)	No specific controls proposed	C = Minor L = Unlikely Medium Risk	N/A	N/A	Although runoff could occur during wetter periods if soils are waterlogged, no additional controls are recommended to reduce the risk of impact to receptors, given the existing licence has conditions to control surface water runoff and site topography and the intervening road (Mandurah Road) prevent surface runoff to Lake Walyungup. In addition, soil at the site has a high infiltration rate and irrigation areas are covered with grass, minimising runoff from open, landscaped areas.

Note 1: Consequence ratings, likelihood ratings and risk descriptions are detailed in the Guidance Statement: Risk Assessments (DER 2017).

Note 2: Proposed licence holder's controls are depicted by standard text. Bold and underline text depicts additional or revised regulatory controls imposed by department.

4.4 Detailed risk assessment for discharge of treated wastewater to land

4.4.1 Description of risk event

The licence holder is planning to increase manufacturing throughput at the premises which will raise the annual volume of treated wastewater generated at the premises from approximately 744 kl in 2018 – 2019 to up to 5,475 kl (the maximum annual treatment capacity of the WWTP). Given treated wastewater is only disposed via irrigation at the premises and storage capacity is limited to one 25 kl storage tank (or a maximum 1 - 2 days storage at a WWTP discharge flow rate of 15 kl/day), the increased volume of treated wastewater generated at the premises will result in the irrigation rate increasing from approximately 3 kl/day to up to 15 kl/day.

The increased irrigation rate may lead to the application of nutrient rich wastewater to land that exceeds the uptake and export capacity of vegetation (nutrient loading). In addition, the increased irrigation rate may exceed the water needs of the vegetation (hydraulic loading), resulting in the seepage of water and nutrients below the root zone to groundwater. Therefore, the risk event can be divided into two events: exceedance of the nutrient loading capacity of the irrigation area and exceedance of the hydraulic loading.

In response to the planned increase in throughput, the licence holder is proposing to increase the irrigation area from 0.1025 ha to 0.3985 ha to allow higher irrigation volumes while remaining compliant with nutrient loading limits conditioned in the existing licence. The proposed expansion will incorporate areas L1a and L1b on Figure 1 for long-term irrigation.

4.4.2 Characterisation of emission and potential impact

Untreated brewery wastewater typically contains high concentrations of TN and TP and high biochemical oxygen demand (BOD). Concentrations of TN and TP usually range between 30 – 100 mg/l while BOD is typically between 600 – 5,000 mg/l. The discharge of wastewater with high levels of nutrients and oxygen demand to land has potential to cause local soil degradation and groundwater contamination which may migrate off-site and adversely affect ecosystem health at the down-hydraulic gradient Lake Walyungup.

The potential for soil and groundwater impacts in the proposed irrigation areas L1a and L1b is dependent on the long-term capacity for vegetation and the upper soil profile to accommodate the nutrient and hydraulic loading applied to the areas. Historical testing indicates that soils beneath area L1a have a relatively high capacity to adsorb phosphorus whereas soils only have a moderate capacity to adsorb phosphorus in area L1b. Both areas are covered with grass in average to good condition and have a few established trees. Area L1a is on a steep slope that drains toward area L2 while Area L1b is primarily flat.

Revised hydraulic loading assessment

The risk assessment undertaken for existing licence L8983/2016/1 identified a high infiltration rate across the premises that reduces the risk of ponding and surface runoff but increases the risk of nutrients leaching to groundwater. The area currently authorised for irrigation at the premises (L2) was considered to be insufficient to accommodate the hydraulic loading when the premises reaches full production, with wastewater predicted to infiltrate to groundwater within two days along the western perimeter. The department therefore applied outcomebased conditions to reduce the concentration of nutrients in groundwater, including pretreatment of phosphorus with SuperPFix prior to discharge and maintaining healthy vegetation cover to promote nitrogen uptake.

A physical constraint for siting a wastewater irrigation scheme is ensuring that the area of land selected is sufficiently large to enable the wastewater and its dissolved constituents to be

taken up by vegetation or retained within the soil profile without excessive seepage into groundwater. An assessment on the land area required to ensure that wastewater can be applied to land at a suitable hydraulic loading can be undertaken using the equation (US EPA, 2006):

$$A = (365 \times Q)/(L \times T_{app})$$

Where:

A = land area (hectares) Q = flow rate of wastewater (m3/day) L = wastewater hydraulic loading to soil (cm/week) $T_{app} = period of wastewater application each year (weeks)$

The formula can be re-arranged to determine the maximum volume of treated wastewater that can be applied to the irrigation area (0.3985 ha) without exceeding the areas capacity to accommodate the hydraulic loading. Using a generic pasture hydraulic loading rate of 4cm/week (US EPA, 2006) and presuming irrigation is undertaken throughout the year, the maximum volume of wastewater the irrigation area could accommodate per annual period is 7,852 kl (at an average irrigation rate of 21.5 kl/day), without additional loading from rainfall. Therefore, in this scenario, the expanded irrigation area is considered to be sufficient.

However, the department generally requires that irrigation is avoided during the wet season when the uptake of nutrients by vegetation is often greatly reduced or when there is an increased risk of contaminants being transported to the water table in seepage from saturated soils and a higher water table. A review of rainfall and evaporation data for the premises location indicates that rainfall exceeds evaporation during the months of May, June, July and August.

In a scenario where irrigation at the premises is restricted to 35 weeks per year (September to April), the maximum volume of wastewater that the expanded irrigation area could accommodate across the irrigation period is 3,558 kl at an average irrigation rate of 14.5 kl/day. In this scenario, the proposed maximum irrigation rate of 15 kl/day would be acceptable. However, given that beer manufacturing occurs throughout the year and up to 5,475 kl of treated wastewater may be generated annually at the maximum WWTP flow rate, additional controls are recommended to avoid or minimise irrigation during the wetter months of May through to August, such as off-site disposal of treated wastewater or increased storage capacity.

Revised nutrient loading assessment

Nitrogen and phosphorus concentration limits for treated wastewater were set in the existing licence using DoW advice to apply 'Category B' eutrophication risk criteria in *Water Quality Protection Note 22 – Irrigation with nutrient-rich wastewater* (DoW, 2016),. The criteria are based on a scenario where 50 mm water (500 kl/ha) is applied per week over 32 weeks per year. However, the risk assessment undertaken for the existing licence identified a lack of site specific information and that the nutrient loading and concentration limits set for the relatively small irrigation area L2 may be reached prior to maximum beer production levels being achieved. Therefore, given measured effluent data is now available, a revised assessment of the irrigation area required to accommodate the nutrient loading at the maximum WWTP discharge flow rate was undertaken using the following formula outlined in the NSW guidelines for the irrigation of domestic wastewater (NSW EPA, 1998):

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

Where:

 $A_N = land area required for nutrient uptake by crops (m²)$ <math>C = concentration of nutrient in the wastewater (mg/L)Q = daily wastewater flow rate (L/day)

 $L_N = critical \ loading \ rate \ of \ nutrient \ (mg/m^2/day)$

The critical loading rate for perennial pastures was applied which takes up nitrogen at a rate of 18 to 36 mg/m²/day. A conservative scenario using the existing licence TN wastewater limit of

11 mg/L, a maximum WWTP discharge flow rate of 15 kl/day (irrigated evenly across a 52 week period) and a conservative critical loading rate of 36 mg/m²/day, the minimum land area required to accommodate the nutrient loading is 0.46 ha, which is more than the land available for irrigation (0.39 ha). However, if the 2019 average TN concentration of 1.1 mg/L was applied, only 0.05 ha would be required in the same scenario.

The results for TP are comparable. Using the existing licence TP concentration limit of 1.2 mg/L, the minimum land area required to accommodate the nutrient loading is 0.45 ha. If the TP concentration is reduced to the reported 2019 average of 0.396 mg/L, only 0.15 ha would be required for irrigation.

The department also requires that the BOD application rate is restricted to soil profiles being clogged by bacterial slimes. The average BOD concentration reported in 2019 (5 mg/L) equates to a BOD loading of approximately 0.19 kg/ha/day at an irrigation discharge rate of 15 kl/day, which is significantly within the existing licence limit of 30 kg/ha/day.

4.4.3 Criteria for assessment

Nutrient loading criteria

The DoW Water Quality Protection Note 22: Irrigation with nutrient –rich wastewater (WQPN 22) sets appropriate assessment criteria to determine nutrient loading limits and maximum nitrogen and phosphorus concentration limits in treated wastewater used for irrigation to land. However, these loading rates are based on irrigation only occurring for 32 weeks of the year to allow for periods of high rainfall or soil moisture when irrigation would not be appropriate.

The Australia and New Zealand (ANZECC) Guidelines for Fresh and Marine Water Quality (2000) provide environmental health criteria for wastewater used for disposal to irrigated lands that may impact on groundwater or surface water guality.

Hydraulic loading criteria

As outlined in section 4.4.2, the NSW guidelines for the irrigation of domestic wastewater (NSW EPA, 1998) provide guidance on hydraulic loading. WQPN 22 also provides guidance on water application rates, advising that sandy sites may accept up to 15 mm/hour without run-off.

444 Licence holder controls

The licence holder referred to existing controls conditioned in L8983/2016/1 as sufficient to manage the risk of exceeding the hydraulic and nutrient loading limits in the expanded irrigation area, as detailed in Table 2 of this report. In addition, the licence holder has confirmed that the WWTP can maintain effective treatment of nutrients and BOD at the maximum treatment rate of 15 kl/day. However, any increase in flow rate in excess of 15 kl/day would require an engineering change to the plant and upstream fixtures to ensure the quality of the treated effluent is not compromised.

4.4.5 **Key findings**

The Delegated Officer has reviewed the information regarding the risk of impacts to receptors from the increased discharge of treated wastewater to land and has found:

Hydraulic loading risk event

- 1. The proposed irrigation area is considered sufficient to accommodate an irrigation rate of 14.5 kl/day during September to April;
- 2. However, there is an increased risk of wastewater seepage past the root zone to groundwater from May to August when rainfall exceeds evaporation rates, especially beneath areas L2 and L1b where groundwater is shallow;
- Irrigation from May to August should be avoided or significantly reduced, though 3. treated wastewater storage capacity currently limited to 1 - 2 days at the proposed maximum WWTP discharge rate of 15 kl/day.

Nutrient loading risk event

- 4. At current nutrient concentrations, the proposed expanded irrigation area is considered sufficient to accommodate the predicted nutrient loading at an irrigation rate up to 15 kl/day; and
- 5. Nutrient concentrations reported in treated wastewater at the premises are comparatively low for brewery wastewater, which lowers the risk profile for excessive nutrient loading and indicates that the WWTP is operating effectively.

4.4.6 Consequence

Based upon the information provided by the licence holder, site monitoring data and existing licence conditions the Delegated Officer has determined that the impact of emissions to land (from excessive hydraulic and nutrient loading) may be low-level, off-site impacts at a local scale. Therefore, the Delegated Officer considers the consequence to be *moderate*.

4.4.7 Likelihood

Based upon the low concentrations of nutrients in treated wastewater, the expanded irrigation area and existing licence conditions the Delegated Officer has determined that the likelihood of off-site impacts at a local scale from excessive nutrient loading is *unlikely*. However, based upon the proximity to groundwater, proximity to the adjacent lake and the lack of treated wastewater storage capacity, the Delegated Officer has determined that the likelihood of off-site impacts at a local scale from excessive hydraulic loading is *possible*, especially during winter months when soils are saturated.

4.4.8 Overall rating of discharge of treated wastewater to land

The Delegated Officer has applied the consequence and likelihood ratings described above to the Risk Criteria table in the *Guidance Statement: Risk Assessments* and determined that the overall rating for the risk of emissions to land on sensitive receptors is *Medium*.

5. Compliance inspections

Department Officers completed an Environmental Inspection to assess performance against existing licence conditions on 19 November 2019 (DWER, 2019). Officers observed that the requirement in existing Condition 8 to establish vegetation cover in area L2 was achieved, although the licence holder had limited success in restricting vegetation in the area to Kikuyu grass and White Clover. The Officers determined that maintaining two specific grass species was impractical, particularly in a highly disturbed and developed region, and recommended that Condition 8 be revised to allow for any species or removed altogether. This recommendation resulted in this amendment application being lodged.

6. Decision

6.1 Risk-based amendments

The risk assessment identified a medium risk of impact to receptors from the application of an increased volume of treated wastewater to the expanded irrigation area. The likelihood of excessive nutrient loading was considered to be unlikely, given the demonstrated low concentrations of TN, TP and BOD in treated wastewater. However, the likelihood of excessive hydraulic loading was considered to be possible, particularly in winter months when soils are saturated and the groundwater table is high. Therefore, to reduce the risk of impacts to soil and groundwater to an acceptable level, the Delegated Officer has added the following controls to the existing licence:

• Development of a Winter Irrigation Management Plan, with a particular focus on increased wastewater storage options or off-site disposal during winter; and

 Installation of a new groundwater monitoring bore down-hydraulic gradient to irrigation area L1b.

In addition, minor revisions were made to existing conditions, based on the detailed risk assessment, are described in Table 6.

6.2 CEO initiated amendments

The CEO has initiated several additional amendments to existing licence conditions. Material changes are explained in this section and include specifying an assessed production throughput level and removing redundant conditions. Other minor changes improve clarity in existing conditions and are summarised in Table 8.

The premises has a maximum design capacity of 1,300 kl per year, based on a total fermentation tank capacity of 50 kl operating on a fortnightly cycle. However, the licence holder has stated that the maximum production volume will be not more than 1,000 kl of alcoholic beverage per year. Therefore, the Delegated Officer has set the assessed production throughput level for prescribed premises *Category 25: Alcoholic beverage manufacturing* at not more than 1,000 kl of beer and cider per year. Should the licence holder intend to exceed this limit then a licence amendment application will be required to have an increased throughput assessed.

The Delegated Officer has removed the requirement in existing Condition 9 to cease irrigation in area L1 after 120 days, given areas L1a and L1b are now available and considered suitable for long-term irrigation. The Delegated Officer has also removed existing Condition 24 specifying the quarterly reporting of monitoring data (including monthly irrigation volumes discharge per area and nutrient loading rates). Quarterly reporting of this data was previously conditioned to ensure the department could review the performance of the WWTP and seasonal nutrient loading rates during the initial operating phase. This data is now to be reported in the Annual Environmental Report as per amended Condition 15.

The requirement to establish Kikuyu grass and White Closer exclusively in irrigation area L2 (Condition 8) was also removed. The Delegated Officer agreed that it was challenging for the licence holder to maintain these species exclusively and that it provided minimal nutrient uptake benefit compared to other species. A less onerous requirement to maintain healthy grass cover in all irrigation areas is specified in Table 1, Condition 1.

7. Consultation

Table 7 provides a summary of the consultation undertaken by the department.

Table 7: Consultation

Consultation method	Comments received	Department response
Licence holder was provided with draft amendment on 27 July 2020. A response was received from the licence holder's consultant on 15 October 2020 after DWER granted an extension to the comment period.	The proposed restriction on the WWTP treatment rate in line with DoH approval would place the business at risk as they would not be able to operate at maximum production.	The Delegated Officer removed the proposed restriction given the licence holder has demonstrated that the WWTP is performing effectively and is designed to treat wastewater to the required standard (licence limits) at a maximum treatment rate of 15 kl/day. The increased irrigation rate of up to 15 kl/day has been used to determine the risk associated with the potential hydraulic and nutrient loading in the expanded irrigation area.

concentration limit for treated cha wastewater to 15 mg/L to achieve a pla more desirable nitrogen to con phosphorus application ratio, thus the enabling phosphorus to be taken up nut completely by the grass. inc	change to the existing licence limit placed on the nitrogen concentration in wastewater given the potential for an excessive nutrient loading at the proposed increased irrigation rate of 15 kl/day.
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8. Conclusion

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

8.1 Summary of amendments

Table 8 provides a summary of the proposed amendments and will act as record of implemented changes. All proposed changes have been incorporated into the revised licence as part of the amendment process.

Previous Condition	New Condition	Proposed amendment
N/A	Prescribed Category	Inclusion of prescribed premises <i>Category 25: Alcoholic beverage manufacturing</i> assessed production throughput level
1, 2, 3, 4	-	Conditions now redundant
5, 6	1	Conditions consolidated and infrastructure operational requirements revised to improve clarity or removed if redundant Infrastructure location column added to Table 1
		Operational requirements in Conditions 7 and 11 moved to Table 1
7	-	Operational requirements consolidated into Table 1, Condition 1
8	-	Condition now redundant
9	2	Inclusion of irrigation areas L1a and L1b as authorised emission points.
		Removed requirement to cease imgation in area L1 arter 120 days
-	3, 4	New requirement to develop a Winter Irrigation Management Plan
11	-	Irrigation operational requirements consolidated into Table 1, Condition 1
12, 13	5, 6	Emission points L1a and L1b added to Table 3 and Table 4 to ensure emissions are monitored and emission limits are applied in new irrigation areas
14, 15	7, 8	Installation of new groundwater monitoring bore MB3 and groundwater monitoring at MB3

 Table 8: Summary of licence amendments

16	19	Soil monitoring program expanded to include new irrigation areas Requirement to undertake hydraulic conductivity testing removed
17	-	Condition now redundant.
18	10	-
19	-	Condition now redundant.
20, 21, 22, 23	11, 12, 13, 14	-
24	-	Condition now redundant.
25	15	Inclusion of quarterly monitoring data in Annual Environmental Report
Definitions and Interpretation	Definitions	Definitions tabulated
Map 1, Schedule 1	Map 1, Schedule 1	Increased scale and irrigation areas added
Map 3, Schedule 1	Map 3, Schedule 1	Area 3 for installation of MB3 added to figure
Map 5 and 6, Schedule 1	-	Figures removed given they lack clarity and are no longer required
Schedule 2	-	Infrastructure table removed. Relevant controls incorporated to Table 1

References

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- 3. Department of Water (DoW) 2008b, *Water Quality Protection Note 22 Irrigation with nutrient-rich wastewater*, July 2008.
- 4. DoW 2016, *Department of Water review of NIMP and Licence Application for White Lakes Brewing*. Correspondence dated 4 October 2016.
- 5. DER 2016, Guidance Statement: Environmental Siting, Perth, Western Australia.
- 6. DER 2016, Decision Report for White Lakes Brewing Licence L8983/2016/1, December 2016.
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- 12. Preston Consulting 2019, *Revised Annual Environmental Report*, Prepared for T & J.J. Nominees by Preston Consulting Pty Ltd, 12 August 2019.
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