


TECHNICAL MEMORANDUM

INVESTIGATION	Kingston Wastewater Consent Review	PROJECT	ORC Consent Reviews
CLIENT	Otago Regional Council	PROJECT NO	C03263537
CLIENT CONTACT	Sarah Davidson	PREPARED BY	Oliver Hunt & Hilary Lough
CLIENT WORK ORDER NO/ PURCHASE ORDER	PO013492	SIGNATURE	
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Introduction

Pattle Delamore Partners Limited (PDP) has been engaged by Otago Regional Council (ORC) to review a consent application by Queenstown Lakes District Council (QLDC) to discharge treated wastewater into land from a proposed community reticulated wastewater scheme for Kingston. PDP previously reviewed information on the proposed scheme submitted to ORC for pre-application review in 2018. This review was documented by PDP in a memorandum dated 1 June 2018. The consent application has been prepared by Lowe Environmental Impact (LEI). An ecological review by e3Scientific (e3s) has been appended to the application. This was prepared for ORC as part of a pre-application meeting and site visit in 2020 by LEI, ORC and e3s and the document was not intended to form part of the application. e3s are reviewing the surface water and ecological aspects of the application on behalf of ORC.

This discharge will be from the existing township, with allowance for growth, and a new subdivision adjacent to the existing township. At total completion, the proposed wastewater treatment plant (WWTP) and land treatment area(s) (LTAs) are expected to receive an average of 900 m³/d from 1200 dwellings. The proposed LTAs are located in Kingston Station to the south of the township and the proposed subdivision. Sub-surface drip irrigation is proposed.

While we agree that on the whole, a reticulated system with discharge away from the lake shore has the potential to reduce potential environmental effects, following an initial review of the application several sections have been deemed to provide insufficient information regarding the receiving environment and the actual and potential effects of the discharge. This memorandum has been prepared to recommend to ORC the further information that should be requested from the applicant, prior to completing a full review of the application.

Projected Flows

LEI use projected wastewater flows carried out by Hadley Consultants of 900 m³/day for an Average Dry Weather Flow and 1800 m³/day for Peak Wet Weather Flow. They note that these flows are conservative as they reflect full occupancy of all lots. We note that the Average Day Dry Weather Flow of 250 L/person/day is also a conservative estimate in relation to recommended daily flows in ASNZS 1547: 2012 and TP58. However, the average of 3 people per household may not reflect seasonal holiday fluctuations. Additionally, we suggest inclusion of the restaurants, cafes and tourist facilities to be allowed for in the calculation of daily flow, or further information to show this is expected to be a minor contribution.

Assessment of Receiving Environment Sensitivity – Groundwater and Surface Water

We consider that the application does not adequately consider the sensitivity of the receiving environment under s105 of the Resource Management Act 1991. In Section 3 of the e3Scientific report it is reported that LEI's preference was to mitigate the effects rather than better understand the ecology and flow paths of the

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identified waterbodies. We consider that a good understanding of the receiving environment, including the potential flow paths identified by e3s and all wetlands, ponds, streams and Lake Wakatipu near Kingston, is required to understand the potential adverse environmental effects and inform mitigation. This matter is further covered in a separate review by e3s of the potential surface water quality and ecological effects.

We consider that the long-term median water quality statistics at the Kawerau outlet do not quantify the sensitivity of, or the potential adverse effects at, the shallow lake shore near Kingston. Given the scale of the discharge, it is important to fully understand the sensitivity of any surface water environments and the potential for adverse effects. We would recommend sampling at the lake shore to better understand current and therefore potential future impacts, particularly with respect to nitrogen. This matter is further covered in a separate review by e3s of the potential surface water quality and ecological effects.

We consider that further information needs to be provided regarding the sensitivity of all potential receiving environments in order for the application to meet the requirements of s105. The assessment of groundwater beneath the site is not considered sufficient to fully understand the hydrogeological conditions, which is required to assess the actual and potential risks to groundwater and surface water. The conclusion of Section 2.6.1 that the groundwater flow direction is unknown and groundwater is 30 – 60 m deep (despite being assessed at potentially less than 10 m in some areas of the LTA by e3s using available limited bore data) without on-site data is not considered sufficient to assess the potential adverse environmental effects to both groundwater and surface water via hydraulic connection.

At a minimum, it is recommended that the following should be monitored/determined:

1. Groundwater levels upgradient and downgradient of the LTAs to determine groundwater flow direction.
 - a. At least 1 year of water level monitoring data should be obtained. We recommend that this is commenced as soon as possible to understand levels and flow directions, with a minimum of 3 months and ideally 6 months of monthly monitoring prior to a decision being made on granting of consent, although the full 12 months could be worked into consent conditions so that it is required to be completed before the scheme becomes operational. The bores should be logged accurately to provide sufficient information on the strata beneath the site.
 - b. The catchment, Mataura or Wakatipu, the groundwater flows into needs to be determined. Some additional piezometers to the south of those shown in Appendix C of the application may be required to assess the catchment divide location.
2. Background water quality upgradient and downgradient of the LTAs at sufficient intervals to determine seasonal and land use impact variability (ideally monthly to begin with). As with groundwater levels, we recommend that this is commenced as soon as possible to understand background quality, with a minimum of 3 months and ideally 6 months prior to a decision being made on granting of consent, although the full 12 months could be worked into consent conditions so that it is required to be completed before the scheme becomes operational.

Natural Hazards

PDP agrees that the risk to the LTA and WWTP from natural hazards is likely to be low based on the information provided. Due the elevation, there is minimal risk of flooding from the lake. There are no known fault lines within the immediate area and the risk of liquefaction is low. Additionally, the LTA appears to be located on ice age moraine rather than an alluvial fan based on the Otago Natural Hazards Portal.

Kingston Closed Landfill

Monitoring information from the Kingston Closed Landfill Closure Plan (MWH, 2011) and subsequent correspondence indicates that leachate is no longer being discharged from the landfill in any significant quantities. The depth to groundwater was 11.4 – 15.3 m bgl from 1999 – 2009. Given this depth it is unlikely

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that any groundwater mounding as a result of the discharge will impact the landfill. Therefore, the risk from the landfill is not expected to significantly alter as a result of the wastewater discharge. However, we agree with the applicant's proposal to monitor bore F42/0136 prior to commencement of the discharge. We also recommend ongoing monitoring of the bore for a period after commissioning of the system.

Irrigation Design, Nitrogen Loading and Plant Uptake

The proposed plant uptake rates have been based on a dry matter production of 12,000 kg DM/ha/yr. No evidence to support this assumption has been provided. Evidence needs to consider similarities in climate and soil. It is worth considering that the data provided to use for a separate consent application prepared by LEI showed that in 2018 the cut and carry LTA at Jacks Point had an annual yield of 3,037 kg DM/ha/yr. The dry matter production will have a large effect on nitrogen uptake and therefore leaching, contrary to the statement about leaching sensitivity in Section 6.3.3 of the AEE.

The proposed design irrigation rates have considered hydraulic conductivity but do not consider other relevant parameters including, but not limited to, crop evapotranspiration, precipitation, and nitrogen loading. A complete assessment of all factors affecting the DIR should be completed. We consider that use of a soil moisture model is necessary for irrigation of this scale, especially considering that the design loading rates are relatively high for an LTA. PDP would suggest that at the current hydraulic loading rate will limit nitrogen fixation as the soluble nitrate will be flushed through the soil limiting the availability for plant uptake.

The application has only presented nitrogen application, uptake, and leaching values as a yearly average. This should be broken down into a monthly basis to understand the fate of nitrogen applied to the LTAs during periods where there is low or no crop growth, which is a significant proportion of the year. The breakdown should consider:

1. Potential dry matter production in each month.
2. Potential nitrogen uptake in each month.
3. Nitrogen applied in each month (considering seasonal variations in effluent quality)
4. Nitrogen surplus or deficit (relative to potential plant uptake)
5. Nitrogen uptake based on available nitrogen and potential plant uptake.
6. Nitrogen leaching based on available nitrogen and potential plant uptake.

The application predicts leaching at 140 kg N/ha/yr. However, using a simple monthly breakdown of expected dry matter production and seasonal variations in effluent quality, the leaching could be higher and represent a significant increase compared to the assessment of existing leaching.

PDP would suggest the proposed nitrogen application on an areal basis and leaching rates are higher than would be expected given the sensitivity of the receiving environment (Lake Wakatipu). Despite plant uptake and denitrification, the predicted leaching from the LTAs is greater than 140 kg N/ha/yr. This is a very high leaching rate compared to the 15 kg N/ha/yr permitted activity limit, and while we acknowledge a higher leaching rate directly beneath LTA's may be acceptable, our view is that this could be significantly improved with better pre-treatment of the wastewater and a larger land area with lower hydraulic loading. The applicant should provide further information to support the high leaching rate.

Further consideration of the depth of the dripper lines is recommended. 300 mm is in-line with QLDC requirements to prevent freezing, which is greater than the 200 mm proposed, although maximising plant uptake of nutrients should also be considered.

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Assessment of Effects

An assessment of effects on groundwater and surface water should be completed in more detail, allowing for the monthly OVERSEER outputs, with consideration of seasonal changes in effects, and incorporating on-site monitoring data. This should consider potential flow paths for irrigated wastewater to enter each surface water body including via sub-surface flow and the actual and potential effects on those water bodies.

Regarding Lake Wakatipu it is considered that the current assessment of effects is not sufficient to quantify the actual and potential adverse effects on the lake, particularly for nitrogen transport via groundwater. While the comparison of pre and post development leaching is useful for understanding potential relative changes, it is not considered appropriate, given the scale of discharge and the high value of the receiving environment, to base this assessment solely on a calculation using typical values specified in AS/NZS 1547:2012 and TP58. The assessment does not use any Kingston based evidence to determine occupancy, nor does it consider seasonal changes in occupancy. For instance, following the same methodology but using the occupancy data from the 2018 (6/3/2018) census yields 1150 kg N/y from the township instead of 1848 kg N/y as suggested in the AEE. Uncertainty should be considered in the potential changes in nitrogen leaching and it is considered that a good level of nitrogen removal should be achieved by the proposed treatment system, both in the short and long term. The potential effects calculated using this approach also need to be validated by groundwater and surface water quality monitoring.

Additionally, it is not considered appropriate when considering the actual existing environmental effects to use the permitted activity leaching limit of 15 kg N/ha/y for the subdivision and LTA areas. Given the policy statement in the draft National Policy Statement for Freshwater Management to ensure that the health and wellbeing of waterbodies and freshwater ecosystems is maintained or improved, our view is that the actual pre-development leaching should be used. While under the current regional plan leaching of 15 kg N/ha/yr may be permitted it is not necessarily what is occurring, nor what is appropriate for this receiving environment if leaching occurred at that level across all land in the catchment. The post-development comparison needs to be against what is actually likely to be occurring, not what could be occurring.

Further consideration of the effects of pathogens on groundwater is recommended, once information is obtained on depth to groundwater and strata type beneath the LTA's. It is recognised that there may be an improvement to the risk created from current septic tanks, but the risk to down-gradient drinking water supplies is important to consider from the proposed system, including any short-circuiting risk from overland flow/breakouts. It would be helpful if further information could be provided on whether the proposed community supply bore will mean all properties will be connected to a reticulated water supply, with no further use of private bores expected. It would also be helpful if the application could clarify which properties are not expected to connect to the reticulated wastewater treatment system.

Conclusion

Overall, we consider the application does not provide sufficient information regarding the sensitivity of the receiving environments and the adverse effects of the proposed discharge on those environments. We recommend that the applicant should undertake the following assessments to provide further information for ORC:

- ∴ A detailed hydrogeological assessment of the groundwater system beneath the LTA and Kingston, including monitoring of groundwater levels and assessments of flow direction.
- ∴ A detailed groundwater quality monitoring scheme analysing both existing groundwater quality at the LTAs and within Kingston.
- ∴ A detailed ecological assessment of all surface water bodies which could be affected by the discharge (Refer to e3Scientific review for additional detail).

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- ∴ Further assessment of a suitable irrigation rate and nitrogen loading rate, considering likely plant nutrient uptake throughout the year.
- ∴ Further assessment of the actual and potential adverse effects on the receiving environment(s) including a detailed assessment of the sensitivity of the receiving environment(s).

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