MOTT MACDONALD

Shotover WWTP Consent Application Audit

Further Information Request

Project:	Shotover Wastewater Treatment Plant – Process and Options Review		
Our reference:	705100894-004-RPT-01-RevB	**Your reference:**	RM26.297
Prepared by:	Dylan Walton	**Date:**	02 November 2026
Approved by:	Nick Dempsey	**Checked by:**	Dylan Kiernan
Subject:	Further Information Request – Recommended Section 92 Questions		

1 Introduction

Queenstown Lakes District Council (QLDC) owns and operates the Shotover Wastewater Treatment Plant (WWTP) located at the confluence of the Shotover and Kawarau Rivers and adjacent to Queenstown Airport. Following continued poor performance of the disposal field from 2020, Otago Regional Council (ORC) obtained an Enforcement Order obliging QLDC to (a) apply for a short-term discharge consent to address the failings of the plant that led to the breaches of consent, and (b) apply for a long-term consent, permitting QLDC to discharge in the long term. The application was made in June 2026.

ORC has engaged Mott MacDonald to assist with the review of the long-term consent application, specifically aspects of the application that relate to the wastewater treatment process. ORC has also requested that Mott MacDonald assess the alternative treatment and disposal options that have been investigated by QLDC. A full description of ORC's requirements is provided in the scope given in the proposal email dated Wednesday 26 August 2026, from Nick Dempsey (Mott MacDonald) to Hannah Gosling (ORC).

This memo fulfils the second part of ORC's requirements, namely recommending questions to be put to QLDC from a wastewater treatment process perspective as part of a comprehensive Section 92 request. The documents reviewed are as follows:

- The AEE, in particular Sections 2, 3, and 5, insofar as they relate to our area of expertise;
- Appendix A - Surface Water and Groundwater Assessment (in particular Sections 2.2, 2.3 and 2.4);
- Appendices F, G, and I (assessments of alternative options);
- Appendix O - proposed consent conditions.

The first part of ORC's requirements - a high-level review and audit of the application information - was provided in the Mott MacDonald document "Shotover WWTP Consent Application Audit – Initial review of documentation", dated 26 August 2026. Subsequently, Mott MacDonald met with the applicant's technical advisors (Ian Ho, GHD), on 18 September 2026 to discuss these initial observations. This report follows from the initial review and presents our queries in Section 2, in a format that provides (a) the reasons for the questions, followed by (b) the questions themselves. Section 3 provides responses to specific

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questions about the treatment process, as required by ORC in the scope. Section 4 further provides a response following review of alternative treatment and disposal options.

We note that Sections 3 and 4 were also part of Mott MacDonald's high-level initial review; following a secondary review of the application documents, we are confident that our conclusions in the high-level review relating to the process and discharge options stand.

The following specific documents are referred to in this memo as "Reference A" and "Reference B":

A. "Resource Consent Application to Otago Regional Council for Discharge of Treated Wastewater & Associated Activities - Shotover Wastewater Treatment Plant" by Landpro Limited (29 May 2026).
B. "Shotover WWTP Surface Water and Groundwater Assessment" Revision 0 by GHD (28 May 2026). This document is Appendix A to the Landpro Limited report.

2 Section 92 Response

This section describes Section 92 questions for the applicant, from a. to s.

2.1 UV disinfection – health risks

The Applicant has proposed the addition of a new UV system (Section 2.4.3 in Reference A). However, Section 7.6.2 in Reference B suggests that the addition of further UV treatment is only being considered. A generic microbial risk assessment (MRA) to assess the risk of illness from norovirus has also been undertaken (Section 7.7.2 in Reference B). The Applicant has also presented data from the same study suggesting *Escherichia coli* (*E. coli*) can be used as an indicator of when a norovirus risk-based threshold may be exceeded.

The risk assessment presented in Section 7 does identify risks associated with viruses (particularly norovirus), as well as *Campylobacter*, and provides the design UV dose for the existing UV plant. Ultimately, the Applicant has proposed a 95th percentile *E. coli* consent limit of 100 cfu/100 mL (condition 4 of the proposed consent conditions, given as Appendix O to Reference A). However, they also acknowledge that a discharge-specific quantitative microbial risk assessment (QMRA) needs to be conducted to refine the estimates of risk to recreational users.

a. What flow does the dose of 27 mJ/cm^2 relate to? Will this be sufficient for future flows?
b. For an application such as this it would not be typical to grant a consent limit for *E. coli* alone, given that it may be quite possible to achieve a relatively low concentration of *E. coli* while not reducing viruses significantly. For example, if norovirus requires 9.1 mJ/cm^2 for 1 log removal (Table 7.4 in Reference B), then a dose of 27 mJ/cm^2 may not be sufficient to reduce the viruses to an acceptable level, particularly if there is a viral outbreak. It is understood that a discharge-specific QMRA is currently being undertaken; please suggest a dose-based consent limit, taking into consideration the outcome of the QMRA and the monitoring requirements, noting that ORC will likely recommend conditions relating to the following:
    - a minimum validated UV dose;
    - continuous monitoring of critical UV performance parameters (such as flow, UV intensity, UV transmittance, and lamp status);
    - alarm and corrective-action requirements; and
    - compliance monitoring of the treated effluent (e.g. *E. coli*).

c. It is unclear whether there will be a new UV plant or not. Please confirm the UV plant requirement following the completion of the QMRA.

2.2 Addition of alum or polyaluminium chloride

One of the proposed improvements to the system is the dosing of aluminium sulphate (alum) or polyaluminium chloride (PACl) to reduce the concentration of phosphorus in the treated wastewater. While this is typically an effective means of reducing the concentration of phosphorus, the side effects include an increase in sludge quantity and possible changes to the pH of the treated wastewater. Not only can this put the consented discharge pH at risk, but it can also affect the biological process. The application does address the impact that any additional aluminium in the treated wastewater will have on the receiving environment. However, it does not mention the other impacts, which may not only put the process at risk but may also present ongoing operational issues and costs. We have the following questions:

d. Typically, the addition of alum, PACl, or other phosphorus precipitating chemicals will increase the waste sludge volume by 20% to 30%. What impact will this have on the site's solids handling equipment, and could limitations in solids handling capacity restrict the mass of solids that can be removed from the system and thereby adversely affect the MLE treatment process?
e. The thickened and dewatered sludge (biosolids) will have a higher concentration of aluminium and phosphorus. Does this place any limitations on how the biosolids can be handled and where it can be delivered to?
f. What impact will the chemical dosing have on the nature of the mixed liquor and how will this affect sludge age and subsequent biological treatment performance?
g. Similarly, could the addition of alum or PACl reduce the process pH to unacceptably low levels and, if so, how would the process respond and what mitigation measures would be required?
h. Will the lower temperatures expected across winter (particularly with water entering through infiltration) affect the efficacy of the dosing and, if so, how will this be addressed?
i. What residual aluminium concentration can be expected in the treated wastewater and what are the risks of it being so high that it is unacceptable for the receiving environment?

2.3 Sludge age and ability to remove nitrogen

We are aware that sludge age is currently controlled through wasting of solids from the clarifier underflow return activated sludge (RAS) stream, with wasting adjusted to maintain a certain mixed liquor suspended solids (MLSS) in the activated sludge reactors. This is typically a more difficult method of controlling sludge age as it relies on knowing the concentration of solids in the clarifier underflow, which can vary throughout the day depending on flow. More commonly, wasting MLSS occurs directly from the reactor, providing greater control of sludge age. A better understanding is therefore required for how the plant will respond to chemical addition and what control or mitigation measures may be required to reduce the risk of non-compliance with the nitrogen limits. Considering the changes to sludge characteristics and pH described above, we have the following questions:

j. How will the system react in terms of nitrogen removal? For example, by creating additional aluminium and phosphorus sludge, it is assumed the MLSS concentration will increase for a given sludge age, which may affect the capacity of the reactors. However, one might also expect MLSS settling to improve due to the addition of the chemical, which could cancel out the reduced capacity of the overall system. Can you please provide more information about the behaviour and capacity of the system in terms of nitrogen reduction after the addition of alum or PACl?
k. Will any additional control measures be put in place to further refine control of the sludge age? If so, what could these be? If not, please explain why sludge age control and nitrogen removal are not a concern with the provision of chemical dosing.

2.4 Option for wetlands prior to river discharge

There appears to be sufficient area south of the existing ponds, such that a larger wetland than the three-hectare wetland proposed for the wetland option could be constructed. While it is acknowledged that the hydraulic retention time of a wetland of three hectares is unlikely to be sufficient for any notable additional treatment of key contaminants (particularly as it relates to nutrients), a larger wetland would result in a longer hydraulic retention time, and potentially improved treatment. 'Polishing' wetlands, with an appropriate hydraulic retention time, can be effective at removing metals (such as aluminium), per- and polyfluoroalkyl substances (PFAS), pharmaceuticals, microplastics, and other emerging organic contaminants. If sufficiently sized, nitrate could also be reduced further.

In Section 9 of the Short List Report, Kai Tahu provides a position statement in which Ka Runaka state that they "...support options that will use natural processes to treat the wastewater and absorb and remove contaminants", and that "...superficial or token contact..." with whenua that does not provide any additional treatment "...is not sufficient." As above, an appropriately sized wetland (if the land is available) could potentially remove contaminants that are normally difficult to reduce through conventional wastewater treatment:

l. Why was the wetland option limited to three hectares in area when there appears to be significantly more area available in that general location?

m. How effective would the proposed three-hectare wetland be under Option B at removing additional contaminants such as metals, per- and polyfluoroalkyl substances (PFAS), pharmaceuticals, microplastics, and other emerging organic contaminants?

n. Could the wetland be increased in size to further reduce nitrate and the other contaminants listed above?

o. Could a larger wetland be located away from the delta, to enable a level of treatment that meets Kai Tahu expectations?

2.5 Consent conditions

p. In addition to the parameters identified for monitoring in river contaminiants, in condition 22, we recommend that aluminium is also added to the list in condition 22(b)(ii).

3 Process Response

The following are the process responses to questions raised in the scope of work, and are included here for completeness:

1. **Will the WWTP consistently achieve the proposed discharge limits and performance standards?**

   There is little design detail provided on the sizing of the wastewater treatment plant. However, the existing processes along with the proposed new processes are conventional methods that, provided the WWTP is appropriately sized, operated, and maintained, are frequently used to meet the proposed discharge limits and performance standards.

2. **Are there any contaminants or parameters that may be difficult to treat reliably?**

   The total phosphorus (TP) limit (at 1 mg/L) is low, but, as above, provided the appropriate controls are maintained, the proposed WWTP can feasibly meet the proposed limit. The proposed total nitrogen (TN) limit, at 10 mg/L, should be achievable, but is highly dependent on "sludge age" and control of that parameter. This will become more difficult to control as the population and flow to the plant increases. We understand that solids wasting from the clarifier underflow is adjusted to maintain the desired reactor

MLSS concentration, rather than being controlled directly to a specified sludge age. The addition of alum or polyaluminium chloride will result in (a) the production of more sludge, which will need to be carefully managed and may require a sludge age adjustment to account for this, and (b) possible changes to the pH of the system. Our concerns have been raised in Section 2 of this memo.

3. **Is the WWTP appropriately sized to accommodate the proposed inflow projections over the duration of the resource consent sought?**

   No. The existing treatment plant, comprising MLE1 and MLE2 and associated clarifiers, is sized for flows up to the year 2048, while the proposed consent provides for treatment for flows at the 2060 design horizon. In Section 2.2.1 of the "Surface Water and Groundwater Assessment" it is acknowledged that a "...further capacity upgrade will be required within the consent duration when the capacity is reached." However, this is not alluded to in the proposed conditions. We understand that QLDC's engineers, GHD, have been briefed to provide a design only to the 2048 design horizon. It is suggested that a condition be included in the consent for QLDC to provide regular updates (every three to five years) on planning for wastewater treatment, with this reporting frequency increasing to annually from 2040 onwards.

4. **Will the WWTP operate reliably over the duration of the resource consent sought?**

   There are few reasons to think that it would not, notwithstanding the questions we have regarding sludge age control and the need to upgrade the plant within the lifetime of the consent. The existing technologies are relatively simple and well established and the new processes (disc filter, disinfection plant, and chemical dosing for phosphorus removal) are also well established technologies. Reliability should be comparable to other WWTPs of similar size using similar technologies, provided the appropriate monitoring and operating control procedures are in place.

5. **Are there any maintenance or operation risks that could compromise treatment performance?**

   The main maintenance and operation risks are likely to arise from sludge age control and chemical dosing for phosphorus removal (the risks being residual aluminium in the treated wastewater and biosolids). The addition of a phosphorus-binding chemical will also generate more sludge, which may affect the whole plant (recycle rates, operating parameters for the MLE reactors, sludge dewatering and thickening, and sludge volumes, among others), and this will need to be addressed in the design, with follow-through into operation and maintenance. We have raised this in Section 2 of this memo.

6. **Is the proposed operation and monitoring regime appropriate? Are any additions required?**

   A full operating and monitoring regime was not provided. Proposed conditions 15 to 21 address operations and maintenance by requiring an "Operations and Maintenance" (O&M) manual, which will also include a Contingency and Incident Response Plan (CIRP), and this will include details on how to operate the plant. The proposed conditions include the requirement that QLDC submit the O&M manual to ORC at least one month prior to the exercise of the consent for "certification". This is not unusual and a full review of the operating and monitoring regime can be undertaken at that stage.

7. The proposed consent conditions also provide for sampling and monitoring of the discharge and the receiving environment in conditions 5 (general environmental impact), 10 to 14 (treated wastewater), and 22 to 25 (receiving environment). At a high level, the sampling frequency and discharge parameters to be analysed appear reasonable. We have concerns around the only required pathogen indicator being *Escherichia coli* (*E. coli*), and we are likely to recommend a condition requiring ongoing monitoring of the UV plant to ensure the required dose is being met. We have alerted QLDC to this in our questions above.

8. Receiving environment monitoring also appears reasonable, but while the sampling frequency (monthly) is good, we consider that given the proposed chemically assisted settlement, that aluminium should also be monitored. Condition 24 also triggers additional action to be taken if there is a change of more than 20% in some measured parameters. Is 20% an arbitrary number, or is it based on more substantive information?

9. **Are contingency measures appropriate in the event of equipment failure or process upsets?**

   The Applicant is constructing an emergency "calamity" pond for treated wastewater that will provide 48 hours of storage at the 2060 average daily flow (ADF), which we consider appropriate at this stage.

There is also an emergency pond for raw wastewater. However, it is unclear how the use of the calamity pond will be triggered without using continuous online monitoring of key discharge parameters to inform operators when out-of-specification wastewater is exiting the wastewater treatment plant.

10. The proposal states that three tertiary filters will be provided for the 2060 flow of 60,000 m^3/d, with a space for a fourth for additional redundancy. Similarly, two UV disinfection units are proposed for the peak discharge volume of 60,000 m^3/d with provision for a third as the population and flow grows. In both cases, both systems appear to have one unit of redundancy, which is adequate.

11. **Has sufficient information been provided to demonstrate the treatment plant will perform as proposed?**

    No, there is little or no sizing information. If appropriately sized, however, the technologies proposed are capable of achieving the proposed limits.

12. **Are there any assumptions requiring further justification?**

    The condition requiring reduction in *E. coli* assumes that the health risk assessment in Section 7 of the Surface Water and Groundwater Assessment is sufficient to enable a pathogen or bacterial consent limit to be imposed. However, as the application acknowledges, viruses also need to be considered, and these tend to be more resistant to UV inactivation than bacteria. Section 2.4.3 of the Resource Consent Application document suggests the UV plant will be sized for a 2-log reduction of viruses, but the UV resistance of viruses is highly variable. Therefore, justification for the *E. coli* limit and any other disinfection monitoring need to be supported by a QMRA. We have raised this as an issue in Section 2 of this memo.

13. **What additional information should ORC request before the application can be fully assessed?**

    See Section 92 questions above.

14. **Are there any additional conditions (beyond those in Appendix O) that you would recommend be adopted?**

    Yes. These are likely to relate to (a) monitoring of the new UV system, (b) monitoring for aluminium in the receiving environment, and (c) staging of any future upgrades. We will suggest wording in our full and final report, following QLDC's response to the Section 92 questions.

4 Alternative Options Response

15. **Is the range of disposal options considered appropriate and sufficiently comprehensive?**

    The Applicant originally interrogated 12 disposal options, including direct discharge to river, discharge to river via wetland, discharge to land using slow-rate irrigation, discharge to land via trenches, discharge to groundwater via well injections, discharge to land via soakage holes, and discharge to land via low-rate spray or drip irrigation.

    The land disposal options were later supplemented by an additional study which investigated possible sites for slow-to-moderate irrigation and assessed feasibility of six possible sites around Queenstown. In effect, 18 possible options have been considered, comprising a range of locations and methods. We consider that the options investigated are appropriate and sufficiently comprehensive.

16. **Have the technical feasibility and limitations of alternative disposal methods been appropriately assessed?**

    In our opinion, yes. The process by which the preferred option was reached was thorough, comprising a long list of the 12 original options (plus the options for slow-to-moderate land disposal), which were then

narrowed down to a shortlist of five via a multi-criteria analysis (MCA). Stakeholders had an opportunity to input to the selection of the shortlisted options via a workshop.

Further work was done by the Applicant's engineer to refine the shortlisted options, which were again the subject of another workshop attended by key stakeholders. We consider that the process by which the Applicant has arrived at the preferred option is appropriate. In addition, and in brief, we consider that sufficient design work has been conducted to fairly assess each of the options at the appropriate stages, with more work being undertaken for the shortlisted options. We consider the selection process appropriate; we will provide more detail in our final report.

17. **Have any potentially feasible disposal alternatives been overlooked or insufficiently assessed?**

As above, the options assessment appears thorough. Our only query is why was the wetland option limited to three hectares although some plans appear to show a larger area. We acknowledge that the hydraulic retention time of a wetland of that size will not be sufficient for any notable additional treatment, particularly as it relates to nutrients. However, polishing wetlands, with an appropriate hydraulic retention time, can be effective at removing metals (such as aluminium), per- and polyfluoroalkyl substances (PFAS), pharmaceuticals, microplastics, and other emerging organic contaminants. If sufficiently sized, nitrate could also be reduced further.

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