Better environments Better returns

LANDPRO.

13 August 2025

Landpro Reference: 24131
Council Reference: RM25.177, RM25.206

Attention: Hannah Goslin
Otago Regional Council
via email: hannah.goslin@orc.govt.nz

Dear Hannah,

RE: Request for Further Information under Section 92(1) of the Resource Management Act 1991 – Applications RM25.177 and RM25.206 relating to the discharge of treated wastewater and associated activities at QLDC's Shotover Wastewater Treatment Plant (WWTP).

In reference to your requests for further information dated 19 June 2025 please find below our response to these requests.

Three technical reports have been provided to support the response to these requests and are attached as Appendices A to C. These technical reports should be referred to for a full response.

- Appendix A - Water Quality – Authored by GHD
- Appendix B – River Protection and Diversion – Authored by GHD
- Appendix C - Freshwater Ecology – Authored by Boffa Miskell

RM25.206 – Discharge of treated wastewater and associated works

Future effects of the discharge on the Shotover River/Kimiākau and Kawarau Rivers

1. *Please provide modelling or mass-balance assessments to support the conclusion in the application that the effects will be less than minor.*
    a. *Quantify expected key contaminant concentrations (including but not limited to ammonia, phosphorus, E.coli, filtered carbonaceous BOD and TSS) at the downstream extent of the reasonable mixing zone;*
    b. *Compare expected contaminant concentrations at the downstream extent of the reasonable mixing zone with water quality thresholds set out in the National Policy Statement for Freshwater Management 2020, the water quality standards in Schedule 15 of the RPW and any other relevant thresholds commonly used to indicate the onset of adverse effects;*
    c. *Consider background water quality conditions and low flow scenarios;*
    d. *Include assumptions for dilution rates, river flow and discharge volumes;*

e. Identify to what extent the diversion sought under RM25.177 is taken into account when considering undertaking modelling or mass-balance assessments;

f. Assess the consistency between the predicted (modelled or estimated) effects of the discharge on water quality and the monitoring date or observed water quality since the discharge commenced; and

g. Consider effects at the end of the zone of reasonable mixing (based on the response to Question 2 below), after full mixing in the Shotover River/Kimiākau and after full mixing in the Kawarau River.

2. If modelling or mass-balance assessments are considered to be unnecessary, please provide an explanation for why.

3. Please provide an updated assessment of effects of the discharge based on the results obtained from modelling or mass-balance calculations.

The technical report in **Appendix A** provides a detailed response to the above questions in Section 5.1.

Detailed mass balance modelling assessments were completed for the proposed activity, being the discharge with Stage 2 WWTP upgrades complete, and with additional diversion flows. Certain assumptions were made for this assessment which are set out in Section 5.1.2 of **Appendix A**, including the need to provide for ongoing maintenance of the existing braid conditions contributing to mixing of the discharge.

Mass balance calculations were used to inform the volume of the diversion needed to providing mixing to achieve NPSFM national bottom line water quality parameters at the end of the reasonable mixing zone (see answer to Question 4 for discussion on the mixing zone).

The quality of the effluent expected following the completion of Stage 2 WWTP upgrades (second MLE and clarifier commissioning) was re-visited to ensure accurate data could be used in the mass balance modelling. This is summarised in Table 2 of **Appendix A.** I note that these figures are slightly different to those proposed as consent limits in Table 5 of the application. This was necessary for the assessment of maximum values (95th percentile) and no changes to the limits originally sought are proposed which use mean and 90th percentile values.

In general, the **Appendix A** report indicates the importance of the diversion to provide an adequate level of dilution as soon as possible. For specific water quality parameters GHD note the following after reasonable mixing:

- Ammonical-N: Concentrations are predicted to remain below the NPSFM national bottom line (majority consistent with A band but on occasion may have higher levels) and the ORC Schedule 15 limits.
- DRP: Concentrations likely to be consistent with NPSFM B and D bands, but not meet Schedule 15 limits until the braids are fully mixed (location RS10). The Schedule 15 limits reflect an A Band concentration consistent with natural reference conditions.

The influence of DRP on the Shotover River is within specific braids and not the fully mixed Shotover or Kawarau Rivers. The influence of this on ecology is expected to be limited, due to the often turbulent nature of the river flow and highly mobile bed substrate.

- Nitrate-N: Concentrations are predicted to be consistent with Attribute band A, reflecting low toxicity and meeting the national bottom line for nitrate-N. However, they are likely to exceed the Schedule 15 limits. While concentrations are unlikely to cause toxicity effects, the elevated nitrate concentrations may contribute to periphyton growth and ecosystem health changes in the affected reach. Similar to DRP, the Schedule 15 limits are met at the downstream monitoring location RS10. The potential for periodically elevated nitrate concentrations to result in meaningful periphyton growth is considered to be limited by the often turbulent flow in braids and mobile gravel substrate.
- BOD – BOD concentrations are predicted to remain low, and most often <1 mg/l. Together with the shallow water depth and turbulence occurring in braided river flow, reduction in dissolved oxygen due to microbial digestion of treated wastewater sourced organic matter is therefore predicted to be negligible.
- TN and TP – Concentrations of TN and TP are predicted to be elevated in river braids influenced by treated wastewater discharge. The influence of elevated TN and TP levels in river braids, relative to background, on periphyton growth and ecosystem are described in more detail in the ecology report in **Appendix C**.

Determining the zone of reasonable mixing

4. *Please describe and justify what is considered to be the zone of reasonable mixing and provide an updated assessment of effects, if necessary, based on the zone of reasonable mixing.*

Unlike other more contemporaneous plans, the Otago Regional Plan: Water (RPW) does not provide a definition for a reasonable mixing zone. In order to seek more context in the Otago region, the draft Otago Land and Water Plan was referred to as it contains a draft policy (IP-P20) on mixing zones. While this plan has not been notified, the general guidance is in line with the policies of other regions.

IP-P20 proposes either a:

(a) default mixing zone based on length and wetted channel width, or

(b) site specific mixing zone taking into account the default mixing measurements and the smallest zone necessary to achieve the required water quality in the receiving waters.

GHD in **Appendix A**, highlight that the dynamic nature of braided rivers means that the receiving environment changes frequently, therefore the default calculations using wetted width may not be appropriate for this setting. Instead, their assessment and proposed mitigation has focussed on achieving a downstream water quality that avoids the following effects from section 107(1) of the RMA:

(c) the production of any conspicuous oil or grease films, scums or foams, or floatable or suspended materials:
(d) any conspicuous change in the colour or visual clarity:
(e) any emission of objectionable odour:
(f) the rendering of fresh water unsuitable for consumption by farm animals:
(g) any significant adverse effects on aquatic life.

On that basis, the mixing zone has been defined as being no more than 200 m downstream of the discharge, with RS06B (approximately 170 m downstream) considered to represent conditions after reasonable mixing. It is expected that, with the proposed mitigation (particularly the second MLE clarifier becoming operational and the additional flow diversion), the water quality criteria above and in the NPSFM will be met. It is noted, however, that the location of RS06B may necessarily move over time as the braid moves.

Further detailed assessment of effects within and beyond this mixing zone is contained within **Appendix A**.

Proposed limits in Table 5 of the resource consent application

5. *Please provide an explanation as to why a limit has not been identified, or alternatively update Table 5 to include a limit for Total Phosphorus.*

Existing consents are in place (through to 2044) that do not set a limit on TP in the discharge. No changes are being proposed to the treatment system through this application. However, I note the previous consent was issued on the basis of a discharge to land before entering groundwater/surface water.

Based on the MLE Clarifier results in Table 4 of the application, the MLE TP varied between 0.74 (median) to 2.8 mg/L (90^{th} percentile). If TP limits are to be included post MLE2 commissioning (from Jan 2026 onwards), median limit of 3 mg/L could be adopted from the proposed wastewater discharge standard.

6. *If it is considered that ongoing legacy effects on phosphorus from the previous discharge is still being released from bed sediments, please provide an explanation for how this is intended to be managed in future and how any ongoing effects can be separated from the discharge sought to be authorised in this process.*

GHD (**Appendix A**) conclude the following:

- That the effects of the discharge of treated wastewater through the DAD on the Delta are evident in river water samples taken near the river bank, of both the Kawarau and Shotover Rivers.
- With the cessation of the DAD discharge, groundwater conditions, and contaminant flux via groundwater, to surface water is predicted to reduce over time, with groundwater reaching a new equilibrium of much lower concentrations. The same is

expected to occur with river sediments influenced by this historical discharge. Ongoing flushing of soluble contaminants and desorption of bound contaminants provides a natural attenuation process.

- Ongoing monitoring is assisting to inform the timeframes over which improvements in groundwater and surface water may be realised, and to inform the long-term direction for wastewater disposal in Queenstown. Direct discharge of wastewater to the Shotover river as per the current and proposed activity, does provide an effective means of reducing wastewater related contaminants concentrations in the greater extent of riverbank areas that are particularly sensitive to nutrient and contaminant effects.
- Beyond ceasing discharge from the DAD and the proposed activity, no further actions have been identified as providing realistic opportunity for further reducing impacts to river water quality associated with historical discharges.

7. *With respect to TAN limits, please provide:*
    a. *an explanation for how these TAN limits have been determined as appropriate;*
    b. *an explanation for why TAN limits have not been proposed for the discharge up to 31st December 2025.*

Refer to **Appendix A** for the full response.

Initially, the proposed limits from 1st Jan 2026 onwards in Table 5 of the application were derived from the Stage 3 consent limits 2008.238.V2, as this is what the MLE2 upgrade has been designed to achieve. Table 15 of the application compared the recent MLE clarifier effluent results against the proposed wastewater discharge standard, which for Shotover River / Kimiākau, the discharge falls under moderate dilution category.

For "moderate dilution", a 90%tile limit of 3 mg/L (for ammoniacal nitrogen) had been proposed. Nonetheless, a median limit is more useful for more consistent plant performance, hence 1.5 mg/L has been selected as the proposed discharge limit. The corresponding 90%tile limit of 5 mg/L allows for seasonal variabilities as complete nitrification is the most difficult to achieve during winter months also where Shotover River / Kimiākau flow is much higher.

Given the seasonal location and generally colder temperatures, the 90th percentile is considered appropriate at this stage to allow some flexibility in plant performance. Once MLE2 is operational, this can be revisited for the long-term consent application, which is due to be lodged in mid-2026.

Prior to MLE2 online (remainder of 2025), there is no scope of improving ammoniacal nitrogen removal especially when the system is already at a very high loading in both ponds

and MLE1. Moreover Shotover River / Kimiākau flow is higher during winter and spring months, further mitigating effects further downstream from the discharge.

Additional information requested to support and clarify conclusions made based on monitoring results

8. *Please confirm that Figure 5 in the application and the similar figures in the application document titled 'Resource Consent Application to Otago Regional Council for Discharge of Treated Effluent to Kimi-ākau/Shotover River' dated 1 May 2025 prepared by Landpro Limited (application for resource consent), represent combined pond and clarifier waste streams post UV.*

Figures 5, 7, 9, 11, 13 and 15 are taken from the effluent consent compliance sample data, at the UV outlet as the combined stream of pond effluent and clarifier effluent.

Figures 6, 8, 10, 12,14 and 16 are sample data points taken from the clarifier outlet.

9. *Please provide an explanation for how a single round or a small number of samples can be considered representative and why further replication was not considered as this would be standard practice.*

Statements made regarding the representativeness of sample results were done so in the context of the assessment i.e. for the purpose of the assessment the results were adopted as being representative of background water quality. This was not intended to imply that individual samples could adequately represent the broad range of water quality conditions experienced within the river.

Replication of the background monitoring of the Shotover River, to obtain a robust data set for the assessment as is standard practice, was not considered because of the nature of the emergency discharge; it was not apparent prior to the discharge that an assessment or background data set would be required. The single monitoring event carried out prior to the emergency discharge was the commencement of a broader programme to understand the effects of the DAD discharge and inform the long term direction for wastewater disposal for Queenstown. The commencement of that monitoring was unrelated to decisions made regarding emergency discharge or need for supporting assessment.

10. *In relation to Section 3.8.2.2 of the Surface Water and Groundwater Assessment, please:*
    a. *explain why only a sub-set of water quality parameters are presented and why ammonia and BOD in particular have not been assessed.*
    b. *summarise all available water quality data from historic compliance monitoring in terms of percentile, means and maximums; and*
    c. *explain why the standard statistical comparisons of the historic upstream and downstream water quality (i.e: Wilcoxon signed rank tests) have not been conducted to support the conclusions made.*

Water quality results for the historical discharge were provided to demonstrate that changes in river flow and braid conditions result in significant change in water quality outcomes. The sub-set of parameters selected represent typical indicators of wastewater influence and control. Detailed analysis of the historical discharge data, including consideration of ammonia and BOD, was originally considered unlikely to provide meaningful information for the following reasons:

- Water quality monitoring locations differ from the current locations
- The river braids and flow conditions significantly differ from current conditions
- The historical discharge differs from the proposed activity, which includes management of water quality outcomes.

In the context of identifying trends for general comment, the progressive reduction in contaminant concentrations (downstream – shown as orange line in **Error! Reference source not found.**5 of Appendix A) is considered to be sufficiently apparent and statistical analysis is considered unlikely to provide additional significant information.

11. *In relation to Sections 3.8.2.4, 3.8.2.5 and 4.7 of the Surface Water and Groundwater Assessment, please:*
    a. *provide an explanation for how the approximate 15-to-25-fold dilution of treated wastewater in the Shotover River/Kimiākau was verified without hydraulic calculations, dye tests or flow modelling to substantiate the dilution assumption and mixing zone extent.*

The wastewater discharge was initiated as an emergency discharge and so the discharge preceded the assessment. The estimates of dilution were derived from the monitoring data of the effects of the discharge. i.e. dilution was not assumed or predicted, it was measured, and so verification of predictions was therefore not needed

    b. *provide a map showing the monitoring sites listed in Table 3.8.*

An updated map is attached to the report in Appendix A.

    c. *confirm how far downstream of the discharge RS16 is located, and if it is at the point of the discharge, why the next closest site was chosen 150 metres downstream.*

RS16 is approximately 5 m from the discharge, in an area where discharged wastewater pools before flowing downstream. It represents unmixed water quality.

RS06B is considered to be representative of the water quality following reasonable mixing as discussed in the response to Question 4. It is noted that current mixing without mitigation (flow diversion) is limited due to a general migration of river flow towards the true left bank, as discussed in Section 4 of Appendix A. The river braid extending ~140 m downstream of the discharge is not easily or safely accessible for sampling due to thick vegetation and steep river bank.

d. it appears that the water quality monitoring results obtained from RS06, RS06B, RS09, RS11 and RS13 shows significantly high ammonia concentrations (especially RS06). Please provide an explanation on whether water quality monitoring results obtained from these sites are due to the wastewater treatment plant discharge.

i. If the cause of the significantly high ammonia concentrations are due to the wastewater treatment plant, please provide an explanation of the next steps that have been undertaken to investigate and remediate the cause of the elevated results.

Monitoring results for RS6B and RS09 are considered to reflect the influence of the emergency discharge to the Shotover River, with some small and periodic background water quality influences.

Location RS06, is considered to represent pooled water, un-mixed with river, and sourced from groundwater. Elevated ammoniacal concentrations at this location were evident before the emergency discharge commenced and are consistent with groundwater chemistry identified in upgradient and down gradient monitoring wells. The influence of wastewater discharge from the DAD is discussed in response to Question 6.

The Dose and Drain (DAD) field was designed to discharge wastewater to ground, infiltrating the shallow groundwater table beneath the DAD. The wastewater mixed and moved with groundwater before discharging to the surface water environment. Figure 3.9 in the surface water and groundwater effects assessment shows groundwater moving to the southeast and east away from the DAD. Seepage from groundwater may affect surface water in these down gradient areas, particularly when the surface water is disconnected from flows (RS06) or poorly mixed. Samples RS11 and RS13 are downgradient of the DAD, samples in these areas are likely to be influenced by groundwater seepage. Monitoring of groundwater quality is being undertaken on a regular basis. It is expected that groundwater quality will improve over time as the effects of the previous discharge move through and out of the groundwater system.

The actions that have been taken to address this is:

- Cease use of DAD for disposal to ground
- Stage 2 upgrades (MLE2) which will significantly reduce ammonia levels in the wastewater discharge.

12. In relation to Sections 3.9 and 4.8 of the Surface Water and Groundwater Assessment, please:

a. confirm whether macroinvertebrate monitoring data are available for the period considered representative of the future discharge (2017-2019).

b. provide a spreadsheet with all of the ecological data referenced in Section 3.9.

c. confirm whether standard equivalence testing can be conducted on the QMCI data to statistically test the potential effects of the discharge.

d. provide all available periphyton data and an explanation on whether heterotrophic growths have been monitored and if they have, whether they have been detected. I note that this is specifically mentioned in the Kawarau River Water Conservation Order (WCO).

13. In relation to Section 4.9 of the Surface Water and Groundwater Assessment:

a. given that E. coli is a poor indicator of health risk from wastewater, please explain why a Quantitative Microbial Risk Assessment (QMRA) has not been conducted particularly given the references to suitability for bathing in the WCO.

b. Either undertake a QMRA or undertake a similar assessment using an alternative method.

The Kawarau WCO requires that certain outstanding values are recognised and protected (e.g. wild and scenic, natural character, recreational uses etc) and sets certain limits/restrictions:

- no damming allowed;
- water quality to be managed to Class CR standard

Class CR Water Quality Standard from Schedule 3 of the RMA (being water managed for contact recreation purposes) applies after reasonable mixing:

> (1) The visual clarity of the water shall not be so low as to be unsuitable for bathing.
>
> (2) The water shall not be rendered unsuitable for bathing by the presence of contaminants.
>
> (3) There shall be no undesirable biological growths as a result of any discharge of a contaminant into the water.

However, it does not outline how suitability for bathing shall be assessed. The Otago RPW was prepared after the Kawarau WCO was in place and states that "*The Order has been recognised and provided for within this Plan*". The plan therefore includes in its rules that damming is prohibited and provides an *E.coli* limit of 260 cfu/100mL (after mixing) in the water quality standards to be met to reflect the use for bathing (Schedule 15 RPW). Taken as a 95th percentile, this *E.coli* limit reflects the 'Good' NPSFM Attribute Band for primary contact sites in lakes and rivers (during bathing season).

Given the direction of the RPW for meeting the Kawarau WCO through the use of *E.coli*, commonly used as a faecal indicator bacteria for risk screening, and the limited potential for pathogen exposure due to limited use of the Shotover River for bathing, a comprehensive QMRA was not considered to be necessary to assess public health risk.

Elevated *E.coli* concentrations do occur in the Shotover River, as evidenced by periodic increases in response to rainfall and catchment run-off events, such as measured upstream of the discharge. The relatively low *E.coli* concentrations measured at locations RS06B and RS09, considered to reflect water quality after reasonable mixing, with measured

concentrations at these locations meeting the suitability for bathing requirements outlined in the RPW.

c. it is described that there was an initial flush of microbial contaminants from the engineered channel on commencement of the discharge. Please provide water quality monitoring results for E.coli from the UV channel discharge to validate this observation.

The data requested is provided within **Appendix A**.

14. Please provide proposed conditions of resource consent for the discharge permit to discharge treated wastewater to the Shotover River.

Attached as **Appendix D** are some proposed conditions of consent for the discharge permit.

As part of preparing this response, draft conditions were provided for comment to Rūnanga via Te Ao Marama (TAMI) and Aukaha, and also to Department of Conservation (DoC) and Otago Fish & Game (F&G). Both TAMI and Aukaha indicated that they were unable to provide specific comment on these conditions until they had received a copy of this s92 response. A copy will be provided to them at the same time as being provided to ORC and conversations will be ongoing and further updates may then be provided.

Initial comments/feedback from DoC and F&G have been incorporated into the attached proposed conditions.

Works in the bed of the Shotover River/Kimiākau to construct an outfall structure

15. The following information is requested to validate the technical information provided to support the application for works in the bed of the Shotover River/Kimiākau to construct an outfall structure. Please provide:

a. plans or schematics of the discharge outlet structure.

The outlet structure comprises gabion walls, gabion baskets and a riprap basin in front of the discharge channel.

Please refer to Sections 3 and 4 of **Appendix B** for further details and Figure 3 and Figure 4 of **Appendix B** for a schematic design of the outlet structure.

b. a description of how construction will be undertaken (i.e: will it require dewatering of the area and will fish salvage be required).

The proposed outfall features interfere minimally with the river system and its habitats. No dewatering and fish salvage is deemed required as the majority of the installation can be done in low flows and outside of the main side braid.

Refer to Section 6 of **Appendix B** for the high-level construction methodology.

The key features of construction include:

- Excavation and reshaping the side slopes of the riverbank for the discharge channel erosion protection with an approximate footprint of 4m x 4m and height of 2m with a batter slope of 1:3 with a total volume of 10m³ on either side of the discharge channel for construction of the proposed river protection system (total 35m² and 20m³).
- Excavation of 5m x 5m footprint to the depth of 700mm (approx. 18m³) in the riverbed in front of the gabion outlet to install the riprap basin.
- No significant vegetation clearance expected.

Conditions such as the following are recommended to be included on the consent:

- 20 working days prior to construction commencing a copy of the detailed design plans shall be provided to ORC.
- 20 working days prior to construction commencing a construction management plan (CMP) shall be provided to ORC for approval. This plan shall include details of the location and method of works, any proposed methods for working in wet areas or areas of flow, a plan showing erosion and sediment control measures and where they will be located.
- A copy of this CMP shall be provided to all contractors undertaking this work.

c. an assessment undertaken by a freshwater ecologist of effects on aquatic ecosystems as a result of the construction and design of the discharge outlet structure

The full ecology assessment report is contained in **Appendix C**. In summary, Boffa Miskell conclude the following in respect of the effects of the outfall structure:

- Bed disturbance will be kept to a small footprint near the outfall and in a period of low flows. With the use of appropriate erosion and sediment control measures the effects on freshwater ecology values are considered to be very low.
- Minor exotic vegetation removal of the scale proposed will not result in any discernible change in the freshwater condition and is likely to re-establish within 2-4 years. The potential effects of removing exotic vegetation on freshwater ecology values are considered to be very low.
- In terms of potential sediment discharge, the works in the riverbed directly near the side braid are expected to take less than 10 hours, be undertaken in the dry and will implement appropriate erosion and sediment control measures. The anticipated initial flush of sediment expected after works are completed will be short-lived and not dissimilar to sediment that would naturally be resuspended in a high flow event. With the above mitigation, effects on freshwater ecology values from sediment discharge are expected to be nil to very low.

RM25.177 – Works in the bed for diversion of flow

Description of the proposed activity

1. *Please confirm what the design flow rate is anticipated as a result of the diversion and the likely maximum flow rate.*

Full details are included in **Appendix B**. The diversion flow design target is 2.5 m^3/s. Refer to Section 4 of **Appendix B** for details of the hydraulic capacity of the proposed diversion system.

The design flow rate of the channel will be 2.5 m^3/s, however there is no specific maximum flow rate.

Further explanation of the proposed diversion is given below:

- The proposed method for diversion is via excavating a shallow channel tying into the existing levels at the nearby braid for a relatively short length (400m, approx.) and returning the flow back to the river after diluting the treated effluent discharge.
- The diversion flow is proportional to the available head at the river braid, higher head results in a greater diverted flow rate. Preliminary calculations indicate that when the flow within the braid is approximately 22 m^3/s, the diverted flow approaches the target of 2.5 m^3/s, representing about 10% of the total river flow. The availability of sufficient flow in the braid to achieve the target diversion, depends on the river morphology which can change over time.
- In addition to constructed diversion channel, flow in the adjacent naturally flowing braid, which provides dilution downstream of the discharge, will be maintained to no less than 1 m^3/s by locally lowering the true right-hand side wall of the braid by approximately 300-400mm and reshaping its cross-section. As the braid changes over time, these works would be undertaken as needed to ensure sufficient mixing is occurring within the reasonable mixing zone (up to 200 m downstream of the discharge).
- Ongoing reinstatements will take the form of routine maintenance, with the required volumes depending on the river's condition at the time of the works
- Further assessment and mitigation measures will be addressed by more detailed survey, hydrometric measurements and adjusting the geometry of the diversion system during the detailed design.

Effects on the environment as a result of the diversion within the Shotover River/Kimiākau

2. *Based on the maximum flow rate proposed in response to Question (1) please provide an assessment of:*
    a. *Effects on hydrology, morphology and erosion of the bed and bank arising from the proposed diversion of water at the maximum flow rate, including an assessment of effects on the Council's Training Line.*

Full details are included in **Appendix B**.

The Shotover River is a braided river and is subject to morphological changes, particularly after high flow events. Survey data confirms the cross-section and slope characteristics at the proposed discharge point; however, the location of the main river channel and braids are continuously changing due to natural river braiding dynamics.

The proposed work involves excavating a shallow diversion channel from the nearby braid from 300m (approx.) upstream and may extend to approximately 200m downstream of the discharge channel. This will be within the zone shown in Figure 5 of **Appendix B**. The invert of the proposed diversion channel will tie into the invert of the existing braid at both ends.

In terms of effects on hydrology and morphology of the river:

- The concavity of the nearby main braid at the location of the discharge channel, increases the efficiency of the diversion system even in low flow conditions and likely sustains the main braid at its current location or close to the discharge channel even after flood-induced re-braiding.
- As the proposed diversion system is localised, and the diverted flow, remains in the river system, the impact and disruption to the river environment and its hydraulic characteristics will remain minimal. The design of the diversion channel generally mimics a river braid, and over time movement of the river gravels are expected to provide a more natural form and likely establishment of the channel as a natural braid. Movement of minor braids within the broader river bed is an ongoing occurrence, with gravel extraction activities by third parties already promoting localised river braid movement and entrainment of braids. In this context, the diversion channel, and any maintenance works, are not expected to result in a changes to the river morphology or hydrology that are out of character with the current river environment. As such, potential adverse effects associated with the diversion works are predicted to be limited to potential ecological effects. These are discussed in detail in the Boffa Miskell memorandum (**Appendix C**).
- To accommodate the movement of the river over time, while meeting the dilution needs in the reasonable mixing zone, the location of the diversion channel and its extent are expected to also change over time. A zone of works, rather than a specific channel location, is therefore proposed. While it is expected that the diversion system will require periodic reinstatement due to river sediment deposition or channel migration, such maintenance is temporary in nature and akin to the existing sand extraction and river management operations in the area. Any sediment mobilisation during these works is likewise consistent with current occurrences in the river and within the natural range of effects for river.
- No long-term effects of diversion are expected to occur after this consent expires, as high flow events will effectively remove the remnant diversion channel.

In terms of effects on erosion of the bed and banks of the river:

- The proposed rock riprap or rock bags will suffice to protect the riverbed and banks from erosion as a result of the diversion flow. The high porous nature of the riprap will allow the flow to spread to the mixing basin. The flexible nature of these features is consistent with the unpredictable nature of braided river.

In terms of effects on the ORC Training Line structure:

- There is no anticipated adverse impact on the training line as the diversion works are not located close to the training line, only represent a small portion of the flows, will be directed back into the main braid away from the training line and flows will be retained with the existing braided pattern of the River.

A summary of the proposed construction methodology is included in Section 6 of **Appendix B**. As mentioned under the response to Question 15(b) above, a Construction Management Plan will be provided to ORC for approval prior to works commencing.

b. Effects on aquatic ecosystem particularly habitat availability within the extent of the Shotover River (anticipated to be between 200 and 300 metres) that will have less flow under low flow and very low flow conditions as a result of the proposed diversion at the maximum flow rate.

The full ecology assessment is included in **Appendix C**. Under moderate to high flow conditions, minimal impacts are expected on the ecological values as a result of the flow diversion.

The proposed target diversion volume at low flows of 2.5 m^3/s equates to approx. 14% of the MALF for the Shotover River meaning that a low degree of hydrological alteration and a moderate to high level of ecological protection, with minimal changes in ecosystem function can be expected.

During low and very low flow conditions, there is potential for the following changes to occur:

- A slight reduction in the wetted width and total wetted area of the main channel and a reduction in depth in areas that remain wet. This may lead to changes in water velocity and changes in habitat availability for macroinvertebrates and fish.
- Warmer water temperatures and increased periphyton growth in the main channel for short periods between high flow events.
- Slight increase in the frequency and duration of low flow events int eh affected reach of the braids.

These changes may lead to both increases and decreases in water velocity and habitat and availability for macroinvertebrates and fish, while a reduction in water depth can lead to an increase in habitat availability for some species due to habitat preferences (e.g. water depth and velocity).

Discernible changes in the macroinvertebrate community composition, are therefore expected when there is any measurable change in water velocity, temperature and/or periphyton biomass within the reach of the main braid from the top to the bottom of the

diversion. It is expected to see an increase in overall diversity and increase in abundance of some macroinvertebrate taxa but not necessarily a decline in biotic metrics, such as MCI or QMCI. These changes in community composition will be similar to that seen in the sampling data from 2018 and similar those that naturally occur in any given year in response to lower flows. However, with the proposed diversion, the "low-flow conditions" may be brought on earlier and occur for a longer period of time until the next fresh resets the system within the section of main braid where the diversion channel diverts from.

c. Effects on Schedule 1A and 1AA values as a result of the proposed diversion at the maximum flow rate.

The values identified in Schedule 1A for the Shotover River in the affected reach beside the Delta are included in section 3.8 of the application and include:

- Ecosystem values – gravel bed substrate, large water body with diverse habitat, presence of waterfowl, absence of aquatic pests
- Outstanding Natural Features – wild and scenic naturalness, high natural sediment load and active Delta, recreational uses

In respect of effects on ecosystem values, effects on the instream habitats have been addressed in the report in Appendix C and in response to Question 2(b) above. Effects on waterfowl and waterfowl habitat will be managed by way of the proposed conditions.

Effects on outstanding natural features being the natural character and amenity of the Shotover River are provided in the response for (d) below. The proposed target diversion volume at low flows of 2.5 m^3/s equates to approx. 14% of the MALF for the Shotover River meaning that there is unlikely to be any adverse effect on the users of the river within the affected reach as sufficient flow will remain for existing recreational users.

d. Effects on natural character and amenity values as a result of the proposed diversion at the maximum flow rate.

As provided in the response to Questions 1 and 2, the target diversion rate of 2.5 m^3/s is not dissimilar to the approximate flow originally proposed in the application.

There is no specific maximum flow rate. However, the design will mean that under low to moderate flow conditions only approximately 2.5 m^3/s would be expected to divert down the constructed diversion channel. Under higher river flow conditions, the flows cannot be determined.

Effects on natural character and amenity values are not expected to be adversely affected by the proposed diversion and channel design. The flow diversion will result in similar natural character to the existing river environment. The reasons for this are that:

- the proposed diversion system is localised;
- the diverted flow will remain in the river system ;
- the disruption to the hydrology and morphology of the river is likely to be minimal;

- the period of works to create the diversion will be short (6-8 weeks) and not dissimilar to consented gravel extraction activities in the area;
- the design of the diversion channel generally mimics a river braid, and over time movement of the river gravels are expected to provide a more natural form and likely establishment of the channel as a natural braid;
- movement of minor braids within the broader riverbed is an ongoing natural occurrence, with gravel extraction activities by third parties already promoting localised river braid movement and entrainment of braids.

e. Effects on cultural values as a result of the proposed diversion at the maximum flow rate.

A Cultural Impact Assessment (CIA) has been provided by TAMI which includes specific discussion of the proposed diversion works as well as consideration of the treated wastewater discharge for RM25.206. It is attached as **Appendix E**. A position statement from Aukaha has also been received and attached in **Appendix E**.

It is not appropriate for anyone other than Rūnanga themselves to formally comment on the effect on cultural values.

This diversion consent is sought for a short duration to provide mitigation for the interim solution for disposal of treated wastewater which will limit the duration of cultural effects arising from this diversion and the river will naturally revert to its own changing braided pattern following the expiry of this consent and implementation of a long-term disposal solution.

Objective and policy assessment

3. An assessment of the relevant objectives and policies to the proposal as a whole is contained in Section 6 of the Application document. The following additional information is requested:

a. The assessment of the National Policy Statement for Freshwater Management 2020 (NPSFM) appears to only relate to the bed disturbance works. Please provide an updated assessment of the NPSFM 2020 based on the updated assessments requested under Question (2).

b. Please provide an updated assessment of any additional assessments in Section 6 on the basis of the updated assessment requested under Question (2).

An updated policy assessment is attached as **Appendix F**.

Ngā mihi nui,

Claire Perkins
Planning Technical Lead - Water
E: claire@landpro.co.nz | P: 027 445 6987

Appendix A: Water Quality Report – Authored by GHD

Report

13 August 2025

To	Andrew Hill	**Contact No.**	-
Copy to	Claire Perkins	**Email**	-
From	Dusk Mains & Anthony Kirk	**Project No.**	12645246
Project Name	Shotover WWTP Disposal Field Alternative Discharge		
Subject	RM25.206 & RM25.177 Response to S92 questions		

1. Introduction

Queenstown Lakes District Council (QLDC) has sought consents from the Otago Regional Council (ORC) to discharge treated wastewater to the Shotover River / Kimiākau via an existing discharge channel for five years while a long-term disposal solution is developed. The activity has been undertaken under emergency works provisions relating to the risk of bird strike at the adjacent Queenstown Airport, with the consent application submitted retrospectively following completion of the works. ORC has requested further information (a Section 92 (S92) request) regarding aspects of the applications. ORC's information request relates to the following consents:

– RM25.206.01, RM25.201.02 and RM25.201.03 – discharge of treated wastewater to the Shotover River / Kimiākau, to discharge contaminants into air and to construct and outfall structure in the Shotover River / Kimiākau.
– RM25.177.01, RM25.177.02 and RM25.177.03 – to divert water, disturb the bed of the Shotover River / Kimiākau and to discharge remobilised bed sediment for the purposes of maintaining and contiuous flowing channel past the discharge pint from the Shotover Wastewater Treatment Plant (WWTP).

This report outlines responses to questions for RM25.206 relating to water and wastewater quality within GHD's scope of works.

For this assessment and appendices, Stage 2 refers the completion of the second MLE reactor and clarifier, currently under commissioning and expect to be operational in late 2025. This nomenclature may differ from previous and historical documents where the second MLE reactor and clarifier is referred as Stage 3 upgrade.

1.1 Purpose of this report

Provide a response to the request for further information under section 92(1) of the Resource Management Act 1991 for Consent Application Number RM25.206.

A separate report for the river diversion channel has been prepared. The two GHD documents along with the Boffa Miskell report will form the response from QLDC to ORC.

2. Scope and limitations

2.1 Scope of work

The following questions are addressed in this document.

Table 1 S92 questions addressed in this document

Consent number	Questions
RM25.206	(1) a. – g. (2) (3) (4) a. (5) a. (6) (7) a. – b. (8) (9) a (10) a. – c. (11) a. – d. (13) a. – c.

2.2 Limitations

This report: has been prepared by GHD for Queenstown Lakes District Council and may only be used and relied on by Queenstown Lakes District Council for the purpose agreed between GHD and Queenstown Lakes District Council as set out in section 1.1 of this report.

GHD otherwise disclaims responsibility to any person other than Queenstown Lakes District Council arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report . GHD disclaims liability arising from any of the assumptions being incorrect.

Accessibility of documents

The opinions, conclusions and any recommendations in this report are based on information obtained from, and testing undertaken at or in connection with, specific sample points. Site conditions at other parts of the site may be different from the site conditions found at the specific sample points.

Investigations undertaken in respect of this report are constrained by the particular site conditions, such as the location of buildings, services and vegetation. As a result, not all relevant site features and conditions may have been identified in this report.

GHD has prepared the water quality mixing model ("Model") for, and for the benefit and sole use of, Queenstown Lakes District Council to support assessment of water quality effects and must not be used for any other purpose or by any other person.

The Model is a representation only and does not reflect reality in every aspect. The Model contains simplified assumptions to derive a modelled outcome. The actual variables will inevitably be different to those used to prepare the Model. Accordingly, the outputs of the Model cannot be relied upon to represent actual conditions without due consideration of the inherent and expected inaccuracies. Such considerations are beyond GHD's scope.

The information, data and assumptions ("Inputs") used as inputs into the Model are from publicly available sources or provided by or on behalf of the Queenstown Lakes District Council, (including possibly through stakeholder engagements). GHD has not independently verified or checked Inputs beyond its agreed scope of work. GHD's scope of work does not include review or update of the Model as further Inputs becomes available.

The Model is limited by the mathematical rules and assumptions that are set out in the Report or included in the Model and by the software environment in which the Model is developed.

The Model is a customised model and not intended to be amended in any form or extracted to other software for amending. Any change made to the Model, other than by GHD, is undertaken on the express understanding that GHD is not responsible, and has no liability, for the changed Model including any outputs.

3. Assumptions

A range of assumptions are made in the interpretation of information and assessment of potential effects to water quality, with these described, where appropriate, in the sections below.

4. Shotover River flow characteristics

4.1 Introduction

Additional information is presented regarding the characteristics and dynamics of the Shotover River/Kimiākau to provide context for the assessment of the monitoring data and degree of mixing. This information is supplemented with satellite photographs covering the monitoring period (see Appendix A). While the quality of these photographs is low, the general outline of river braids (darker blue water) compared to the lighter grey gravel can be seen.

4.2 Catchment characteristics

The Shotover River / Kimiākau rises in the Richardson Mountains with the headwaters within 10 km of the main divide (van Woerden, 2018[1]). The river is approximately 75 km long, running north - south for much of its length. The river exits the Shotover Canyon upstream of Arthurs Point, flowing towards the east, before turning back to a southerly flow direction upstream of Quail Rise and the SH6 bridge.

The catchment area is approximately 1100 km^2. The upper catchment is characterised by steep mountainous terrain. With the exception of the Branches Flat area, most of the upper river is incised in a narrow valley within the schist bedrock. The river valley widens downstream of Arthurs Point, with areas of gravel beaches and taking on a braided form. Downstream of the SH6 bridge, the river bed widens forming a large delta at the Kawarau River confluence. Activities and facilities (i.e. WWTP and oxidation ponds) on the true right bank have reduced the active river bed width to approximately 200 m near the SH6 bridge and 400 m near the Kawarau River confluence.

The Shotover River / Kimiākau is the largest sediment contributor to the Clutha River system, with an estimated bedload supply in the order of 120,000-140,000 m^3/year (ORC,1997[2]). Estimates by Hicks et al (2011)[3] suggest a total sediment yield of 1.3 Mt/year, with bedload content in the order of 200,000 t/year (based on bedload proportion typical for braided rivers of 13 -17%). As a consequence, the location of flowing braids on the lower river change frequently, with realignment of channels and deposition of gravel following high flow events.

4.3 Flow dynamics and seasonality

River flows have been recorded at Bowens Peak water level recorder since 1967. The location of the recorder is between Big Beach and Tucker Beach in the lower reaches of the river, approximately 7 km upstream of the SH6 bridge. The flow rating at this recorder is frequently adjusted due to sediment movement changing the bed level.

The difference between flows at Bowens Peak recorder and flows in the Shotover delta is expected to be small due to the small increase in catchment, lack of significant tributaries and lower rainfall area. However, as the riverbed widens downstream, a portion of the river flow is lost to the riverbed gravels. The dynamic nature of braided rivers means that it is common for such surface water lost to the river bed gravels to appear further downstream as seeps or flows out of the river bed. The proportion of the flow held and flowing within the river bed gravels has not been quantified and likely changes regularly, depending on sediment accumulation on the delta.

Gravel extraction activities also affect channel orientation and braid movement in the river delta, both upstream and downstream of the WWTP discharge area. As seen in aerial imagery (Appendix A), excavation of gravels promotes movement of braids towards the excavations. Constructed flood protection features such as the ORC flood training line are also having ongoing influence on the river morphology, effectively closing a historical main

[1] van Woerden, T.H. (2018) Quaternary Geology and Landslide Dam Hazards Assessment of the Shotover Gorge, Otago. MSc thesis, University of Canterbury.
[2] Otago Regional Council (ORC), 1997. Shotover River delta sedimentation investigation.
[3] Hicks, D.A., Shankar,U., McKerchar, A.I., Basher, L., Jessen, M., Lynn, I., & Page, M. (2011): Suspended sediment yields from New Zealand rivers. Journal of Hydrology (nZ) 50(1):81-142

river channel, significantly narrowing the active river delta and promoting sediment accumulation on the true right riverbank.

Rainfall varies significantly throughout the catchment. In the upper catchment near the main divide, orographic effects (associated with westerly weather patterns) result in very high rainfall, with a mean annual precipitation in excess of 5,000 mm (van Woerden, 2018). Rainfall decreases with elevation and distance from the divide, with an annual rainfall of approximately 700 mm/year in the Wakatipu Basin. In the upper catchment a significant proportion of the rainfall falls as snow during winter and early spring. The combination of spring snow melt and prevalence of northwest-westerly weather patterns in spring results in high flow conditions in spring and early summer.

Rainfall events in the upper catchment typically result in short duration flood peaks, decreasing to base flow conditions within a few days. Due to snow melt, base flow conditions are higher during spring. September and October of 2024 was characterised by several late snow falls in the mountain catchment, this is likely to have contributed to high flow conditions during 2024 spring (Figure 1).

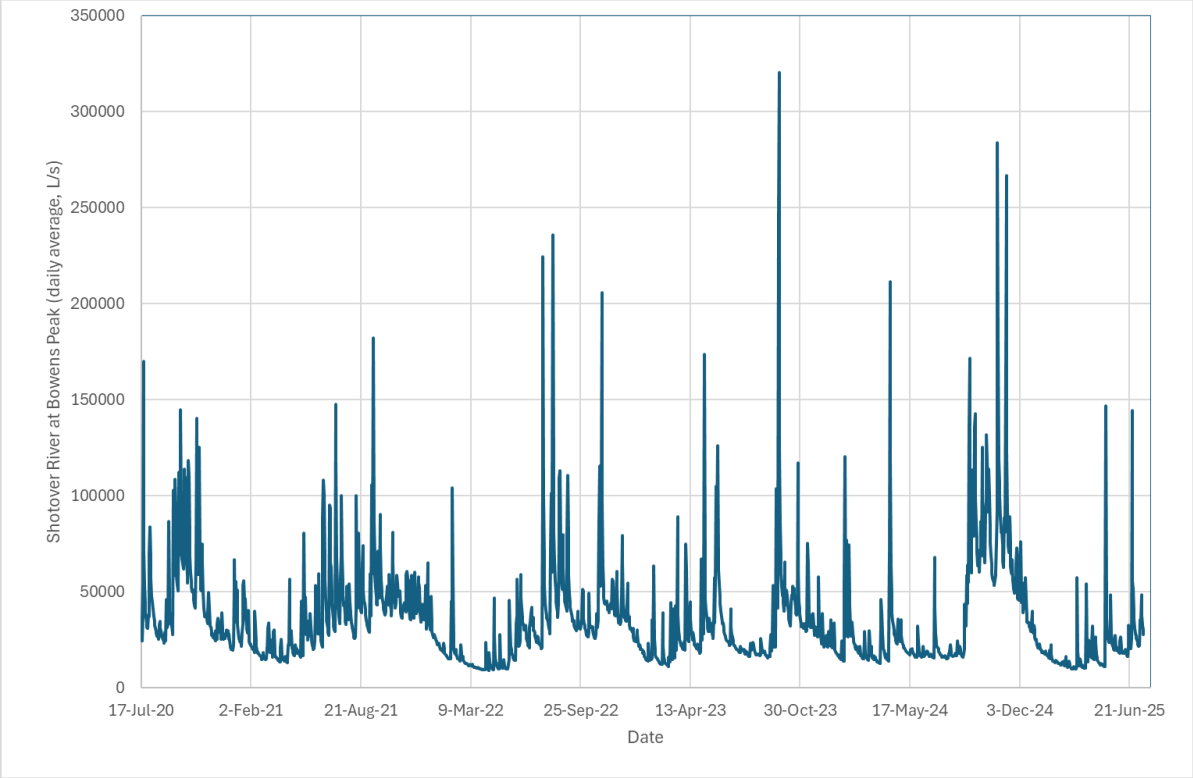


Figure 1 *Shotover River / Kimiākau flow at Bowens Peak, past 5 years (daily average)*

4.4 Flow conditions during recent monitoring period

Daily average flow for the past year is shown in Figure 2. The graph shows the high flow conditions recorded in Spring of 2024 as discussed above. Dry conditions over summer resulted in very low flows during March 2025 when background samples were collected (10-11 March) prior to the discharge activity commencing.

During the monitoring period from April to July 2025, flows have been at average base levels, with the exception of the following sampling events:

– Very low flows on 6 May 2025 (10,774 L/s).
– High flow conditions on 3 April 2025 (41,466 L/s).

While Bowen Peak record gives an indication of flows from the catchment on the day of sampling, the dynamic nature of the braided river means that individual braids and locations can experience changes in flow conditions that differ to the overall change in river flow. Such changes to braids are evident in satellite images of the Shotover Delta (presented in Appendix A) collected over the monitoring period, and are supported by estimation of braid

flow provided by mass balance calculations (Section 5.1.2). While the quality of these photographs is low, the general outline of river braids (darker blue water) compared to the light grey gravel can be seen. In summary:

– Images from November - December 2024 reflect high flow conditions. The contrast between the flowing braids and gravel is not very distinct as the gravel is either wet or submerged.
– Low flow conditions occurred from January to March 2025. As average water level has dropped the extent of gravel beds increases, and submerged braid width decreases.
– Images from April to July 2025 reflect average flow conditions that have been prevalent throughout the monitoring period.
– Upstream of the discharge channel, the main river braid is located against the true right bank of the river bed. This braid splits into multiple channels approximately 250 m upstream of the discharge channel. Sample RS04B is collected after this split from small channel against the true right bank.
– Comparing images from April through to July 2025, there is a gradual shift of wetted braids towards the true left bank, away from the discharge area. As a result, a smaller proportion of the river flows past the discharge channel outfall and is available for mixing. This observation aligns with the water quality trends at the monitoring locations RS06B and RS09, with mass balance calculations likewise indicating decreases in mixing volume provided by the braid represented by these monitoring locations. (as discussed in the response to Questions 1-3, Section 5.1.2).

The satellite images show at least three areas of gravel extraction in the lower Shotover River / Kimiākau (as indicated on the 1 March 2025 image in Appendix A). The removal of gravel to appears to influence braid migration, with braids moving to the low points which allow infilling with surrounding sediment and these areas becoming part of a flowing braid in subsequent images (April to July).

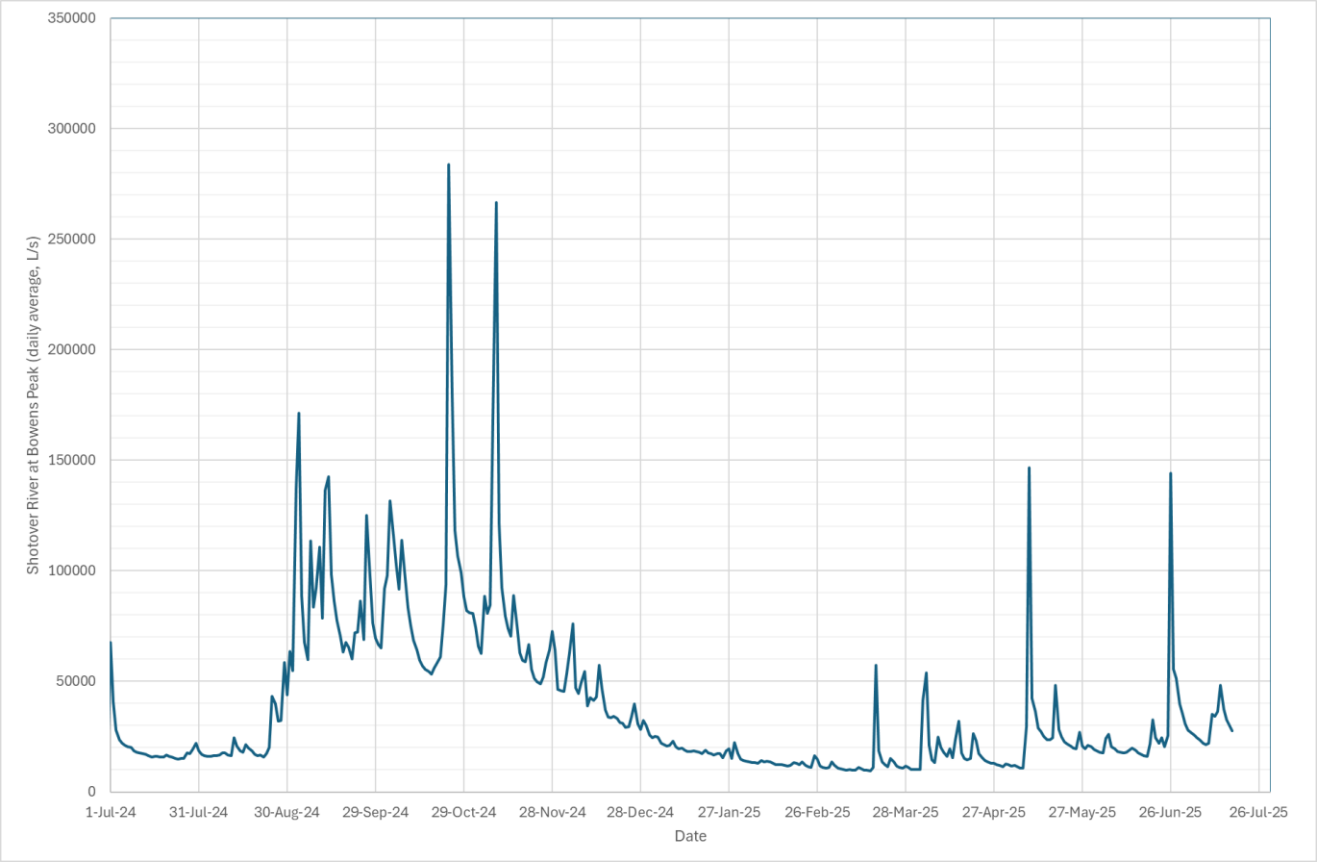


Figure 2 *Shotover River / Kimiākau at Bowens Peak past year (daily average)*

5. Response to S92 questions

5.1 RM25.206

Future effects of the discharge on the Shotover River/Kimiākau and Kawarau Rivers

(1) It is acknowledged that, due to the requirements of Section 330A of the RMA, the application required lodgement within 20 working days of notifying the Council the discharge had commenced under Section 330. The application relies on a small amount of monitoring data to support the conclusions reached in terms of the scale and significance of effects. It is understood that monitoring is ongoing, and further data will be provided as it becomes available. Observations from current monitoring indicates that ammonia concentrations at RS06, RS06B, RS09, RS11 and RS13 suggests there is potential for the discharge to cause exceedances of the national bottom line for ammonia. Specifically, each of these sites have at least one exceedance of the 95%ile statistic in the limited available monitoring record. Please provide modelling or mass-balance assessments to support the conclusion in the application that the effects will be less than minor. In particular this assessment should:

- *a. Quantify expected key contaminant concentrations (including but not limited to ammonia, phosphorus, E.coli, filtered carbonaceous BOD and TSS) at the downstream extent of the reasonable mixing zone;*
- *b. Compare expected contaminant concentrations at the downstream extent of the reasonable mixing zone with water quality thresholds set out in the National Policy Statement for Freshwater Management 2020, the water quality standards in Schedule 15 of the RPW and any other relevant thresholds commonly used to indicate the onset of adverse effects;*
- *c. Consider background water quality conditions and low flow scenarios;*
- *d. Include assumptions for dilution rates, river flow and discharge volumes;*
- *e. Identify to what extent the diversion sought under RM25.177 is taken into account when considering undertaking modelling or mass-balance assessments;*
- *f. Assess the consistency between the predicted (modelled or estimated) effects of the discharge on water quality and the monitoring date or observed water quality since the discharge commenced; and*
- *g. Consider effects at the end of the zone of reasonable mixing (based on the response to Question 2 below), after full mixing in the Shotover River/Kimiākau and after full mixing in the Kawarau River.*

(2) If modelling or mass-balance assessments are considered to be unnecessary, please provide an explanation for why.

(3) Please provide an updated assessment of effects of the discharge based on the results obtained from modelling or mass-balance calculations.

The assessment of effects provided with the consent application, and supporting technical assessments outlined the current effects of the emergency discharge, and described the mitigations that would allow management of water quality effects. The proposed activity is the discharge with mitigations, with the intention being to maintain water quality such that concentrations of contaminants remain lower than the National Policy Statement for Freshwater Management 2020, October 2024 (NPSFM) national bottom-line criteria.

In undertaking the assessment, as the discharge was already providing information on where mixing was occurring and the degree of mixing, commensurate with a tracer test, simple dilution calculations (mass balance calculations) were used to derive estimates of the contaminant dilution achieved in the river braids in which wastewater mixed. These calculations considered:

1. The discharging wastewater quality.
2. The change in water quality measured between monitoring locations upstream (background water quality) and downstream of the discharge.

Estimates of additional dilution needed to maintain mixed concentrations at levels below NPSFM national bottom line was likewise made by mass balance calculations, considering the measured wastewater discharge rates, measured contaminant concentrations following river mixing and the relevant water quality criteria. This additional dilution volume was proposed to be provided as a water quality mitigation by diversion of up to 2 m^3/s of river water into the braid in which wastewater mixing was occurring. At the time of application, the proposed diversion was sufficient to meet national bottom-line criteria.

Since providing the application, ongoing monitoring of wastewater, river water and groundwater has provided greater understanding of the dynamics of the Shotover River / Kimiākau braids and influence of this on mixing. Notably, changes in the river braids and inability to promote further dilution over the period of monitoring, has resulted in contaminant concentrations increasing relative to those presented in the original application. Ammonia concentrations at monitoring locations RS06B and RS09 have been detected regularly at levels above national bottom-line since the consent application was lodged. The proposed diversion required to meet national bottom line criteria has been recalculated at 2.5 m^3/s, with the ability to maintain a minimum flow in the braids of the reasonable mixing zone also considered to be a requirement to meet the water quality criteria.

In response to questions 1, 2 and 3 of the Section 92 request for more information, the mass balance analysis and prediction of water quality has been updated with the findings of ongoing monitoring. The analysis is presented in detail below, however, to provide context for the calculations a discussion of the reasonable mixing zone, requested in Question 4 of the Section 92 request.

5.1.1 Reasonable Mixing Zone (Question 4)

(4) Section 5.3 of the resource consent application document notes that the historic downstream monitoring site "is within the mixing zone i.e: not fully mixed". There are various references throughout the application document to the mixing zone, the initial mixing zone and the discharge being fully mixed.

a. Please describe and justify what is considered to be the zone of reasonable mixing and provide an updated assessment of effects, if necessary, based on the zone of reasonable mixing.

The current ORC regional plan does not have a discussion on what is considered to be a reasonable mixing zone, however the draft Land and Water Plan does have a proposed policy (IP-P20) on mixing zones. While this plan has not been notified, the general guidance is in line with the policies of other Regions. IP-P20 proposes either a:

(a) default mixing zone based on length and wetted channel width or a,

(b) site specific mixing zone taking into account the default mixing measurements and the smallest zone necessary to achieve the required water quality in the receiving waters.

The dynamic nature of braided rivers (as discussed in Section 4) means that the receiving environment changes frequently, therefore the default calculations using wetted width may not be appropriate for this setting. Instead, the assessment and proposed mitigation has focussed on achieving a downstream water quality that avoids the following effects:

(c) the production of any conspicuous oil or grease films, scums or foams, or floatable or suspended materials:

(d) any conspicuous change in the colour or visual clarity:

(e) any emission of objectionable odour:

(f) the rendering of fresh water unsuitable for consumption by farm animals:

(g) any significant adverse effects on aquatic life.

On that basis, the mixing zone has been defined as being no more than 200 m downstream of the discharge, with RS06B (approximately 170 m downstream) considered to represent conditions after reasonable mixing. It is expected that, with the proposed mitigation, the water quality criteria will be met. It is noted, however, that the location of RS06B may necessarily move over time as the braid moves.

5.1.2 Further Water quality assessment (Questions 1, 2, & 3)

5.1.2.1 Methodology

The further assessment of water quality utilised the monitoring data collected over April and July 2025 (included in Appendix B), and adopted a mass balance approach to quantify the effects on water quality. The monitored results provide an understanding of the extent of the influence of the discharge at the time and informs the extent at which mitigation is needed.

As outlined in Section 4.4, the result from the monitoring period reflect a period of relatively low flow within the Shotover River, and are considered suitable for assess the potential effects to water quality. This, primarily because the mass balance predictions focus on localised braids and flows within the reasonable mixing zone, and determine the flows required to meet specific water quality criteria.

Based on these results, two future scenarios were modelled:

– Water quality effects following the completion of the Stage 2 upgrades (*i.e. the completion of the second MLE reactor/clarifier*)
– Water quality effects following the completion go the Stage 2 upgrades and proposed mitigation (flow diversion)

The assessment continues to make use of a mass balance modelling approach, using the monitoring results to reflect the current state. The effects of improved wastewater quality by the completion of the second MLE reactor/clarifier and increased braid flow (due to river water diversion) are assessed as changes to the mass balance calculations for each monitoring event.

5.1.2.2 Current state

Contaminant dilution rates presented in the assessment for each monitoring event reflect the direct comparison of key parameter concentrations within wastewater, upstream of the discharge (RS04B) and downstream of the discharge (RS06B). It is acknowledged that this approach has the underlying assumption that the samples collected are representative of the water quality within the wastewater and the braid (i.e. an average quality) at the time of monitoring.

Braid flow rates and dilution factors) have been calculated, using a mass balance approach, and the following data:

– Total nitrogen (TN) concentrations (g/m^3) in wastewater at the point of discharge (RS15). Total nitrogen has been used as an indicator for dilution, due to the limited potential for uptake or adsorption of nitrogen in the flow path. While specific nitrogen species may change, such as by nitrification of ammoniacal-N to nitrite-N and then nitrate-N, for the purpose of the assessment it is assumed that there is a net preservation of nitrogen mass.
– For a select number of monitoring events, high laboratory detection level for TKN meant that organic nitrogen was not included in the laboratory calculation of TN. For these sample results, organic nitrogen contribution to TN has been estimated based on the measured ammoniacal-N concentration and the average ratio of organic nitrogen to Ammoniacal-N, measured in other samples at that location. While introducing additional uncertainty in the prediction of dilution, the overall influence of this assumption on the assessment findings is considered to be relatively minor. The interpreted TN values include four samples for RS06B and one sample for RS09, with these noted in the tabulated results presented in Appendix B.
– Wastewater average discharge rate (l/s) measured on the day monitoring. It is assumed that the daily rate of WWTP discharge measured reflects the discharge conditions before and during the collection of samples.
– Total nitrogen concentrations (g/m^3) in the flowing river braid immediately upstream of the discharge (RS04B).
– Total nitrogen concentrations (g/m^3) in the flowing river braid downstream of the discharge (RS06B). This location is immediately after the confluence of the riverbank braid in which discharged wastewater flows, and the flowing river braid represented by RS04B upstream of the discharge. Under low river flow conditions, no meaningful mixing of discharged wastewater occurs prior to this confluence.
– Total nitrogen concentrations (g/m^3) in the flowing river braid further downstream of the discharge (RS09). The same braid as represented by RS04B and RS06B, this location is assumed to reflect a larger and more mixed river environment.

The estimate braid flow rates and dilution factors are included in the predictions tables in Appendix B.

The results of the modelling are summarised below and presented in Appendix B.

5.1.2.3 Predicted Stage 2 WWTP upgrades – wastewater quality

Completion of the Stage 2 WWTP upgrades (post completion of the second MLE bioreactor and clarifier) will see a significant improvement in wastewater quality, as oxidation ponds will no longer be part of the treatment process and will not influent the discharging wastewater quality.

The proposed wastewater contaminant limits following upgrade work completion are outlined in the table below, and discussed in more detail in response to Question 7 of the Section 92 request.

To provide analysis for comparison of predicted contaminant concentrations to NPSFM Attribute Band criteria, median, 80th percentile and 95th percentile concentrations have been assessed. These are outlined in the following Table 2.

Table 2 Expected treated wastewater quality following completion of Stage 2 upgrades (second MLE and clarifier commissioning)

Parameter	Median	80th Percentile	95th Percentile
Ammoniacal-N[1]	0.72 g/m^3	1.44 g/m^3	7.5 g/m^3
Dissolved reactive phosphorus	1.0 g/m^3	1.25 g/m^3	3.0 g/m^3
Total phosphorus	1.5 g/m^3	-	5.0 g/m^3
Carbonaceous Biochemical Oxygen Demand ($cBOD_5$)	10 g/m^3	-	30 g/m^3
Total nitrogen	10 g/m^3	-	20 g/m^3
Nitrate-N	8.0 g/m^3	9 g/m^3	15 g/m^3
E. coli	10 cfu/100ml	-	250 cfu/100ml

Notes:

[1] – as measured at pH 8, and 20 degrees C.

River water quality following reasonable mixing, such as at monitoring locations RS06B and RS09, is predicted by replacing the measured discharge quality on the day of monitoring within the mass balance model, where the median and 95th percentile values are based off the expected quality following the Stage 2 plant upgrade completion (i.e. the second MLE bioreactor and clarifier are operational).

5.1.2.4 Predicted Stage 2 WWTP Upgrades and mitigating river diversion

Predicted river water quality after completion of upgrade works was compared to NPSFM bottom line criteria, to determine what additional dilution was needed to meet these key limits. Ammonia has been identified as the primary risk driver for toxicological effects associated with the discharge and therefore the 95th percentile expected concentration for ammoniacal-N concentrations in wastewater (after plant upgrades) has been compared to the NPSFM national bottom line 95th percentile limit of 0.4 mg/l at pH 8 and 20ºC.

Reflective of a low probability event, river water quality is considered in the context of a summer condition as follows:

– River flows at base flow level (as measured over the monitoring period),
– River water pH at pH 8, with this at the upper levels experienced in the river and reflective of groundwater discharge from the local schist aquifer i.e. low base flow condition.
– River water at 20ºC, assumed to be reflective of an unusually warm summer condition.

An estimate of the volume of river water needed to effectively control key water quality effects was made by increasing the braid flow within the mass balance model, until such times as predicted water quality was below the national bottom line levels for all monitoring days.

A similar scenario, considering proposed median ammoniacal-N limits for wastewater and a receiving environment water temperature of 10ºC was also tested and compared to NPSFM national bottom line for median ammoniacal-N concentrations of 0.24 mg/l. This scenario was tested to provide an indication of whether mitigation of water

quality effects would be required during regular operation, with water temperature of 10ºC assumed to reflect those conditions.

Key contaminants considered in the prediction of water quality include:

– Total nitrogen (TN)
– Nitrate nitrogen (Nitrate-N)
– Ammoniacal nitrogen (Ammoniacal-N)
– Total phosphorous (TP)
– Dissolved reactive phosphorous (DRP)
– Total carbonaceous biological oxygen demand (cBOD)

Prediction of E.coli concentrations has not been undertaken as E.coli concentrations measured at RS06B and RS09 meet the NPSFM national bottom line for bathing and Otago RPW Schedule 15 good water quality criteria. This is the also the case when E.coli concentrations in treated wastewater have been unusually high, such as during the initial days of discharge and July 2025. With completion of upgrade works, the level of disinfection achieved by the WWTP UV treatment process is expected to improve, due to increased clarity of the treated wastewater allowing for a greater and more consistent UV dose. E.coli concentrations in the river are therefore not expected to increase with plant upgrades or further dilution achieved through diversion of river water to assist mixing.

To provide a comparison with the Otago Regional Plan Water, Schedule 15 good water quality limits, water quality following reasonable mixing was predicted for the proposed 80th percentile wastewater quality, for ammoniacal-N, nitrate-N and DRP. The Shotover River / Kimiākau is part of the Receiving Water Group 2 and exempt from consideration of turbidity, due to its naturally high sediment load. E.coli was not considered in this comparison, as the wastewater 80th percentile concentration for E.coli is below the Schedule 15 limit for good water quality. In the comparison of predicted water quality to the ammonia limit, the temperature of 10 degrees centigrade has been adopted.

5.1.2.5 Predictive time-series modelling

Predictive time series mass balance or numerical modelling, using long term river flow data records or similar are often used to predict future conditions and provide scenario analysis under certain flow conditions. In each case there is a reliance on some relationship between the long term record and activity outcomes.

To assess whether such an approach was appropriate for the Shotover River / Kimiākau and WWTP discharge, braid flows predicted by mass balance analysis, were compared to NIWA measured river stage and calculated river flows from the Bowen Peak monitoring site, approximately 7 km upstream of the discharge location.

Common regression models were assessed and linear regression found to be relatively unbiased, as indicated by a low average residual (stage height of 0.002 m) and near equivalent positive and negative residuals from predictions. The residuals for the linear regression model of mass balance calculated braid flow to NIWA measured river stage height is illustrated in Figure 3.

However, each model had very poor goodness of fit as illustrated in Figure 4, with a coefficient of determination (r^2) of less than 0.05. This apparent disconnect between measured river flow and experienced braid flow is discussed in Section 4 and is interpreted to be the result of ever changing sediment deposition and erosion, changing the morphology of individual braids.

While high flow events, where individual braids are of less importance, could be assessed using the long term record, is not considered possible to use the long term stage and flow record for predicting low flow outcomes. Instead, the record provides supplementary information relating to the broader river conditions at the time of braid monitoring and understanding of whether monitored braid conditions could be reasonably considered as reflecting base flow in the river.

Actual braid conditions, and the influence of the wastewater discharge are expected to require the ability to maintain a degree of river flow into the mixing zone, to ensure a minimum level of mixing is achieved.

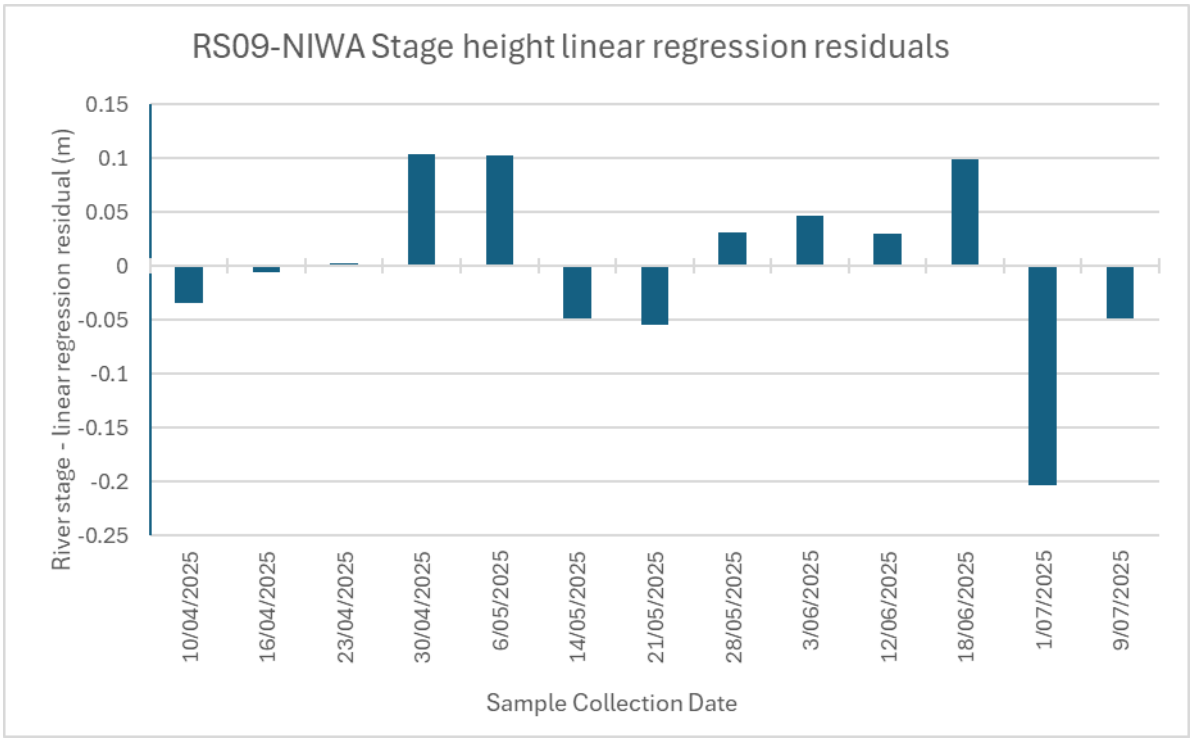


Figure 3 *Linear regression model of mass balance calculated braid flow to NIWA stage height (Bowens Peak)*

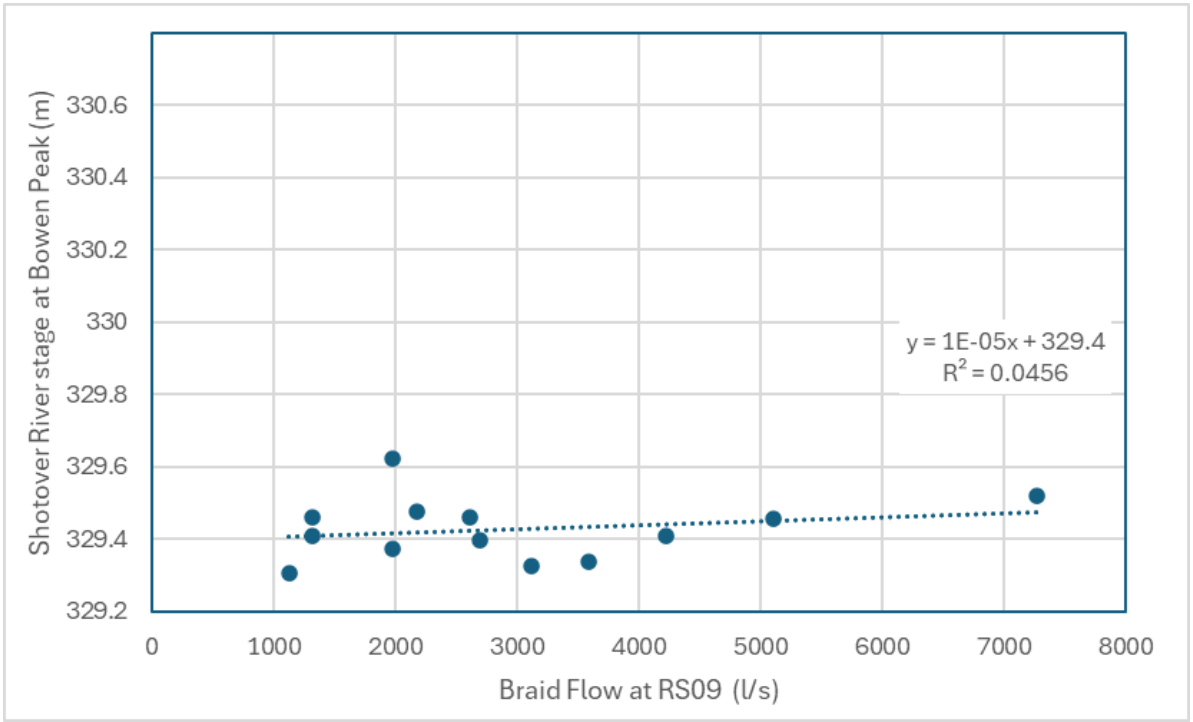


Figure 4 *Shotover River Bowen Peak stage height relationship to estimated braid flow in reasonable mixing zone*

5.1.2.6 Further water quality assessment results

Tabulated results of monitoring associated with the discharge, inclusive of monitoring April though to July 2025, are provided in Appendix B.

Predicted water quality, using the mass balance developed from monitoring results, is also tabulated in Appendix B. Predicted concentrations for water quality after reasonable, following completion of the Stage 2 WWTP upgrade and that with the diversion of river water for mitigation of water quality effects are compared against the current monitoring results. Predictions for median and 95th percentile concentrations are also compared against NPSFM national bottom lines.

A separate prediction of water quality, specifically for comparison to the Otago RPW Schedule 15 good water quality limits which reflect 80th percentile water quality, is also presented as tables in Appendix B.

In summary, the findings of the further water quality assessment reconfirm the importance of promoting and maintaining adequate river flow through the reasonable mixing zone to achieve the desired level of treated wastewater dilution.

Comparison to NPSFM and Otago RPW Schedule 15:

– Ammoniacal-N – the majority of the time medians are consistent with Attribute band A, however, the potential for periods of reduced WWTP performance that are accommodated within the assessed ammoniacal-N levels, results in the low frequency conditions (95th percentile) consistent with Attribute B. Concentrations are expected to remain below the national bottom line for ammonia. Predicted ammoniacal-N concentrations after reasonable mixing are also below the Schedule 15 limit. The influence of elevated ammoniacal-N concentrations on periphyton growth and ecosystem effects outside of toxicity are described in more detail in the Boffa Miskel memorandum[4] accompanying the Section 92 response.
– DRP – Concentrations of DRP are predicted to be elevated following reasonable mixing relative to upstream water quality, with water quality at RS06B and RS09 locations predicted to be consistent with Attribute B and D. Predicted concentrations also exceed the Schedule 15 good water quality limit, however, it is noted that the Schedule 15 DRP limit (80th percentile of 0.01mg/l) is very low, reflecting an Attribute Band A under the NPSFM and reflective of natural reference conditions. Changes in downstream Shotover River water quality at RS10, assumed to reflect a fully mixed river water quality are expected to be minimal and typically unmeasurable, with conditions at this location currently meeting the Schedule 15 limits. The influence of DRP concentrations above this limit is therefore to specific river braids and not the fully mixed Shotover or Kawarau Rivers. The occurrence of elevated DRP within Shotover River braids is expected to have resulted from the historical discharges also. The influence of this on ecology is likewise expected to be consistent with historical outcomes, which are relatively limited, due to the often turbulent nature of the river flow and highly mobile bed substrate. Details regarding this are provided in the assessment of environmental effects, with further assessment provided in the Boffa Miskel memorandum[5] accompanying the Section 92 response.
– Nitrate-N – concentrations are predicted to be consistent with Attribute band A, reflecting low toxicity and meeting the national bottom line for nitrate-N. Concentrations are however predicted to exceed the Schedule 15 good water quality limits. While concentrations are unlikely to cause toxicity effects, the elevated nitrate concentrations may contribute to periphyton growth and ecosystem health changes. As for DRP, the Schedule 15 for nitrate is met at downstream monitoring location RS10, with potential effects limited to specific river braids. The potential for periodically elevated nitrate concentrations to result in meaningful periphyton growth is considered to be limited by the often turbulent flow in braids and mobile gravel substrate. Further discussion of potential ecological effects is provided in the Boffa Miskel memorandum[6] accompanying the Section 92 response.

– BOD – BOD concentrations are predicted to remain low, and most often <1 mg/l. Together with the shallow water depth and turbulence occurring in braided river flow, reduction in dissolved oxygen due to microbial digestion of treated wastewater sourced organic matter is therefore predicted to be negligible.
– TN and TP – Concentrations of TN and TP are predicted to be elevated in river braids influenced by treated wastewater discharge. There are NPS-FW standards for TN and TP in rivers, however we note that the concentrations of both would meet national bottom line limits in a more sensitive lake environment. The influence of elevated TN and TP levels in river braids, relative to background, on periphyton growth and

[4] Boffa Miskell, 11 August 2025. Draft S92 response for Treated Wastewater discharge to Shotover River
[5] Boffa Miskell, 11 August 2025. Draft S92 response for Treated Wastewater discharge to Shotover River
[6] Boffa Miskell, 11 August 2025. Draft S92 response for Treated Wastewater discharge to Shotover River

ecosystem are described in more detail in the Boffa Miskel memorandum[7] accompanying the Section 92 response.

5.1.3 Further information on proposed limits (Questions 5, 6 & 7)

Proposed limits in Table 5 of the resource consent application

(5) The application document titled 'Shotover WWPT Surface Water and Groundwater Assessment' dated 30 April 2025, prepared by GHD (Surface Water and Groundwater Assessment) suggests ongoing legacy effects on phosphorus from the previous discharge. Results of water quality monitoring undertaken between 7 April 2025 and 6 May 2025 also show the discharge is contributing to concentrations of total phosphorus. Table 5 of the application for resource consent does not include a discharge quality limit for Total Phosphorus.

a. Please provide an explanation as to why a limit has not been identified, or alternatively update Table 5 to include a limit for Total Phosphorus.

Based on the MLE Clarifier results in Table 4, the MLE TP varied between 0.74 (median) to 2.8 mg/L (90th percentile). If TP limits are to be included post MLE2 commissioning (from Jan 2026 onwards), median limit of 3 mg/L could be adopted from the proposed wastewater discharge standard.

Existing consents are in place (through to 2044) that do not set a limit on TP in the discharge. No changes are being proposed to the treatment system through this application. However, we note the previous consent was issued on the basis of a discharge to land before entering groundwater/surface water.

(6) If it is considered that ongoing legacy effects on phosphorus from the previous discharge is still being released from bed sediments, please provide an explanation for how this is intended to be managed in future and how any ongoing effects can be separated from the discharge sought to be authorised in this process.

The effects wastewater discharge to ground and groundwater have been assessed as part of the application, with impacts to groundwater evident as elevated ammoniacal-N concentrations and increased DRP amongst other parameters. Through monitoring, relatively limited attenuation of nitrogen is occurring in ground and DRP levels suggest saturation of sediments has been achieved. The discharge of wastewater to ground in the delta has the inevitable effect of discharging contaminants associated with wastewater into the Shotover and Kawarau rivers. The effects of this are evident in river water samples taken near the river bank, of both the Kawarau and Shotover rivers.

With the cessation of the DAD discharge, groundwater conditions, and contaminant flux via groundwater, to surface water is predicted to reduce over time, with groundwater reaching a new equilibrium of much lower concentrations. The same is expected to occur with river sediments influenced by this historical discharge. Ongoing flushing of soluble contaminants and desorption of bound contaminants provides a natural attenuation process.

Ongoing monitoring is assisting to inform the timeframes over which improvements in groundwater and surface water may be realised, and to inform the long-term direction for wastewater disposal in Queenstown. Direct discharge of wastewater to the Shotover River / Kimiākau as per the current and proposed activity, does provide an effective means of reducing wastewater related contaminants concentrations in the greater extent of riverbank areas that are particularly sensitive to nutrient and contaminant effects. However, beyond ceasing discharge from the DAD and the proposed activity, no further actions have been identified as providing realistic opportunity for further reducing impacts to river water quality associated with historical discharges.

(7) Table 5 of the application for resource consent proposes a Total Ammoniacal Nitrogen (TAN) limit that would apply from the 1st January 2026. With respect to TAN limits, please provide:

a. an explanation for how these TAN limits have been determined as appropriate.

b. an explanation for why TAN limits have not been proposed for the discharge up to 31st December 2025.

[7] Boffa Miskell, 11 August 2025. Draft S92 response for Treated Wastewater discharge to Shotover River

Initially, the proposed limits from 1st Jan 2026 onwards in Table 5 were derived from the Stage 3 consent limits 2008.238.V2, as this is what the MLE2 upgrade has been designed to achieve. Table 15 of the application compared the recent MLE clarifier effluent results against the proposed wastewater discharge standard, which for Shotover River / Kimiākau, the discharge falls under moderate dilution category.

For “moderate dilution”, a 90%tile limit of 3 mg/L (for ammoniacal nitrogen) had been proposed. Nonetheless, a median limit is more useful for more consistent plant performance, hence 1.5 mg/L has been selected as the proposed discharge limit. The corresponding 90%tile limit of 5 mg/L allows for seasonal variabilities as complete nitrification is the most difficult to achieve during winter months also where Shotover River / Kimiākau flow is much higher.

Given the seasonal location and generally colder temperatures, the 90th percentile is considered appropriate at this stage to allow some flexibility in plant performance. Once MLE2 is operational, this can be revisited for the long-term consent application, which is due to be lodged in mid-2026.

Prior to MLE2 online (remainder of 2025), there is no scope of improving ammoniacal nitrogen removal especially when the system is already at a very high loading in both ponds and MLE1. Moreover Shotover River / Kimiākau flow is higher during winter months, further mitigating effects further downstream from the discharge.

5.1.4 Additional information regarding monitoring (Questions 8, 9,10,11 & 13)

Additional information requested to support and clarify conclusions made based on monitoring results

(8) Please confirm that Figure 5 in the application and the similar figures in the application document titled ‘Resource Consent Application to Otago Regional Council for Discharge of Treated Effluent to Kimi-ākau/Shotover River’ dated 1 May 2025 prepared by Landpro Limited (application for resource consent), represent combined pond and clarifier waste streams post UV.

Figures 5, 7, 9, 11, 13 and 15 are taken from the effluent consent compliance sample data, at the UV outlet as the combined stream of pond effluent and clarifier effluent.

Figures 6, 8, 10, 12,14 and 16 are sample data points taken from the clarifier outlet.

(9) Section 3.8.2.3 states that a single round of sampling from the Shotover River was undertaken in August 2024 and is considered “representative of Shotover River winter conditions”. Similarly, a number of statements in Section 3.8.2.5 state that monitoring is considered “to represent background Shotover River water quality”.

a. Please provide an explanation for how a single round or a small number of samples can be considered representative and why further replication was not considered as this would be standard practice.

Statements made regarding the representativeness of sample results were done so in the context of the assessment i.e. for the purpose of the assessment the results were adopted as being representative of background water quality. This was not intended to imply that individual samples could adequately represent the broad range of water quality conditions experienced within the river.

Replication of the background monitoring of the Shotover River, to obtain a robust data set for the assessment as is standard practice, was not considered because of the nature of the emergency discharge; it was not apparent prior to the discharge that an assessment or background data set would be required. The single monitoring event carried out prior to the emergency discharge was the commencement of a broader programme to understand the effects of the DAD discharge and inform the long term direction for wastewater disposal for Queenstown. The commencement of that monitoring was unrelated to decisions made regarding emergency discharge or need for supporting assessment.

(10) In relation to Section 3.8.2.2 of the Surface Water and Groundwater Assessment, please:

a. explain why only a sub-set of water quality parameters are presented and why ammonia and BOD in particular have not been assessed.

b. summarise all available water quality data from historic compliance monitoring in terms of percentile, means and maximums; and

c. *explain why the standard statistical comparisons of the historic upstream and downstream water quality (i.e: Wilcoxon signed rank tests) have not been conducted to support the conclusions made.*

Water quality results for the historical discharge were provided to demonstrate that changes in river flow and braid conditions result in significant change in water quality outcomes. The sub-set of parameters selected represented typical indicators of wastewater influence and control.

Tabulated data for the 2017-2019 period is included in Appendix C. This table includes the requested statistics.

We note that conditions at the time of the historical discharge do differ to a degree from those of the current discharge due to:

– Water quality monitoring locations differ from the current locations
– The river braids and flow conditions significantly differ from current conditions
– The historical discharge differs from the proposed activity, which includes management of water quality outcomes.
– However, the historical discharge does provide context for ecological effects that can result in specific river braids as result of discharges without mitigation.

As outlined in the response provided for to questions 10 a) and b), detailed analysis of historical water quality was not proposed due to the limited additional information that was considered likely to provide, given the context of the changing river conditions and apparent water quality. In the context of identifying trends for general comment, and with respect the information presented (reproduced below), the progressive reduction in contaminant concentrations (downstream – shown as orange line in Figure 5) is considered to be sufficiently apparent and statistical analysis is considered unlikely to provide additional significant information.

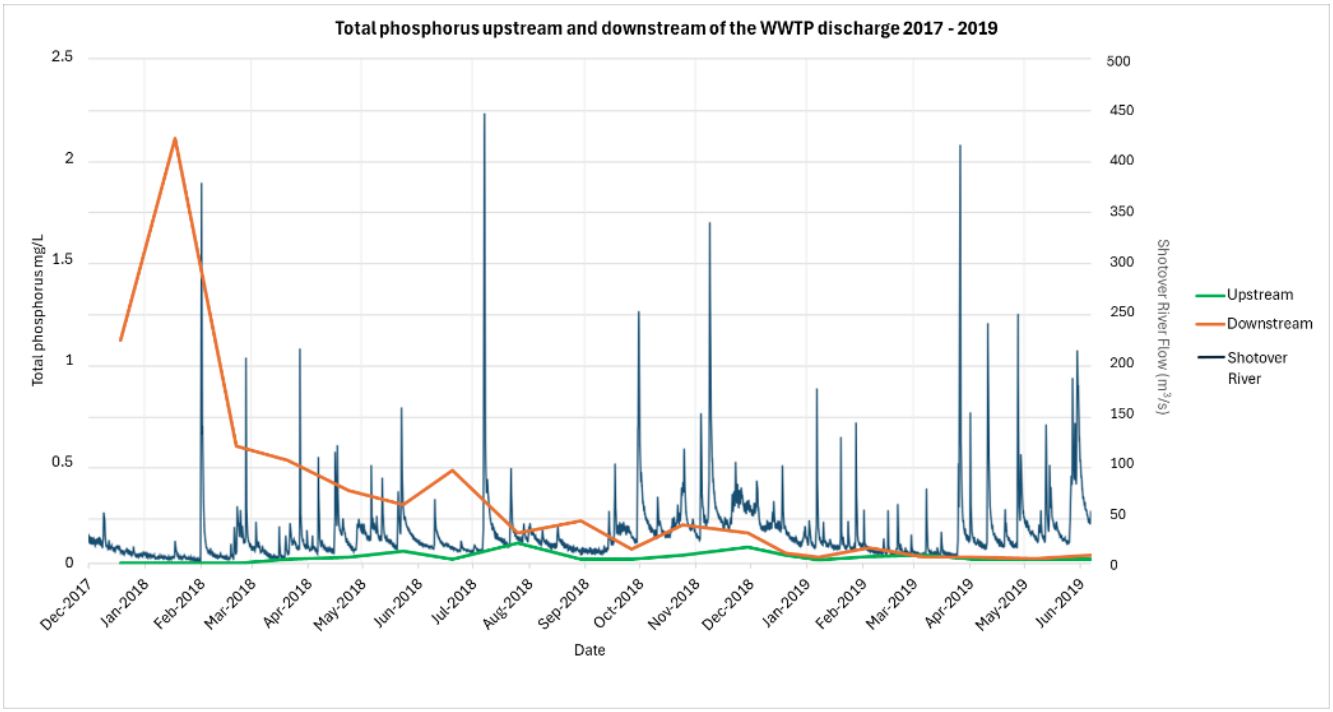


Figure 5 ***Total phosphorous concentration 2017-2019 monitoring***

(11) In relation to Sections 3.8.2.4, 3.8.2.5 and 4.7 of the Surface Water and Groundwater Assessment, please:

a. *provide an explanation for how the approximate 15-to-25-fold dilution of treated wastewater in the Shotover River/Kimiākau was verified without hydraulic calculations, dye tests or flow modelling to substantiate the dilution assumption and mixing zone extent.*

The wastewater discharge was initiated as an emergency discharge and so the discharge preceded the assessment. The estimates of dilution were derived from the monitoring data of the effects of the discharge. i.e. dilution was not assumed or predicted, it was measured, and so verification of predictions was therefore not needed.

b. provide a map showing the monitoring sites listed in Table 3.8

An updated map is included in Appendix D.

c. confirm how far downstream of the discharge RS16 is located, and if it is at the point of the discharge, why the next closest site was chosen 150 metres downstream.

RS16 is approximately 5 m from the discharge, in an area where discharged wastewater pools before flowing downstream. It represents unmixed water quality.

RS06B is considered to be representative of the water quality following reasonable mixing as discussed in the response to Question (4). It is noted that current mixing without mitigation (flow diversion) is limited due to a general migration of river flow towards the true left bank, as discussed in Section 4 of this response (Shotover River flow characteristics). The river braid extending ~140 m downstream of the discharge is not easily or safely accessible for sampling due to thick vegetation and steep river bank.

d. it appears that the water quality monitoring results obtained from RS06, RS06B, RS09, RS11 and RS13 shows significantly high ammonia concentrations (especially RS06). Please provide an explanation on whether water quality monitoring results obtained from these sites are due to the wastewater treatment plant discharge

i. If the cause of the significantly high ammonia concentrations are due to the wastewater treatment plant, please provide an explanation of the next steps that have been undertaken to investigate and remediate the cause of the elevated results.

Monitoring results for RS6B and RS09 are considered to reflect the influence of the emergency discharge to the Shotover River / Kimiākau, with some small and periodic background water quality influences.

Location RS06, is considered to represent pooled water, un-mixed with river, and sourced from groundwater. Elevated ammoniacal concentrations at this location were evident before the emergency discharge commenced and are consistent with groundwater chemistry identified in upgradient and down gradient monitoring wells. The influence of wastewater discharge from the DAD is discussed in response to Question 6.

The Dose and drain (DAD) field was designed to discharge wastewater to ground, infiltrating the shallow groundwater table beneath the DAD. The wastewater mixed and moved with groundwater before discharging to the surface water environment. Figure 3.9 in the surface water and groundwater effects assessment (GHD April 2025) shows groundwater moving to the southeast and east away from the DAD. Seepage from groundwater may affect surface water in these down gradient areas, particularly when the surface water is disconnected from flows (RS06) or poorly mixed. Samples RS11 and RS13 are downgradient of the DAD, samples in these areas are likely to be influenced by groundwater seepage. Monitoring of groundwater quality is being undertaken on a regular basis. It is expected that groundwater quality will improve over time as the effects of the previous discharge move through and out of the groundwater system.

The actions that have been taken to address this is:

– Cease use of DAD for disposal to ground
– Stage 2 upgrades (MLE2) which will significantly reduce ammonia levels in the wastewater discharge

(13) In relation to Sections 3.9 and 4.8 of the Surface Water and Groundwater Assessment, please:

a. given that E. coli is a poor indicator of health risk from wastewater, please explain why a Quantitative Microbial Risk Assessment (QMRA) has not been conducted particularly given the references to suitability for bathing in the WCO.

b. Either undertake a QMRA or undertake a similar assessment using an alternative method.

The Kawarau WCO requires that certain outstanding values are recognised and protected (e.g. wild and scenic, natural character, recreational uses etc) and sets certain limits/restrictions:

– no damming allowed;
– water quality to be managed to Class CR standard

Class CR Water Quality Standard (being water managed for contact recreation purposes) applies after reasonable mixing:

(1) The visual clarity of the water shall not be so low as to be unsuitable for bathing.

(2) The water shall not be rendered unsuitable for bathing by the presence of contaminants.

(3) There shall be no undesirable biological growths as a result of any discharge of a contaminant into the water.

However, it does not outline how suitability for bathing shall be assessed. The Otago Regional Water Plan was prepared after the Kawarau WCO was in place and states that "The Order has been recognised and provided for within this Plan". The plan therefore includes in its rules that damming is prohibited and provides an E.coli limit of 260 cfu/100mL (after mixing) in the water quality standards to be met to reflect the use for bathing. Taken as a 95th percentile, this E.coli limit reflects the 'Good' NPSFM Attribute Band for primary contact sites in lakes and rivers (during bathing season).

Given the direction of the ORWP for meeting the Kawarau WCO through the use of E.coli, commonly used as a faecal indicator bacteria for risk screening, and the limited potential for pathogen exposure due to limited use of the Shotover River / Kimiākau for bathing, a comprehensive QMRA was not considered to be necessary to assess public health risk.

Elevated E.coli concentrations do occur in the Shotover River / Kimiākau, as evidenced by periodic increases in response to rainfall and catchment run-off events, such as measured upstream of the discharge. The relatively low E.coli concentrations measured at locations RS06B and RS09, considered to reflect water quality after reasonable mixing, with measured concentrations at these locations meeting the suitability for bathing requirements outlined in the ORWP.

c. it is described that there was an initial flush of microbial contaminants from the engineered channel on commencement of the discharge. Please provide water quality monitoring results for E.coli from the UV channel discharge to validate this observation.

Table 3 E. coli concentration at locations EFF, RS15 and RS06B

Date	***E. coli* Post UV (EFF)**	***E. coli* at RS15**	***E. coli* at RS06B**
Unit	**cfu / 100ml**	**cfu / 100ml**	**cfu / 100ml**
01 Apr 2025	-	435.2	46.4
03 Apr 2025	<10	32.3	-
07 Apr 2025	-	28.5	36.8
10 Apr 2025	-	17.1	18.7
16 Apr 2025	5	18	11
23 Apr 2025	12	14	8
30 Apr 2025	14	170	20
06 May 2025	4.1	57.6	7.5
14 May 2025	8	40	5
21 May 2025	14	25	<1
28 May 2025	3	13	3
03 Jun 2025	4	28	2
12 Jun 2025	2	33	13
18 Jun 2025	10	16	1
26 Jun 2025	2	8	-

Date	*E. coli* Post UV (EFF)	*E. coli* at RS15	*E. coli* at RS06B
01 Jul 2025	15	65.9	13.7
09 Jul 2025	29	60	13
10 Jul 2025	160	190	-
24 Jul 2025	900	750	130
31 Jul 2025	70	70	10
06 Aug 2025	310	109.1	16.4

Appendices

Appendix A

Satellite images

Table 4 2024 – 2025 Shotover River aerial imagery

Aerial image, image date, Shotover River flow (daily average at Bowens Peak recorder) and closest sampling date	
	
11/11/2024 92,307 L/s	16/11/2024 75,093 L/s

Aerial image, image date, Shotover River flow (daily average at Bowens Peak recorder) and closest sampling date	
 6/12/2024 46,935 L/s	 16/12/2024 36,952 L/s

Aerial image, image date, Shotover River flow (daily average at Bowens Peak recorder) and closest sampling date	
	
15/01/2025 18,545 L/s	04/02/2025 13,426 L/s

Aerial image, image date, Shotover River flow (daily average at Bowens Peak recorder) and closest sampling date	
	
14/02/2025 12,440 L/s	19/02/2025 12,874 L/s

Aerial image, image date, Shotover River flow (daily average at Bowens Peak recorder) and closest sampling date	
	
01/03/2025 10,651 L/s GHD sampled 10th -11th March 2025 ☆ Areas of gravel extraction River flow on day of sampling: 9,941L/s (10th Mar), 9,878 L/s (11th Mar)	10/04/2025 17,863 L/s GHD sampled 3rd and 8th April 2025 River flow on day of sampling: 41,466 L/s (3rd Apr), 24,829 L/s (8th Apr)

Aerial image, image date, Shotover River flow (daily average at Bowens Peak recorder) and closest sampling date	
 25/04/2025 13,622 L/s GHD sampled 6th May 2025 River flow on day of sampling: 10,774 L/s	 20/05/2025 24,928 L/s

Aerial image, image date, Shotover River flow (daily average at Bowens Peak recorder) and closest sampling date	
 04/06/2025 24,289 L/s GHD sampled 3rd June 2025 River flow on day of sampling: 17,760 L/s	 09/06/2025 18,020 L/s

Aerial image, image date, Shotover River flow (daily average at Bowens Peak recorder) and closest sampling date	
	
29/06/2025 39,756 L/s GHD sampled 1st July 2025 River flow on day of sampling: 30,742 L/s	19/07/2025 26,300* L/s

Aerial image, image date, Shotover River flow (daily average at Bowens Peak recorder) and closest sampling date	
 24/07/2025 22,200* L/s	

Notes:

– Aerial imagery downloaded from Sentinel Hub EO Browser **https://apps.sentinel-hub.com/eo-browser**

– Shotover River data (daily average flow) from monitoring location at Bowens Peak

*Data taken from dates at 12.00 pm **https://envdata.orc.govt.nz/AQWebPortal/Data/Location/Dashboard/422/Location/EM215/Interval/Latest** (Otago Regional Council Environmental Data portal)

Appendix B

Water quality assessment results

Surface water sampling results 2025

Location Code	Date	pH (Field)	Electrical conductivity (field)	Dissolved Oxygen (Field) (filtered)	DO (%S) (Field)	Redox (Field)	Temperature (Field)	Clarity	Total Biochemical Oxygen Demand (TBOD)	Carbonaceous Biochemical Oxygen Demand (cBOD5)	Total Coliforms (Colilert)	E.coli	Dissolved Reactive Phosphorus (FIA) (DRP)	Nitrate (as N)	Nitrogen (Total Oxidised) (as N)	Nitrogen (Total)	Kjeldahl Nitrogen Total	Nitrite (as NO2-)	Ammoniacal N	Phosphorus (Total)
		pH units	µS/cm	mg/L	%S	mV	°C	cm	g/m3	g/m3	cfu/100mL	cfu/100mL	g/m3	g/m3	g/m3	g/m3	g/m3	g/m3	g/m3	g/m3
RS04B	07 Apr 2025	7.8	125	-	183.8	137.3	12.4	75	-	<1.00	290.9	19.9	<0.002	0.0277	-	<0.10	<0.10	<0.0010	<0.005	0.018
	10 Apr 2025	-	-	-	-	-	-	-	-	<1.00	122.4	20.1	<0.002	0.0159	-	<0.10	<0.10	<0.0010	0.008	0.015
	16 Apr 2025	7.8	78.5	11.5	-	129.1	10.3	61	-	<2	-	19	0.004	0.02	0.02	0.02	<0.8	<0.01	<0.01	0.03
	23 Apr 2025	8.1	88	11.6	-	-	11.4	-	-	<2	-	5	0.003	0.02	0.02	0.02	<0.8	<0.01	<0.01	<0.01
	30 Apr 2025	7.9	90	11.4	-	-	10.1	-	-	<2	-	9	0.002	0.01	0.01	0.01	<0.8	<0.01	<0.01	0.02
	06 May 2025	7.9	126.2	-	102.9	109.2	6.7	>120	-	-	34.5	4.1	-	-	-	-	-	-	-	-
	14 May 2025	8	76	12.3	-	-	8.7	-	-	<2	-	4	<0.002	0.03	0.03	0.03	<0.8	<0.01	<0.01	0.02
	21 May 2025	7.9	73	13.2	-	-	6.9	-	-	<2	-	<1	0.002	0.03	0.03	0.03	<0.8	<0.01	<0.01	0.02
	28 May 2025	8	114	12.9	-	-	6.1	-	-	<2	-	2	0.003	0.03	0.02	0.02	<0.8	<0.01	<0.01	0.02
	12 Jun 2025	8.2	74	13	-	-	4.8	-	-	<2	-	15	0.04	0.04	0.04	0.04	<15	<0.01	<0.01	<0.01
	18 Jun 2025	8	78	13.5	-	-	3.2	-	-	<2	-	1	0.005	0.03	0.03	0.03	<15	<0.01	<0.01	0.02
	01 Jul 2025	7.74	104.2	-	128.5	12.94	3.2	43	-	-	>201	6.4	<0.002	0.052	0.052	0.2	0.1	<0.001	<0.005	0.034
	09 Jul 2025	8.1	74	13.1	-	-	4.5	-	-	<2	-	1	<0.002	0.04	0.04	0.84	0.8	<0.01	<0.01	0.01
RS06B	11 Mar 2025	8	140.5	10.02	-	-	14.5	-	-	-	>579.4	>40.5	<0.002	0.0212	-	<0.10	<0.10	<0.0010	0.03	<0.0050
	01 Apr 2025	7.93	138.6	-	115.8	115.8	12.5	-	-	<1.00	290.9	46.4	0.014	0.0747	-	<0.10	<0.10	<0.0010	0.04	0.032
	03 Apr 2025	7.88	144.8	-	105.4	136.3	13.3	-	-	<1.00	-	-	0.059	0.16	-	0.56	0.4	0.0016	0.33	0.097
	04 Apr 2025	7.61	104.7	-	104.7	131.5	13.1	-	-	-	2,419.60	410.6	-	-	-	-	-	-	-	-
	07 Apr 2025	7.8	140	-	-	-	-	-	-	<1.00	-	-	0.05	0.168	-	0.5	0.33	0.0018	0.23	0.075
	07 Apr 2025	7.89	135.6	-	97.3	132.3	13.3	97.3	-	-	461.1	36.8	-	-	-	-	-	-	-	-
	10 Apr 2025	7.84	115.7	0.56	-	137.8	9	68	-	<1.00	435.2	18.7	0.098	0.148	-	0.94	0.79	0.0027	0.55	0.18
	16 Apr 2025	7.94	91.2	11.27	-	128.5	12	69	-	<2	-	11	0.034	0.09	0.09	0.37*	0.28*	<0.01	0.21	0.06
	23 Apr 2025	7.9	116	11.4	-	-	12.5	-	-	<2	-	8	0.141	0.26	0.27	1.27	1	<0.01	0.65	0.15
	30 Apr 2025	7.9	120	11.3	-	-	10.9	-	-	<2	-	20	0.109	0.35	0.36	1.37*	1.01*	0.02	0.75	0.19
	06 May 2025	7.86	156	-	106.2	136.7	7.6	>120	-	<1.00	547.5	7.5	0.099	0.306	-	1.08	0.76	0.0108	0.58	0.12
	14 May 2025	8	84	12.3	-	-	8.3	-	-	<2	-	5	0.004	0.16	0.16	0.16	<0.8	<0.01	0.01	0.01
	21 May 2025	8	86	12.7	-	-	7	-	-	<2	-	<1	0.077	0.18	0.18	0.81*	0.63*	<0.01	0.47	0.1
	28 May 2025	7.9	89	12.7	-	-	6.9	-	-	<2	-	3	0.094	0.22	0.23	0.86*	0.63*	<0.01	0.47	0.13
	03 Jun 2025	7.7	146.5	-	90.1	115.8	6.2	116	-	2	-	2	0.089	0.254	-	1.1	0.8	0.008	0.56	0.135
	12 Jun 2025	8	97	12.9	-	-	5.1	-	-	97	-	13	0.122	0.32	0.33	1.48*	1.15*	<0.01	0.86	0.17
	18 Jun 2025	8	142	13.9	-	-	3.6	-	-	<2	-	1	0.106	0.33	0.33	0.33	<15	<0.01	<0.01	0.12
	01 Jul 2025	7.7	129.3	-	127.8	12.88	4.1	50	2	-	>201	13.7	0.136	0.247	0.252	1.3	1	0.006	0.747	0.191
	09 Jul 2025	8	101	12.9	-	-	5.2	-	-	2.63	-	13	0.193	0.51	0.51	3.71	3.2	<0.01	1.28	0.49
RS09	11 Mar 2025	7.8	140	-	-	-	-	-	-	-	-	-	<0.002	0.0177	-	1.1	1.1	<0.0010	0.03	0.0051
	11 Mar 2025	8.13	141	9.9	-	-	14.7	-	-	-	>2,420	>2,420	-	-	-	-	-	-	-	-
	01 Apr 2025	7.87	134.6	-	122.8	122.8	12.1	-	-	<1.00	727	435.2	<0.002	0.0224	-	<0.10	<0.10	<0.0010	<0.005	<0.0050
	03 Apr 2025	7.94	103.5	-	103.6	119.6	13.2	-	-	<1.00	613.1	128.1	<0.002	0.0071	-	<0.10	<0.10	<0.0010	0.005	0.0056
	08 Apr 2025	7.84	131.5	-	105.5	126.4	9.5	45	-	<1.00	1,986.30	435.2	0.078	0.179	-	0.56	0.38	0.0018	0.35	0.11
	10 Apr 2025	7.77	126.9	-	103	123.9	9.2	80	-	<1.00	307.6	20.3	0.073	0.144	-	0.69	0.54	0.0021	0.39	0.12
	16 Apr 2025	7.86	90.6	11.24	-	149.5	11.9	59	-	2	-	15	0.03	0.09	0.09	0.33*	0.241*	<0.01	0.18	0.06
	23 Apr 2025	8	103	11.1	-	-	12.8	-	-	<2	-	14	0.05	0.16	0.16	1.36	1.2	<0.01	0.29	0.07
	30 Apr 2025	8	105	11.3	-	-	10.5	-	-	<2	-	20	0.05	0.23	0.24	0.58*	0.34*	<0.01	0.25	0.07
	06 May 2025	8.15	155	-	107.5	67.5	7.3	>120	-	<1.00	579.4	13.5	0.101	0.301	-	1.09	0.78	0.0107	0.58	0.13
	14 May 2025	7.9	81	11.8	-	-	9.5	-	-	<2	-	7	0.004	0.12	0.12	0.12	<0.8	<0.01	<0.01	<0.01
	21 May 2025	7.8	125	12.8	-	-	8	-	-	<2	-	1	0.063	0.14	0.14	0.68*	0.54*	<0.01	0.4	0.08
	28 May 2025	7.9	82	12.9	-	-	6.5	-	-	8.91	-	6	0.046	0.09	0.09	0.41*	0.32*	<0.01	0.24	0.08
	03 Jun 2025	7.87	138.9	-	95.1	117.5	6.1	115	-	<1	-	3	0.062	0.189	-	0.8	0.6	0.006	0.394	0.099
	12 Jun 2025	8.1	85	12.9	-	-	5.1	-	-	<2	-	12	0.067	0.21	0.21	0.87*	0.66*	<0.01	0.49	0.1
	18 Jun 2025	8.2	78	14.6	-	-	3.7	-	-	<2	-	1	0.065	0.2	0.2	0.2	<15	<0.01	<0.01	0.07
	01 Jul 2025	7.7	129.3	-	133	12.8	3.9	34	2	-	144.5	9.9	0.124	0.242	0.247	1.3	1	0.005	0.696	0.185
	09 Jul 2025	7.9	89	12.8	-	-	5.4	-	-	<2	-	15	0.127	0.37	0.37	2.77	2.4	<0.01	0.85	0.19

Notes:

*Values are estimated. Estimation was used as original lab results show TN values as higher than AmmN, due to a high LOQ for TKN (thus TKN was zero in the lab TN calulation where values fell below the LOQ).
To get a value for TKN: TKN was calculated using percentage of AmmN (assuming percentage remains similar between samples - 74.5%). This TKN estimation was then added to the lab TN result to get an estimated TN value.

Surface water sampling results 2025

Location Code	Date	pH (Field)	Electrical conductivity (field)	Dissolved Oxygen (Field) (filtered)	DO (%S) (Field)	Redox (Field)	Temperature (Field)	Clarity	Total Biochemical Oxygen Demand (TBOD)	Carbonaceous Biochemical Oxygen Demand (cBOD5)	Total Coliforms (Colilert)	E.coli	Dissolved Reactive Phosphorus (FIA) (DRP)	Nitrate (as N)	Nitrogen (Total Oxidised) (as N)	Nitrogen (Total)	Kjeldahl Nitrogen Total	Nitrite (as NO2-)	Ammoniacal N	Phosphorus (Total)
		pH units	µS/cm	mg/L	%S	mV	°C	cm	g/m3	g/m3	cfu/100mL	cfu/100mL	g/m3	g/m3	g/m3	g/m3	g/m3	g/m3	g/m3	g/m3
RS10	11 Mar 2025	7.8	157	-	-	-	-	-	-	-	-	-	<0.002	0.0571	-	<0.10	<0.10	<0.0010	<0.005	<0.0050
	11 Mar 2025	8	157	9.35	-	-	16.4	-	-	-	313	16.1	-	-	-	-	-	-	-	-
	08 Apr 2025	7.8	105.5	-	104.7	108.8	10.2	19	-	<1.00	1,203.30	517.2	<0.002	0.0277	-	<0.10	<0.10	<0.0010	<0.005	0.074
	10 Apr 2025	7.87	105.9	12.06	-	106	9.9	52	-	<1.00	137.4	39.9	<0.002	0.0347	-	<0.10	<0.10	<0.0010	0.02	0.011
	16 Apr 2025	7.79	56.6	10.45	-	164.6	14.4	120	-	<2	-	24	0.007	0.01	0.01	0.01	<0.8	<0.01	<0.01	0.02
	23 Apr 2025	8	83	10.9	-	-	13.1	-	-	<2	-	5	0.004	0.03	0.03	0.03	<0.8	<0.01	0.02	<0.01
	30 Apr 2025	8	78	10.9	-	-	11.7	-	-	<2	-	13	0.006	0.03	0.03	0.084*	0.054*	<0.01	0.04	0.01
	06 May 2025	7.85	96.5	-	103.8	106.2	11	>120	-	8.85	50.4	6.3	<0.002	0.0288	-	<0.13	<0.10	<0.0010	0.01	<0.0050
	14 May 2025	8	79	12	-	-	8.2	-	-	<2	-	5	<0.002	0.05	0.05	0.05	<0.8	<0.01	<0.01	0.01
	21 May 2025	7.6	76	12.4	-	-	7.6	-	-	<2	-	1	0.005	0.05	0.04	0.04	<0.8	<0.01	0.02	<0.01
	28 May 2025	8.1	109	12.4	-	-	8.1	-	-	<2	-	5	0.007	0.03	0.03	0.03	<0.8	<0.01	0.03	0.02
	03 Jun 2025	7.78	110.2	-	90.4	92.4	7.7	>120	-	<1	-	1	<0.002	0.038	-	<0.1	<0.1	<0.001	0.022	0.013
	12 Jun 2025	8.2	74	12.9	-	-	5.1	-	-	<2	-	7	0.004	0.04	0.05	0.05	<15	<0.01	0.01	<0.01
	18 Jun 2025	8.2	69	13.6	-	-	4.5	-	-	<2	-	<1	0.007	0.04	0.04	0.04	<15	<0.01	<0.01	<0.01
	26 Jun 2025	-	-	-	-	-	-	-	-	<2	-	240	0.016	0.03	0.02	1.42	1.4	<0.01	<0.01	1.02
	01 Jul 2025	7.77	108.2	-	120.6	12.8	3.9	34	1	-	88.5	6.4	<0.002	0.07	0.07	<0.1	<0.1	<0.001	<0.005	0.014
	09 Jul 2025	8.1	78	12.7	-	-	5.6	-	-	<2	-	1	<0.002	0.07	0.06	1.56	1.5	<0.01	<0.01	0.03
RS11	11 Mar 2025	7.5	106	-	-	-	-	-	-	-	-	-	<0.002	0.278	-	1	0.72	0.0046	0.63	<0.0050
	11 Mar 2025	7.51	112.4	8.55	-	-	16.5	-	-	-	>217.8	>17.3	-	-	-	-	-	-	-	-
	03 Apr 2025	7.41	71.4	-	101.1	122.1	15.1	-	-	<1.00	1,299.70	36.4	<0.002	0.349	-	0.58	0.33	0.00511	0.3	0.059
	07 Apr 2025	7.4	73.6	-	-	-	-	-	-	<1.00	-	-	<0.002	0.0659	-	<0.10	<0.10	0.0013	0.08	<0.0050
	07 Apr 2025	7.65	74.1	-	111.5	149.1	15.4	120	-	-	547.5	50.4	-	-	-	-	-	-	-	-
	10 Apr 2025	7.67	78.1	-	101.6	100.1	14.2	120	-	<1.00	275.5	57.3	<0.002	0.0677	-	0.46	0.39	0.0011	0.09	<0.0050
	16 Apr 2025	7.74	57.4	10.12	-	143.9	15	120	-	<2	-	19	0.002	0.18	0.18	0.18	<0.8	<0.01	0.11	<0.01
	23 Apr 2025	7.8	54	10.3	-	-	14.4	-	-	<2	-	9	0.003	0.04	0.04	0.04	<0.8	<0.01	0.06	<0.01
	30 Apr 2025	7.8	65	10.1	-	-	13.4	-	-	<2	-	22	0.003	0.04	0.04	0.22*	0.18*	<0.01	0.13	0.01
	06 May 2025	7.47	86.1	-	97.5	119.3	12.9	>120	-	<1.00	52.8	28.1	<0.002	0.105	-	0.25	0.14	0.0017	0.15	<0.0050
	14 May 2025	7.8	52	10.6	-	-	7.8	-	-	<2	-	6	<0.002	0.03	0.03	0.11*	0.08*	<0.01	0.06	<0.01
	21 May 2025	7.6	53	10.7	-	-	12.7	-	-	<2	-	2	<0.002	0.04	0.04	0.11*	0.07*	<0.01	0.05	<0.01
	28 May 2025	7.8	55	11.1	-	-	11.8	-	-	<2	-	2	0.005	0.02	0.02	0.06*	0.04*	<0.01	0.03	0.01
	03 Jun 2025	7.45	67.4	-	94.3	81	11.4	>120	-	<1	-	5	<0.002	0.075	-	0.3	0.2	0.002	0.139	<0.005
	12 Jun 2025	8	58	11.1	-	-	10.3	-	-	<2	-	9	0.014	0.07	0.07	0.28*	0.21*	<0.01	0.16	<0.01
	18 Jun 2025	8.2	48	13.6	-	-	4.5	-	-	<2	-	6	0.004	0.04	0.04	0.16*	0.12*	<0.01	0.09	<0.01
	01 Jul 2025	7.46	68.7	-	80.3	10.74	9.9	>120	1	-	59.1	9.9	<0.002	0.061	0.061	<0.1	<0.1	<0.001	0.051	<0.005
	09 Jul 2025	8	49	11.4	-	-	9.3	-	-	<2	-	1	<0.002	0.07	0.06	2.46	2.4	<0.01	0.07	<0.01
RS15	01 Apr 2025	7.16	358.4	-	182.1	182.1	20.1	-	-	2.19	>2,420	435.2	1.867	6.85	-	8.3	1.43	0.0195	0.15	3.59
	03 Apr 2025	7.38	420.1	-	98.9	195.9	19.2	-	-	12.3	>2,420	32.3	1.774	4.56	-	16	11.2	0.0301	8.62	2.41
	07 Apr 2025	7.8	470	-	-	-	-	-	-	6.17	-	-	1.707	3.95	-	13	9.34	0.0342	6.95	2.27
	07 Apr 2025	8	127.1	-	98	127.1	12.8	74	-	-	>2,420	28.5	-	-	-	-	-	-	-	-
	10 Apr 2025	7.34	324.5	-	35.2	172.8	17.5	27	-	16.5	>2,420	17.1	1.415	2.03	-	14	11.5	0.0396	8.13	1.86
	16 Apr 2025	7.45	374.6	9.32	-	143	17.2	46	-	9.09	-	18	1.01	2.52	2.6	11.5	8.9	0.07	6.23	1.56
	23 Apr 2025	7.4	393	9	-	-	17.4	-	-	9.63	-	14	1.23	2.87	3	13.4	10.4	0.1	6.32	1.56
	30 Apr 2025	7.4	378	9.3	-	-	16.6	-	-	9.27	-	170	1.01	3.43	3.6	13.7	10.1	0.13	7.8	1.52
	06 May 2025	7.42	432.3	-	102.1	111.4	15.9	35	-	<1.00	>2,420	57.6	0.954	3.36	-	11.1	7.58	0.115	5.83	2.2
	14 May 2025	7.3	323	9.3	-	-	16.2	-	-	2.9	-	40	0.038	3.08	3.1	5.29	2.2	<0.01	0.08	0.2
	21 May 2025	7.6	365	10.8	-	-	14.4	-	-	14.5	-	25	1.24	1.55	1.6	12.6	11	0.03	7.33	1.84
	28 May 2025	7.5	449	10.4	-	-	12.9	-	-	18.3	-	13	1.62	1.62	15	15	13.3	0.06	8.82	2.77
	03 Jun 2025	7.43	474.8	-	94.8	167.9	13.4	35	-	12	-	28	1.2	2.87	-	14.3	11.3	0.097	8.1	1.8
	12 Jun 2025	7.6	335	11	-	-	10.2	-	-	15.4	-	33	1.58	1.7	1.8	18.3	16.5	0.06	11.5	2.25
	18 Jun 2025	7.2	306	10.4	-	-	13	-	-	2.17	-	16	2.05	6.36	6.4	6.4	<15	<0.01	0.07	3.09
	26 Jun 2025	-	-	-	-	-	-	-	-	21.2	-	8	1.47	1.02	1.1	18.1	17	0.04	12	2.16
	01 Jul 2025	7.35	380	-	42.3	10.47	11.5	22	18	-	>201	65.9	1.63	2.57	2.62	15.8	13.2	0.047	9.13	2.48
	09 Jul 2025	7.5	313	11.6	-	-	9.8	-	-	18.2	-	60	1.59	1.76	1.8	18.6	16.8	0.04	10.9	2.39

Notes:

*Values are estimated. Estimation was used as original lab results show TN values as higher than AmmN, due to a high LOQ for TKN (thus TKN was zero in the lab TN calulation where values fell below the LOQ).
To get a value for TKN: TKN was calculated using percentage of AmmN (assuming percentage remains similar between samples - 74.5%). This TKN estimation was then added to the lab TN result to get an estimated TN value.

Current state dilution

Date	Total Nitrogen (TN)				Ammoniacal Nitrogen (AmmN)				Dilution based on TN		Discharge volume
Location	RS04B	RS06B	RS09	RS15	RS04B	RS06B	RS09	RS15	RS06B	RS09	
Unit	g/m^3	g/m^3	g/m^3	g/m^3	g/m^3	g/m^3	g/m^3	g/m^3			L/s
3/04/2025	-	0.56	-	16	-	0.33	0.005	8.62	0.035	-	141.68
10/04/2025	<0.10	0.94	0.69	14	0.008	0.55	0.39	8.13	0.067	0.049	135.22
16/04/2025	0.02	**0.39**	**0.33**	11.5	<0.01	0.21	0.18	6.23	0.032	0.027	141.31
23/04/2025	0.02	1.27	1.36	13.4	<0.01	0.65	0.29	6.32	0.093	0.100	145.71
30/04/2025	0.01	**1.44**	**0.58**	13.7	<0.01	0.75	0.25	7.8	0.104	0.042	135.10
6/05/2025	-	1.08	1.09	11.1	-	0.58	0.58	5.83	0.097	0.098	122.43
14/05/2025	0.03	0.16	0.12	5.29	<0.01	0.01	<0.01	0.08	0.025	0.017	125.71
21/05/2025	0.03	**0.86**	**0.68**	12.6	<0.01	0.47	0.4	7.33	0.066	0.052	118.53
28/05/2025	0.02	0.23	**0.41**	15	<0.01	0.47	0.24	8.82	0.014	0.026	112.74
3/06/2025	-	1.1	0.8	14.3	-	0.56	0.39	8.1	0.077	0.056	116.81
12/06/2025	0.04	**1.57**	**0.87**	18.3	<0.01	0.86	0.49	11.5	0.084	0.045	128.14
18/06/2025	0.03	0.33	0.2	6.4	<0.01	0.01	<0.01	0.07	0.047	0.027	97.85
1/07/2025	0.2	1.3	1.3	15.8	<0.005	0.75	0.70	9.13	0.070	0.070	148.03
9/07/2025	0.84	3.71	2.77	18.6	<0.01	1.28	0.85	10.9	0.154	0.104	152.46

Notes:

Red, bold values are estimated. Estimation was used as original lab results show TN values as higher than AmmN, due to a high LOQ for TKN (thus TKN was zero in the lab TN calulation where values fell below the LOQ). To get a value for TKN: TKN was calculated using percentage of AmmN (assuming percentage remains similar between samples). Percentages used: RS06B 69.6%, RS09 74%. This TKN estimation was then added to the lab TN result to get an estimated TN value.

Value shaded in green shows a high background concentration

Proposed activity flow and dilution

Date	Total mix volume		Braid volume contribution		NIWA record		% Braid of total river		Mitigated dilution*	
Location	RS06B	RS09	RS06B	RS09	River Stage	River Flow	RS06B	RS09	RS06B	RS09
Unit	L/s	L/s	L/s	L/s	m	L/s	%	%		
3/04/2025	4047.95	-	3906.27	-	329.70	41466	9%	-	0.022	-
10/04/2025	2013.91	2743.59	1878.69	2608.37	329.46	17863	11%	15%	0.031	0.026
16/04/2025	4392.00	5242.07	4250.69	5100.76	329.46	17676	24%	29%	0.021	0.019
23/04/2025	1561.97	1457.06	1416.26	1311.35	329.41	15329	9%	9%	0.037	0.038
30/04/2025	1296.54	3247.24	1161.44	3112.14	329.33	11556	10%	27%	0.037	0.024
6/05/2025	1258.31	1246.77	1135.88	1124.34	329.31	10774	11%	10%	0.034	0.034
14/05/2025	5115.27	7388.72	4989.56	7263.01	329.52	25023	20%	29%	0.017	0.013
21/05/2025	1799.37	2297.66	1680.84	2179.13	329.48	22652	7%	10%	0.028	0.025
28/05/2025	8053.08	4336.27	7940.33	4223.53	329.41	19507	41%	22%	0.011	0.017
3/06/2025	1518.47	2087.90	1401.67	1971.09	329.37	17760	8%	11%	0.030	0.026
12/06/2025	1532.61	2825.18	1404.48	2697.04	329.40	18852	7%	14%	0.033	0.025
18/06/2025	2087.41	3683.67	1989.57	3585.82	329.34	16213	12%	22%	0.022	0.016
1/07/2025	2126.18	2126.18	1978.15	1978.15	329.62	30742	6%	6%	0.033	0.033
9/07/2025	988.08	1469.33	835.62	1316.86	329.46	21942	4%	6%	0.046	0.040

Notes:

Values considered to be erroneously high, based on low Total Nitrogen concentration at RS06B

*Mitigated dilutions based on diversion flow of 2500 L/s

Proposed activity Ammoniacal Nitrogen (AmmN) results

Date	Current AmmN		Current dilution		Mitigated dilution*		(Stage 2 upgrade complete) Predicted pre-mitigated AmmN median** (pH 8 at 20°C)		(Stage 2 upgrade complete) Predicted pre-mitigated AmmN 95%ile*** (pH 8 at 20°C)		(Stage 2 upgrade complete) Predicted mitigated AmmN median** (pH 8 at 20°C)		(Stage 2 upgrade complete) Predicted mitigated AmmN 95%ile*** (pH 8 at 20°C)	
Location	RS06B	RS09	RS06B	RS09	RS06B	RS09	RS06B	RS09	RS06B	RS09	RS06B	RS09	RS06B	RS09
Unit	g/m^3	g/m^3					g/m^3	g/m^3	g/m^3	g/m^3	g/m^3	g/m^3	g/m^3	g/m^3
3/04/2025	0.33	0.005	0.035	-	0.022	-	0.025	-	0.263	-	0.016	-	0.17	-
10/04/2025	0.55	0.39	0.067	0.049	0.031	0.026	0.048	0.035	0.504	0.370	0.022	0.019	0.23	0.20
16/04/2025	0.21	0.18	0.032	0.027	0.021	0.019	0.023	0.019	0.241	0.202	0.015	0.013	0.16	0.14
23/04/2025	0.65	0.29	0.093	0.100	0.037	0.038	0.067	0.072	0.700	0.750	0.027	0.028	0.28	0.29
30/04/2025	0.75	0.25	0.104	0.042	0.037	0.024	0.075	0.030	0.782	0.312	0.027	0.017	0.28	0.18
6/05/2025	0.58	0.58	0.097	0.098	0.034	0.034	0.070	0.071	0.730	0.736	0.024	0.024	0.25	0.25
14/05/2025	0.01	<0.01	0.025	0.017	0.017	0.013	0.018	0.012	0.184	0.128	0.012	0.009	0.13	0.10
21/05/2025	0.47	0.4	0.066	0.052	0.028	0.025	0.047	0.037	0.494	0.387	0.020	0.018	0.21	0.19
28/05/2025	0.47	0.24	0.014	0.026	0.011	0.017	0.010	0.019	0.105	0.195	0.008	0.012	0.08	0.13
3/06/2025	0.56	0.39	0.077	0.056	0.030	0.026	0.055	0.040	0.577	0.420	0.022	0.019	0.22	0.20
12/06/2025	0.86	0.49	0.084	0.045	0.033	0.025	0.060	0.033	0.627	0.340	0.024	0.018	0.25	0.18
18/06/2025	0.01	<0.01	0.047	0.027	0.022	0.016	0.034	0.019	0.352	0.199	0.016	0.012	0.16	0.12
1/07/2025	0.75	0.70	0.070	0.070	0.033	0.033	0.050	0.050	0.522	0.522	0.024	0.024	0.25	0.25
9/07/2025	1.28	0.85	0.154	0.104	0.046	0.040	0.111	0.075	1.157	0.778	0.033	0.029	0.34	0.30
NPSFM National Bottom Line ammonia toxicity limits							**0.24**		**0.4**		**0.24**		**0.4**	

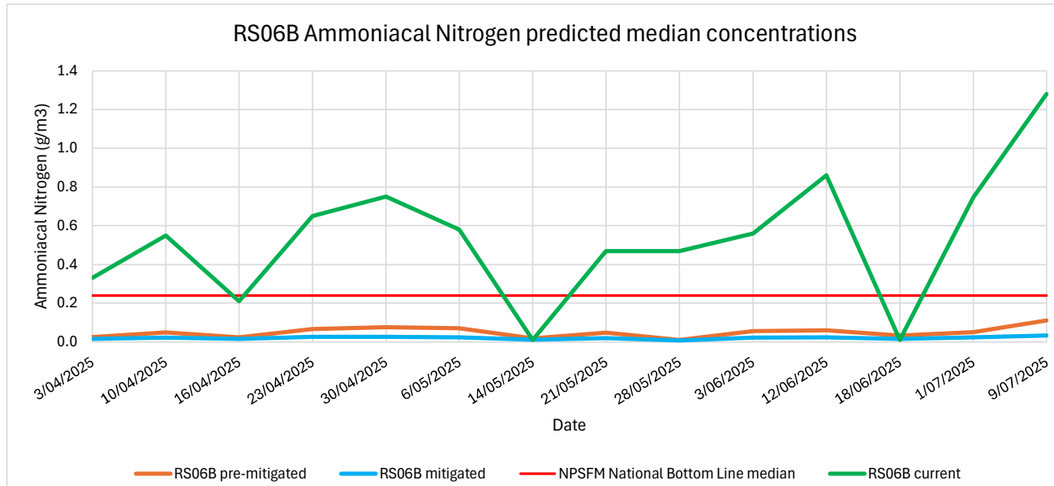
Notes:

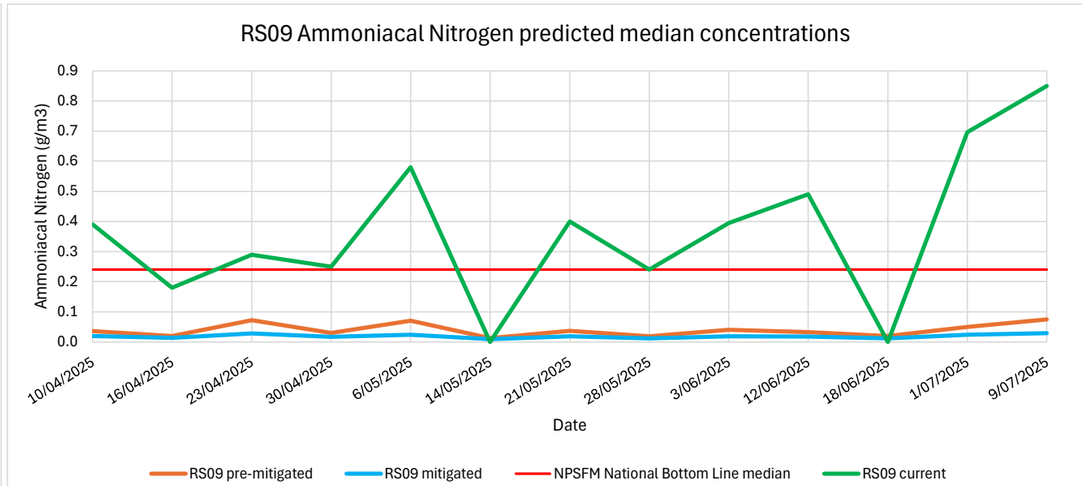
Definitions in this context:
Pre-mitigated - refers to predicted concentrations after Stage 2 upgrades have been completed, but not including river flow diversion.
Mitigated - refers to predicted concentrations after Stage 2 upgrades have been completed, including river flow diversion.

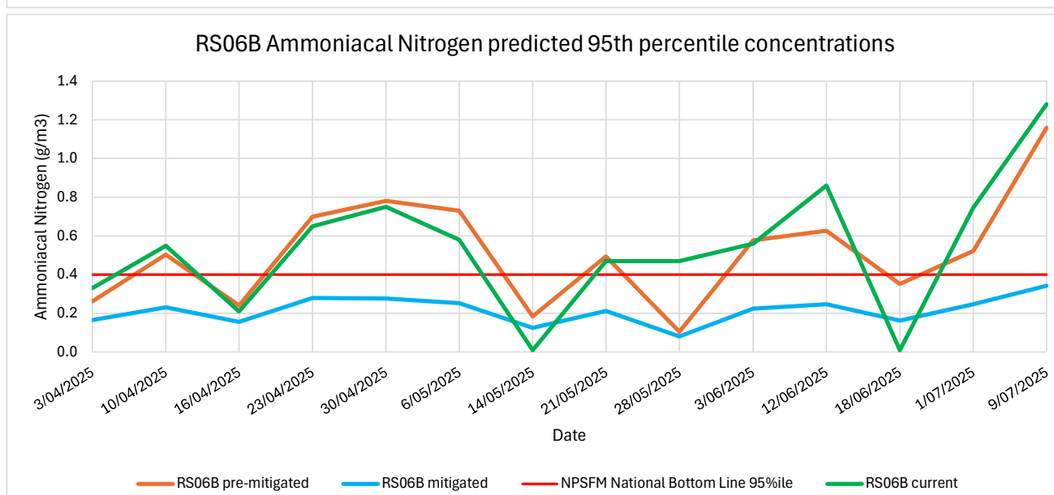
*Mitigated dilutions based on diversion flow of 2500 L/s

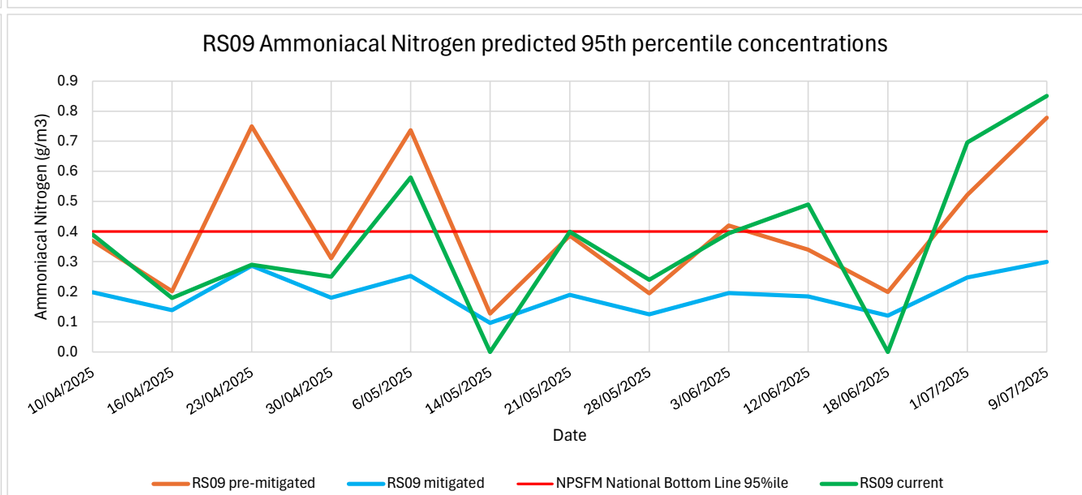
**Based on median AmmN (pH 8 at 20°C) of 0.72 g/m^3

***Based on 95th percentile AmmN (pH 8 at 20°C) of 7.5 g/m^3









Proposed activity Dissolved Reactive Phosphorus (DRP) results

Date	Current DRP		Current dilution		Mitigated dilution*		(Stage 2 upgrade complete) Predicted pre-mitigated DRP median**		(Stage 2 upgrade complete) Predicted pre-mitigated DRP 95%ile***		(Stage 2 upgrade complete) Predicted mitigated DRP median**		(Stage 2 upgrade complete) Predicted mitigated DRP 95%ile***	
Location	RS06B	RS09	RS06B	RS09	RS06B	RS09	RS06B	RS09	RS06B	RS09	RS06B	RS09	RS06B	RS09
Unit	g/m^3	g/m^3					g/m^3	g/m^3	g/m^3	g/m^3	g/m^3	g/m^3	g/m^3	g/m^3
3/04/2025	0.059	<0.002	0.035	-	0.022	-	0.035	-	0.105	-	0.022	-	0.066	-
10/04/2025	0.098	0.073	0.067	0.049	0.031	0.026	0.067	0.049	0.201	0.148	0.031	0.026	0.093	0.079
16/04/2025	0.034	0.03	0.032	0.027	0.021	0.019	0.032	0.027	0.097	0.081	0.021	0.019	0.063	0.056
23/04/2025	0.141	0.05	0.093	0.100	0.037	0.038	0.093	0.100	0.280	0.300	0.037	0.038	0.112	0.115
30/04/2025	0.109	0.05	0.104	0.042	0.037	0.024	0.104	0.042	0.313	0.125	0.037	0.024	0.111	0.072
6/05/2025	0.099	0.101	0.097	0.098	0.034	0.034	0.097	0.098	0.292	0.295	0.034	0.034	0.101	0.101
14/05/2025	0.004	0.004	0.025	0.017	0.017	0.013	0.025	0.017	0.074	0.051	0.017	0.013	0.050	0.039
21/05/2025	0.077	0.063	0.066	0.052	0.028	0.025	0.066	0.052	0.198	0.155	0.028	0.025	0.085	0.076
28/05/2025	0.094	0.046	0.014	0.026	0.011	0.017	0.014	0.026	0.042	0.078	0.011	0.017	0.032	0.050
3/06/2025	0.089	0.062	0.077	0.056	0.030	0.026	0.077	0.056	0.231	0.168	0.030	0.026	0.090	0.078
12/06/2025	0.122	0.067	0.084	0.045	0.033	0.025	0.084	0.045	0.251	0.136	0.033	0.025	0.098	0.074
18/06/2025	0.106	0.065	0.047	0.027	0.022	0.016	0.047	0.027	0.141	0.080	0.022	0.016	0.065	0.048
1/07/2025	0.136	0.124	0.070	0.070	0.033	0.033	0.070	0.070	0.209	0.209	0.033	0.033	0.099	0.099
9/07/2025	0.193	0.127	0.154	0.104	0.046	0.040	0.154	0.104	0.463	0.311	0.046	0.040	0.137	0.120

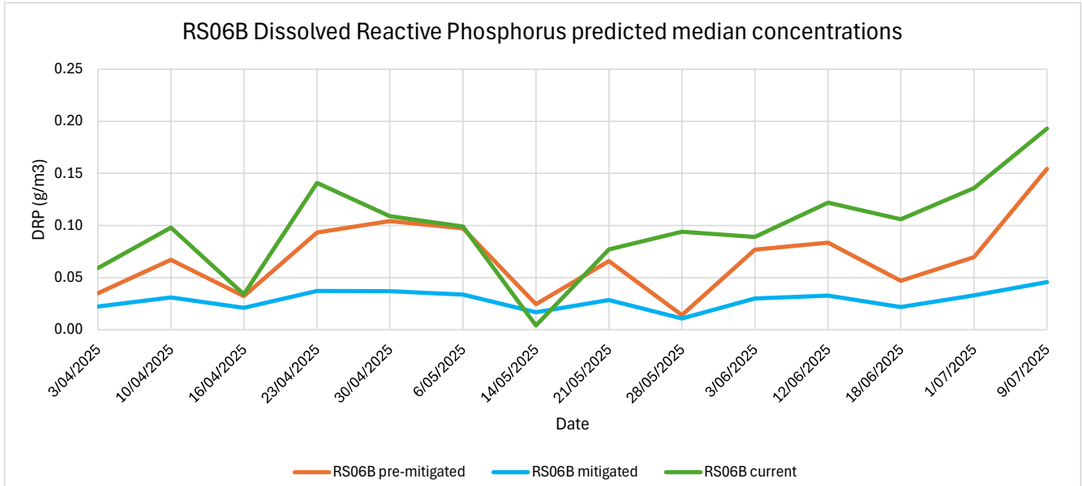
Notes:

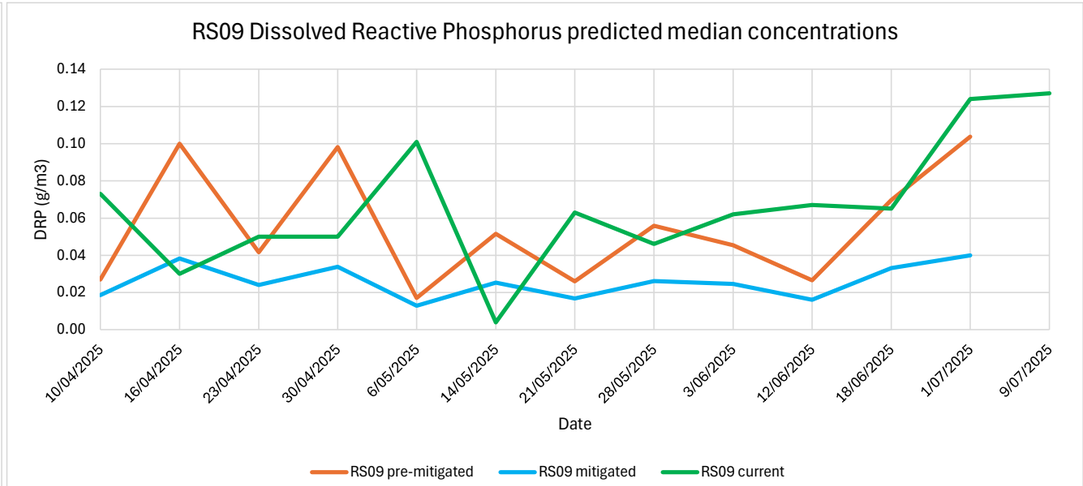
Definitions in this context:
Pre-mitigated - refers to predicted concentrations after Stage 2 upgrades have been completed, but not including river flow diversion.
Mitigated - refers to predicted concentrations after Stage 2 upgrades have been completed, including river flow diversion.

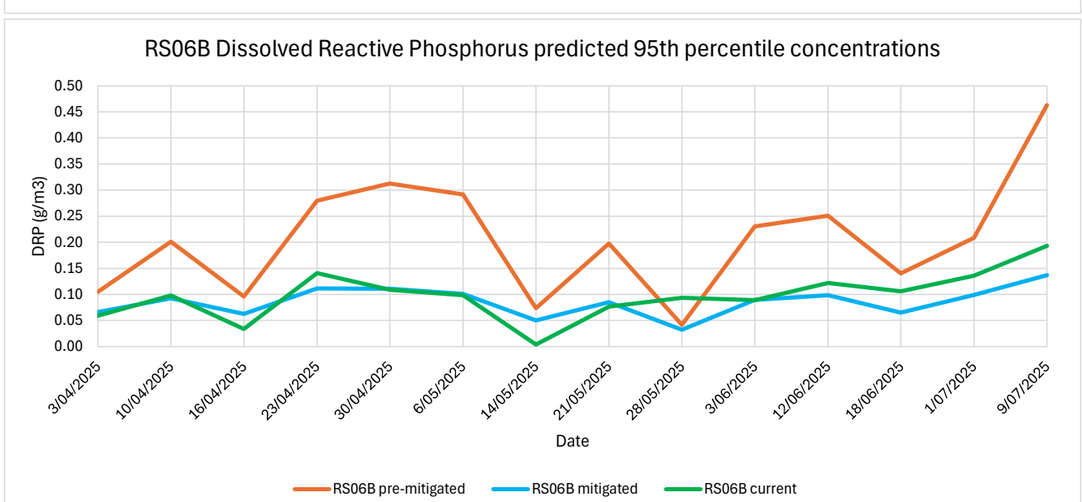
*Mitigated dilutions based on diversion flow of 2500 L/s

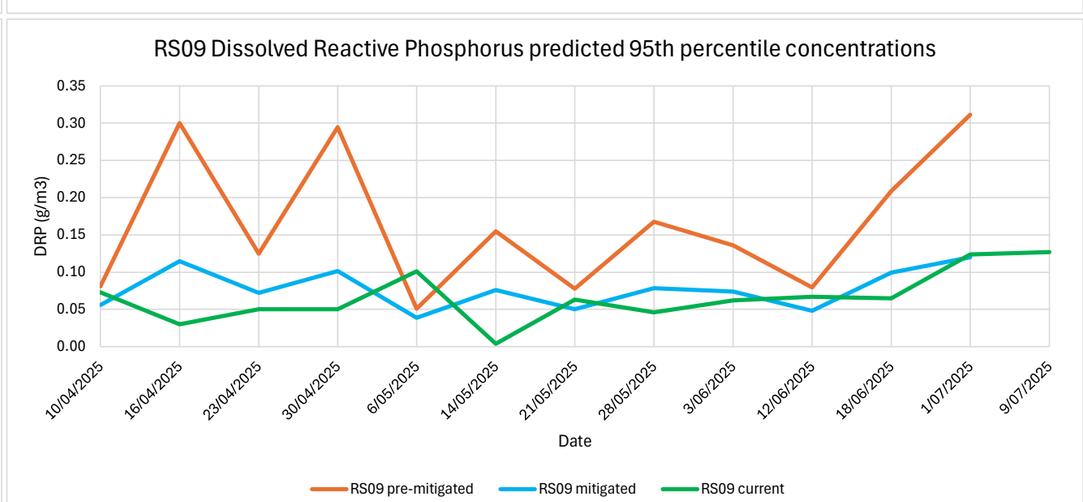
**Based on median DRP of 1.0 g/m^3

***Based on 95th percentile DRP of 3.0 g/m^3









Proposed activity Total Phosphorus (TP) results

Date	Current TP		Current dilution		Mitigated dilution*		(Stage 2 upgrade complete) Predicted pre-mitigated TP median**		(Stage 2 upgrade complete) Predicted pre-mitigated TP 95%ile***		(Stage 2 upgrade complete) Predicted mitigated TP median**		(Stage 2 upgrade complete) Predicted mitigated TP 95%ile***	
Location	RS06B	RS09	RS06B	RS09	RS06B	RS09	RS06B	RS09	RS06B	RS09	RS06B	RS09	RS06B	RS09
Unit	g/m^3	g/m^3					g/m^3	g/m^3	g/m^3	g/m^3	g/m^3	g/m^3	g/m^3	g/m^3
3/04/2025	0.097	0.006	0.035	-	0.022	-	0.053	-	0.175	-	0.033	-	0.111	-
10/04/2025	0.180	0.120	0.067	0.049	0.031	0.026	0.101	0.074	0.336	0.246	0.046	0.040	0.154	0.132
16/04/2025	0.060	0.060	0.032	0.027	0.021	0.019	0.048	0.040	0.161	0.135	0.031	0.028	0.105	0.093
23/04/2025	0.150	0.070	0.093	0.100	0.037	0.038	0.140	0.150	0.466	0.500	0.056	0.057	0.186	0.191
30/04/2025	0.190	0.070	0.104	0.042	0.037	0.024	0.156	0.062	0.521	0.208	0.055	0.036	0.184	0.120
6/05/2025	0.120	0.130	0.097	0.098	0.034	0.034	0.146	0.147	0.486	0.491	0.051	0.051	0.168	0.169
14/05/2025	0.010	<0.01	0.025	0.017	0.017	0.013	0.037	0.026	0.123	0.085	0.025	0.019	0.084	0.064
21/05/2025	0.100	0.080	0.066	0.052	0.028	0.025	0.099	0.077	0.329	0.258	0.043	0.038	0.142	0.127
28/05/2025	0.130	0.080	0.014	0.026	0.011	0.017	0.021	0.039	0.070	0.130	0.016	0.025	0.054	0.084
3/06/2025	0.135	0.099	0.077	0.056	0.030	0.026	0.115	0.084	0.385	0.280	0.045	0.039	0.150	0.131
12/06/2025	0.170	0.100	0.084	0.045	0.033	0.025	0.125	0.068	0.418	0.227	0.049	0.037	0.164	0.123
18/06/2025	0.120	0.070	0.047	0.027	0.022	0.016	0.070	0.040	0.234	0.133	0.033	0.024	0.109	0.080
1/07/2025	0.191	0.185	0.070	0.070	0.033	0.033	0.104	0.104	0.348	0.348	0.050	0.050	0.165	0.165
9/07/2025	0.490	0.190	0.154	0.104	0.046	0.040	0.231	0.156	0.772	0.519	0.069	0.060	0.229	0.200

Notes:

Definitions in this context:

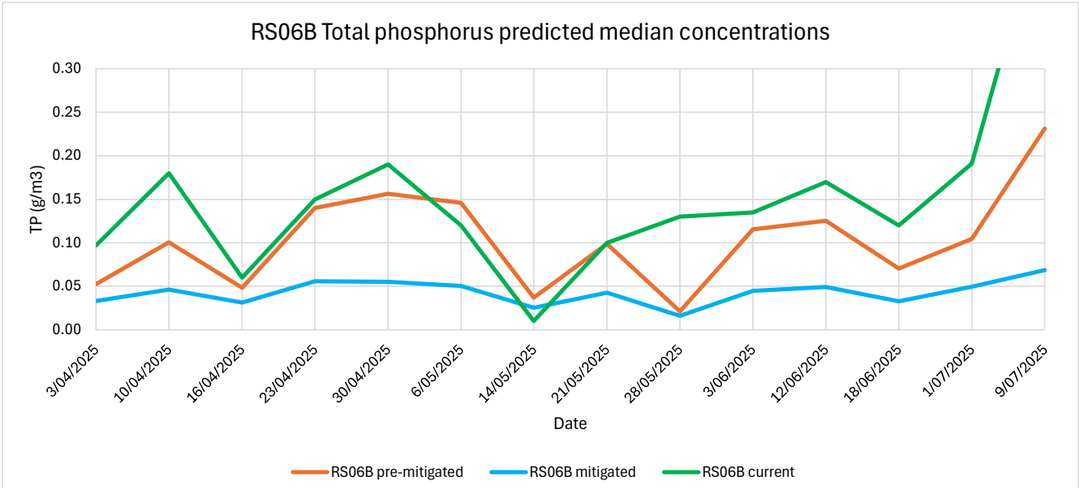
Pre-mitigated - refers to predicted concentrations after Stage 2 upgrades have been completed, but not including river flow diversion.

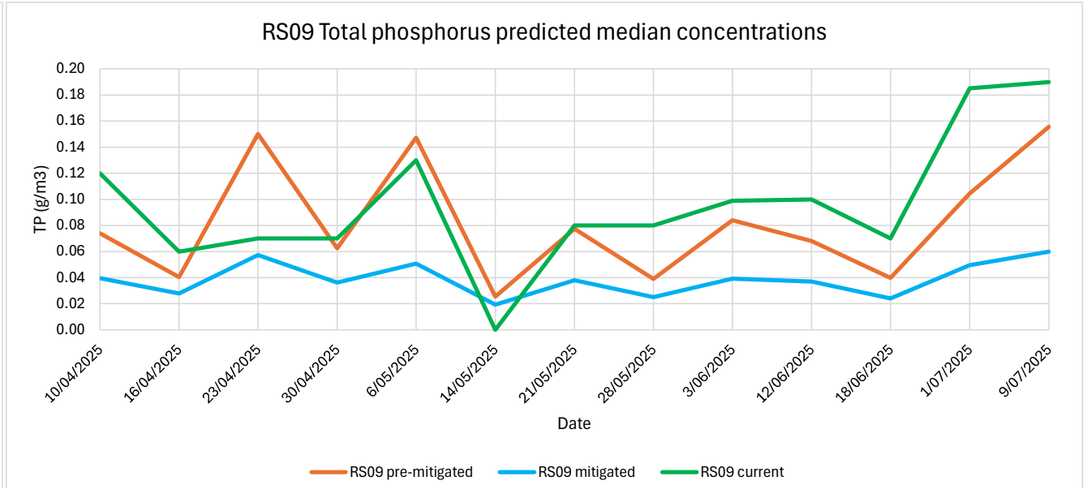
Mitigated - refers to predicted concentrations after Stage 2 upgrades have been completed, including river flow diversion.

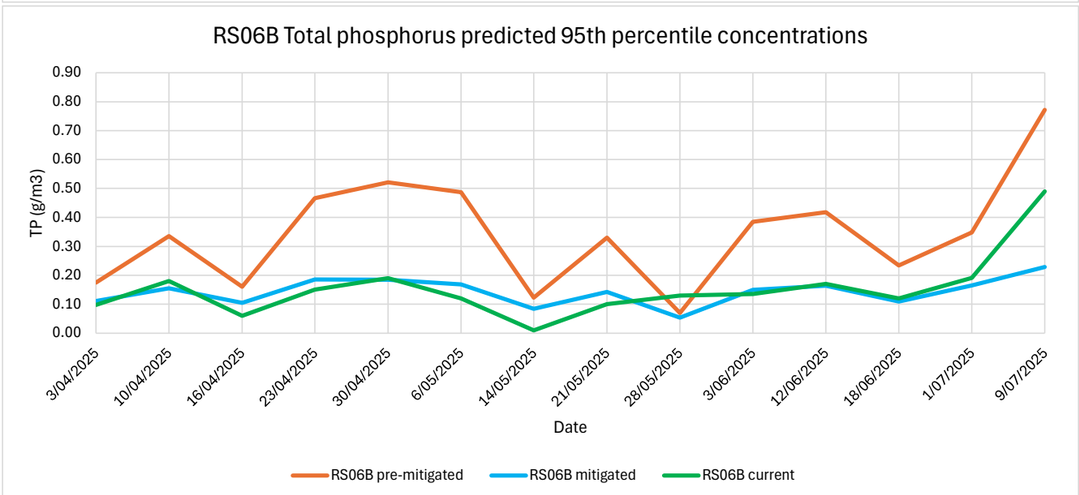
*Mitigated dilutions based on diversion flow of 2500 L/s

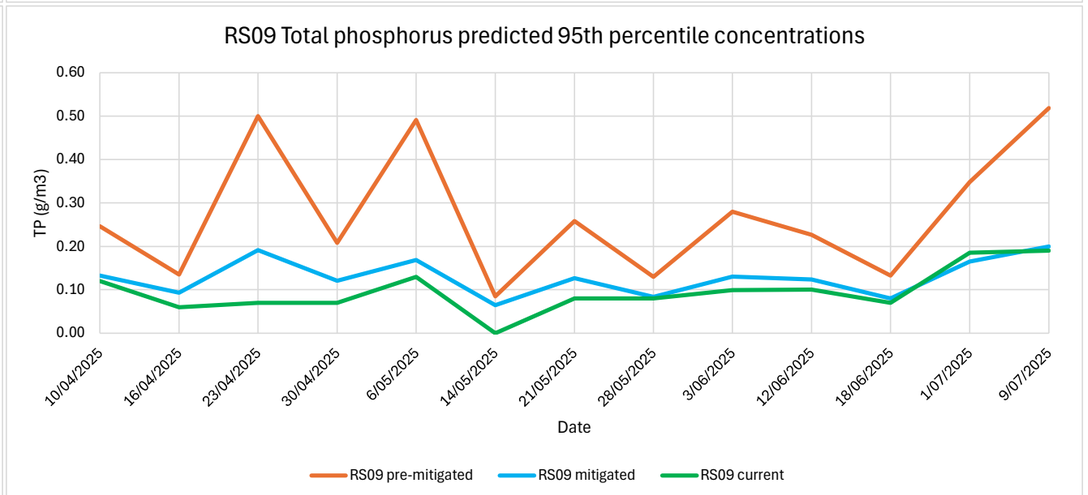
**Based on median TP of 1.5 g/m^3

***Based on 95th percentile TP of 5.0 g/m^3









Proposed activity Carbonaceous Biochemical Oxygen Demand ($cBOD_5$) results

Date	Current $cBOD_5$		Current dilution		Mitigated dilution*		(Stage 2 upgrade complete) Predicted pre-mitigated $cBOD_5$ median**		(Stage 2 upgrade complete) Predicted pre-mitigated $cBOD_5$ 95%ile***		(Stage 2 upgrade complete) Predicted mitigated $cBOD_5$ median**		(Stage 2 upgrade complete) Predicted mitigated $cBOD_5$ 95%ile***	
Location	RS06B	RS09	RS06B	RS09	RS06B	RS09	RS06B	RS09	RS06B	RS09	RS06B	RS09	RS06B	RS09
Unit	g/m^3	g/m^3					g/m^3	g/m^3	g/m^3	g/m^3	g/m^3	g/m^3	g/m^3	g/m^3
3/04/2025	<1.0	<1.0	0.035	-	0.022	-	0.35	-	1.05	-	0.22	-	0.66	-
10/04/2025	<1.0	<1.0	0.067	0.049	0.031	0.026	0.67	0.49	2.01	1.48	0.31	0.26	0.93	0.79
16/04/2025	<2.0	<2.0	0.032	0.027	0.021	0.019	0.32	0.27	0.97	0.81	0.21	0.19	0.63	0.56
23/04/2025	<2.0	<2.0	0.093	0.100	0.037	0.038	0.93	1.00	2.80	3.00	0.37	0.38	1.12	1.15
30/04/2025	<2.0	<2.0	0.104	0.042	0.037	0.024	1.04	0.42	3.13	1.25	0.37	0.24	1.11	0.72
6/05/2025	<1.0	<1.0	0.097	0.098	0.034	0.034	0.97	0.98	2.92	2.95	0.34	0.34	1.01	1.01
14/05/2025	<2.0	<2.0	0.025	0.017	0.017	0.013	0.25	0.17	0.74	0.51	0.17	0.13	0.50	0.39
21/05/2025	<2.0	<2.0	0.066	0.052	0.028	0.025	0.66	0.52	1.98	1.55	0.28	0.25	0.85	0.76
28/05/2025	<2.0	8.91	0.014	0.026	0.011	0.017	0.14	0.26	0.42	0.78	0.11	0.17	0.32	0.50
3/06/2025	2.0	<1.0	0.077	0.056	0.030	0.026	0.77	0.56	2.31	1.68	0.30	0.26	0.90	0.78
12/06/2025	97.0	<2.0	0.084	0.045	0.033	0.025	0.84	0.45	2.51	1.36	0.33	0.25	0.98	0.74
18/06/2025	<2.0	<2.0	0.047	0.027	0.022	0.016	0.47	0.27	1.41	0.80	0.22	0.16	0.65	0.48
1/07/2025	-	-	0.070	0.070	0.033	0.033	0.70	0.70	2.09	2.09	0.33	0.33	0.99	0.99
9/07/2025	2.6	<2.0	0.154	0.104	0.046	0.040	1.54	1.04	4.63	3.11	0.46	0.40	1.37	1.20

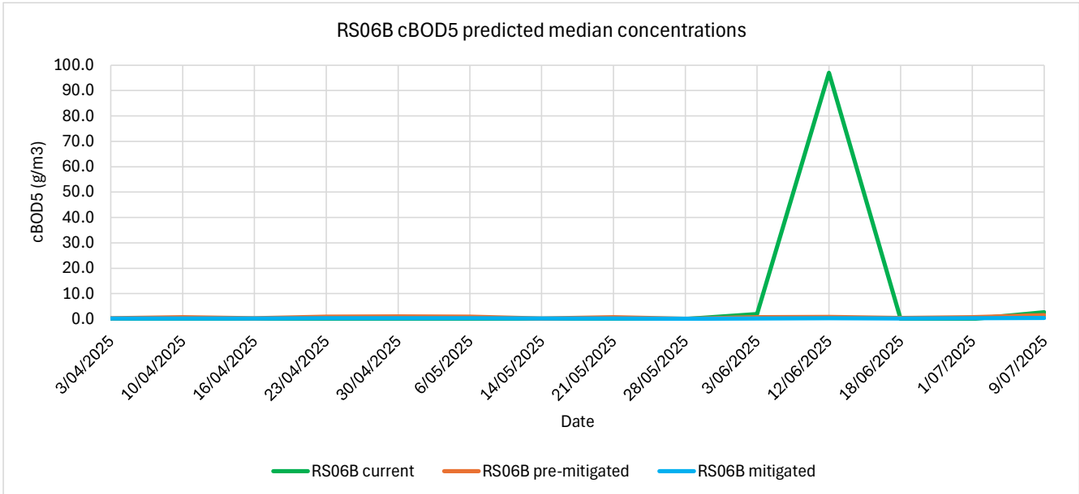
Notes:

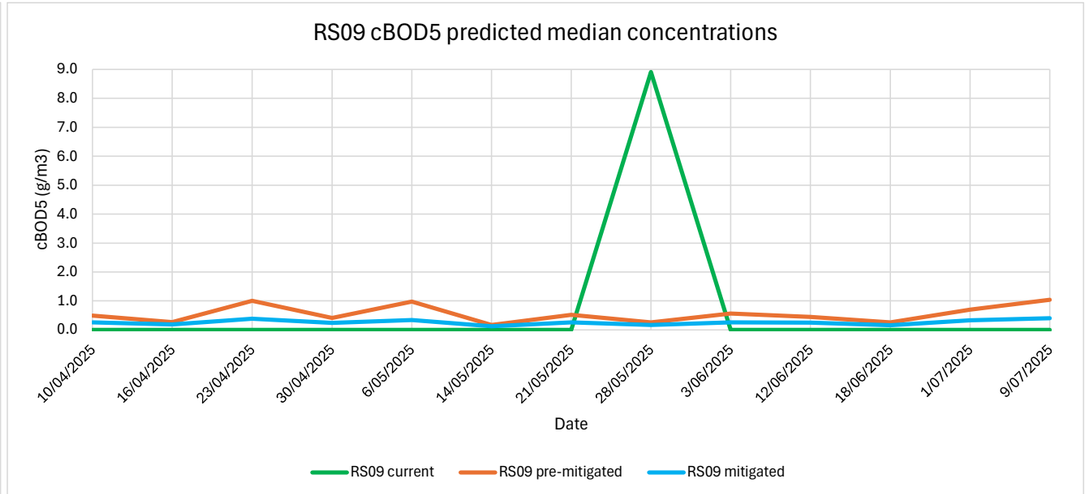
Definitions in this context:
Pre-mitigated - refers to predicted concentrations after Stage 2 upgrades have been completed, but not including river flow diversion.
Mitigated - refers to predicted concentrations after Stage 2 upgrades have been completed, including river flow diversion.

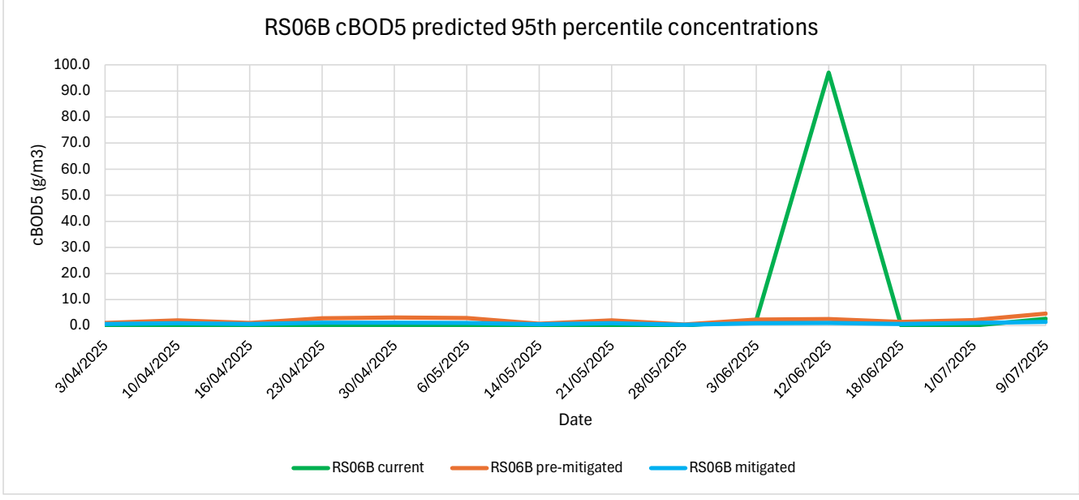
*Mitigated dilutions based on diversion flow of 2500 L/s

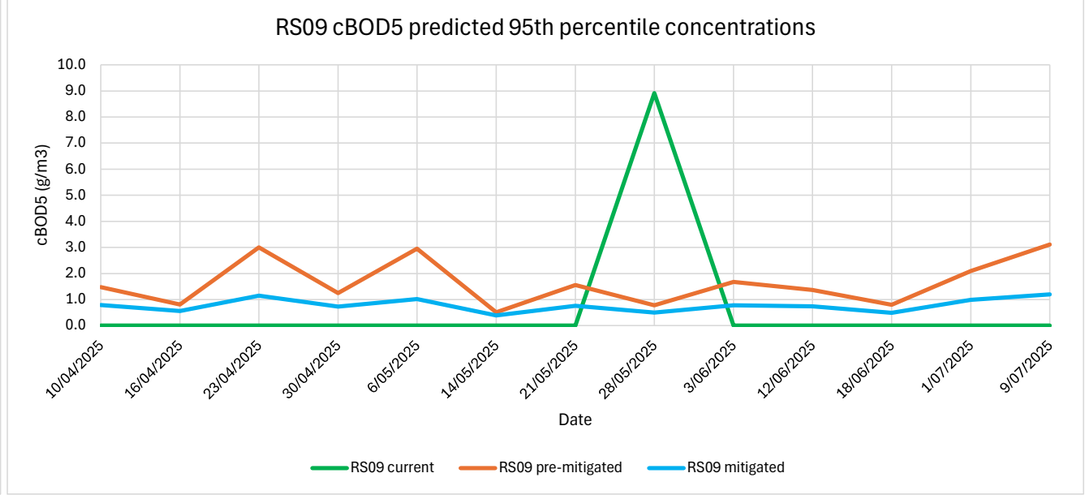
**Based on median $cBOD_5$ of 10 g/m^3

***Based on 95th percentile $cBOD_5$ of 30 g/m^3









Proposed activity Total Nitrogen (TN) results

Date	Current TN		Current dilution		Mitigated dilution*		(Stage 2 upgrade complete) Predicted pre-mitigated TN median**		(Stage 2 upgrade complete) Predicted pre-mitigated TN 95%ile***		(Stage 2 upgrade complete) Predicted mitigated TN median**		(Stage 2 upgrade complete) Predicted mitigated TN 95%ile***	
Location	RS06B	RS09	RS06B	RS09	RS06B	RS09	RS06B	RS09	RS06B	RS09	RS06B	RS09	RS06B	RS09
Unit	g/m^3	g/m^3					g/m^3	g/m^3	g/m^3	g/m^3	g/m^3	g/m^3	g/m^3	g/m^3
3/04/2025	0.56	-	0.035	-	0.022	-	0.35	-	0.70	-	0.22	-	0.44	-
10/04/2025	0.94	0.69	0.067	0.049	0.031	0.026	0.67	0.49	1.34	0.99	0.31	0.26	0.62	0.53
16/04/2025	**0.39**	**0.33**	0.032	0.027	0.021	0.019	0.32	0.27	0.64	0.54	0.21	0.19	0.42	0.37
23/04/2025	1.27	1.36	0.093	0.100	0.037	0.038	0.93	1.00	1.87	2.00	0.37	0.38	0.74	0.76
30/04/2025	**1.44**	**0.58**	0.104	0.042	0.037	0.024	1.04	0.42	2.08	0.83	0.37	0.24	0.74	0.48
6/05/2025	1.08	1.09	0.097	0.098	0.034	0.034	0.97	0.98	1.95	1.96	0.34	0.34	0.67	0.68
14/05/2025	0.16	0.12	0.025	0.017	0.017	0.013	0.25	0.17	0.49	0.34	0.17	0.13	0.34	0.26
21/05/2025	**0.86**	**0.68**	0.066	0.052	0.028	0.025	0.66	0.52	1.32	1.03	0.28	0.25	0.57	0.51
28/05/2025	0.23	**0.41**	0.014	0.026	0.011	0.017	0.14	0.26	0.28	0.52	0.11	0.17	0.22	0.34
3/06/2025	1.1	0.8	0.077	0.056	0.030	0.026	0.77	0.56	1.54	1.12	0.30	0.26	0.60	0.52
12/06/2025	**1.57**	**0.87**	0.084	0.045	0.033	0.025	0.84	0.45	1.67	0.91	0.33	0.25	0.66	0.49
18/06/2025	0.33	0.2	0.047	0.027	0.022	0.016	0.47	0.27	0.94	0.53	0.22	0.16	0.44	0.32
1/07/2025	1.3	1.3	0.070	0.070	0.033	0.033	0.70	0.70	1.39	1.39	0.33	0.33	0.66	0.66
9/07/2025	3.71	2.77	0.154	0.104	0.046	0.040	1.54	1.04	3.09	2.08	0.46	0.40	0.91	0.80

Notes:

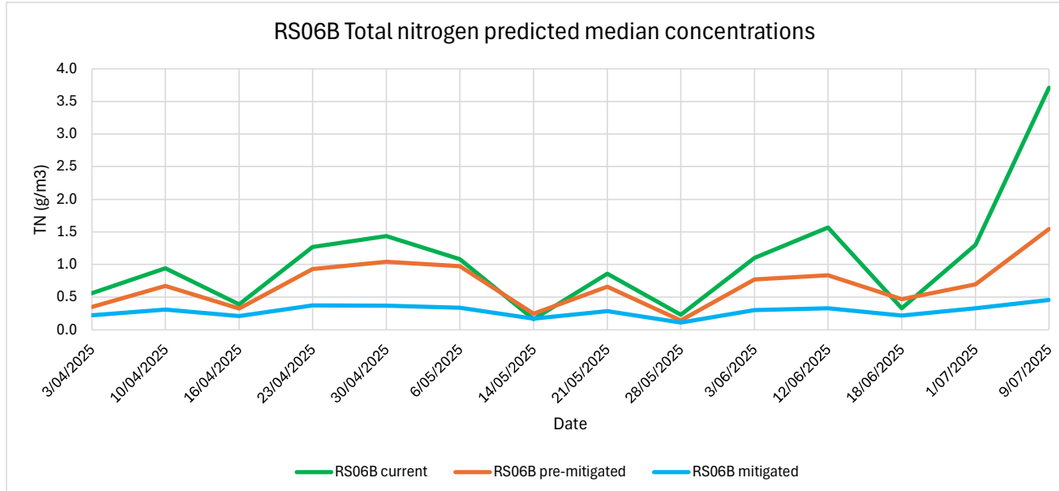
Definitions in this context:
Pre-mitigated - refers to predicted concentrations after Stage 2 upgrades have been completed, but not including river flow diversion.
Mitigated - refers to predicted concentrations after Stage 2 upgrades have been completed, including river flow diversion.

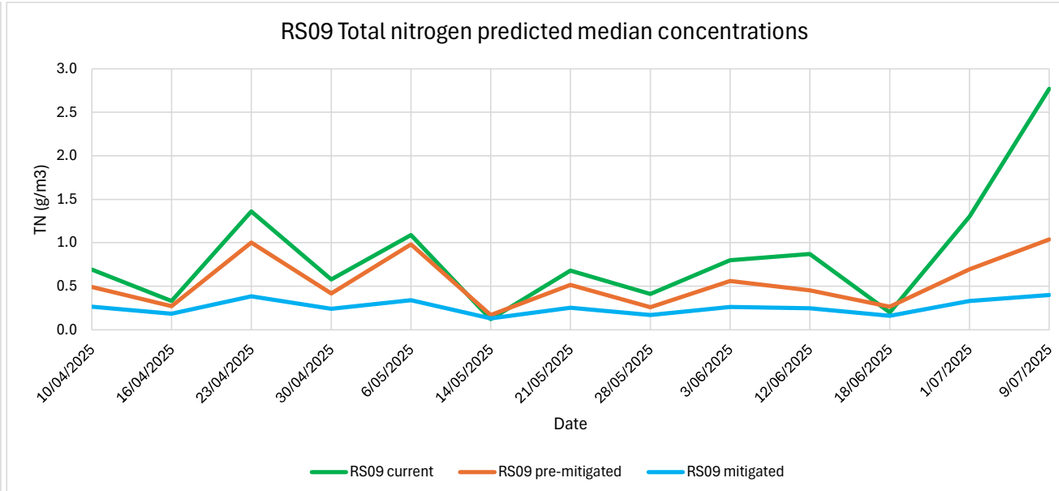
Red, bold values are estimated. Estimation was used as original lab results show TN values as higher than AmmN, due to a high LOQ for TKN (thus TKN was zero in the lab TN calulation where values fell below the LOQ). To get a value for TKN: TKN was calculated using percentage of AmmN (assuming percentage remains similar between samples). Percentages used: RS06B 69.6%, RS09 74%. This TKN estimation was then added to the lab TN result to get an estimated TN value.

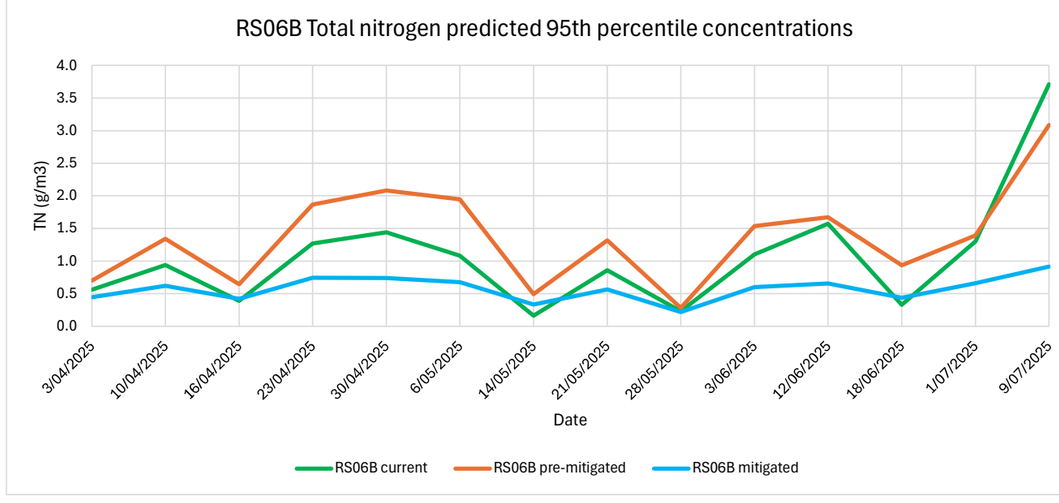
*Mitigated dilutions based on diversion flow of 2500 L/s

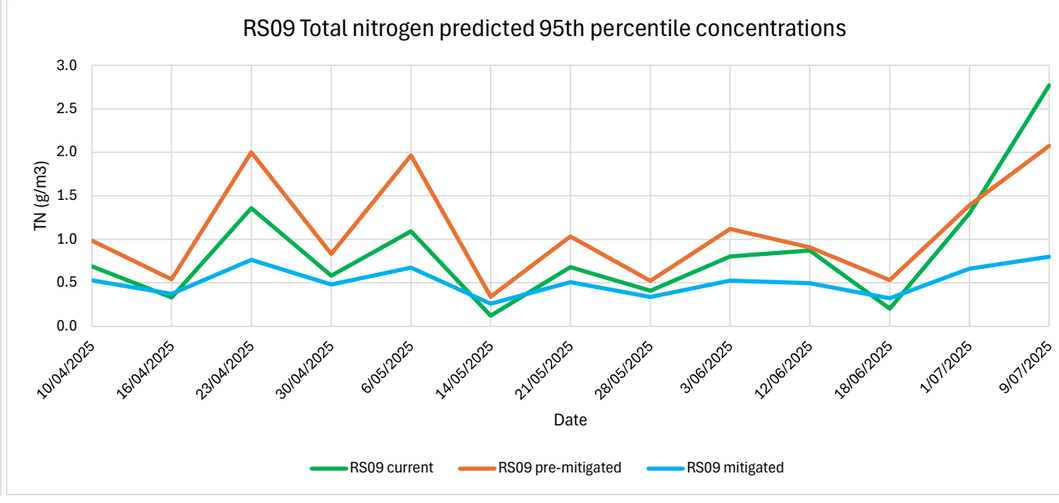
**Based on median TN of 10 g/m^3

***Based on 95th percentile TN of 20 g/m^3









Proposed activity Nitrate results

Date	Current Nitrate		Current dilution		Mitigated dilution*		(Stage 2 upgrade complete) Predicted pre-mitigated Nitrate median**		(Stage 2 upgrade complete) Predicted pre-mitigated Nitrate 95%ile***		(Stage 2 upgrade complete) Predicted mitigated Nitrate median**		(Stage 2 upgrade complete) Predicted mitigated Nitrate 95%ile***	
Location	**RS06B**	**RS09**	**RS06B**	**RS09**	**RS06B**	**RS09**	**RS06B**	**RS09**	**RS06B**	**RS09**	**RS06B**	**RS09**	**RS06B**	**RS09**
Unit	**g/m^3**	**g/m^3**					**g/m^3**	**g/m^3**	**g/m^3**	**g/m^3**	**g/m^3**	**g/m^3**	**g/m^3**	**g/m^3**
3/04/2025	0.16	0.01	0.035	-	0.022	-	0.28	-	0.53	-	0.18	-	0.33	-
10/04/2025	0.15	0.14	0.067	0.049	0.031	0.026	0.54	0.39	1.01	0.74	0.25	0.21	0.46	0.40
16/04/2025	0.09	0.09	0.032	0.027	0.021	0.019	0.26	0.22	0.48	0.40	0.17	0.15	0.31	0.28
23/04/2025	0.26	0.16	0.093	0.100	0.037	0.038	0.75	0.80	1.40	1.50	0.30	0.31	0.56	0.57
30/04/2025	0.35	0.23	0.104	0.042	0.037	0.024	0.83	0.33	1.56	0.62	0.30	0.19	0.55	0.36
6/05/2025	0.31	0.30	0.097	0.098	0.034	0.034	0.78	0.79	1.46	1.47	0.27	0.27	0.51	0.51
14/05/2025	0.16	0.12	0.025	0.017	0.017	0.013	0.20	0.14	0.37	0.26	0.13	0.10	0.25	0.19
21/05/2025	0.18	0.14	0.066	0.052	0.028	0.025	0.53	0.41	0.99	0.77	0.23	0.20	0.43	0.38
28/05/2025	0.22	0.09	0.014	0.026	0.011	0.017	0.11	0.21	0.21	0.39	0.09	0.13	0.16	0.25
3/06/2025	0.25	0.19	0.077	0.056	0.030	0.026	0.62	0.45	1.15	0.84	0.24	0.21	0.45	0.39
12/06/2025	0.32	0.21	0.084	0.045	0.033	0.025	0.67	0.36	1.25	0.68	0.26	0.20	0.49	0.37
18/06/2025	0.33	0.20	0.047	0.027	0.022	0.016	0.38	0.21	0.70	0.40	0.17	0.13	0.33	0.24
1/07/2025	0.25	0.24	0.070	0.070	0.033	0.033	0.56	0.56	1.04	1.04	0.26	0.26	0.50	0.50
9/07/2025	0.51	0.37	0.154	0.104	0.046	0.040	1.23	0.83	2.31	1.56	0.37	0.32	0.69	0.60
NPSFM National Bottom Line nitrate toxicity limits							**2.4**		**3.5**		**2.4**		**3.5**	

Notes:

Definitions in this context:

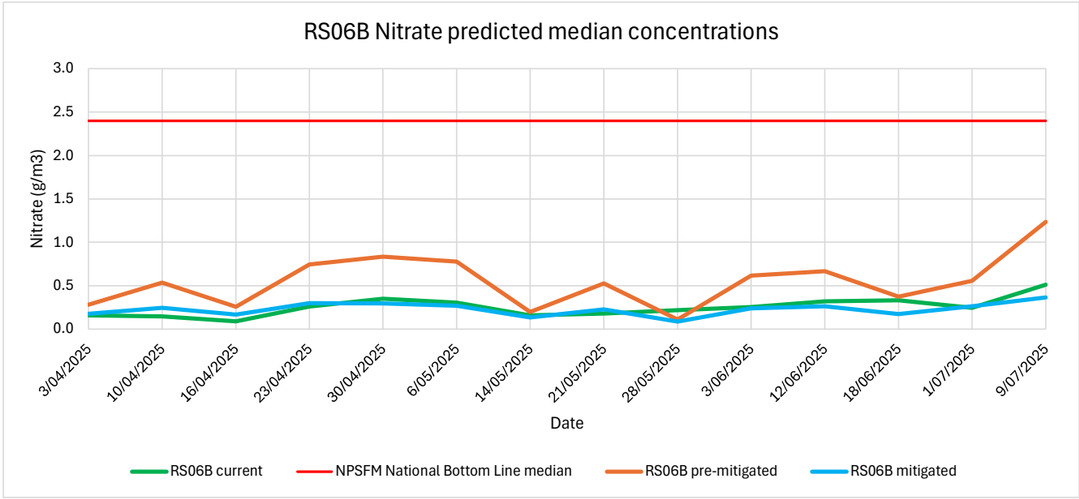
Pre-mitigated - refers to predicted concentrations after Stage 2 upgrades have been completed, but not including river flow diversion.

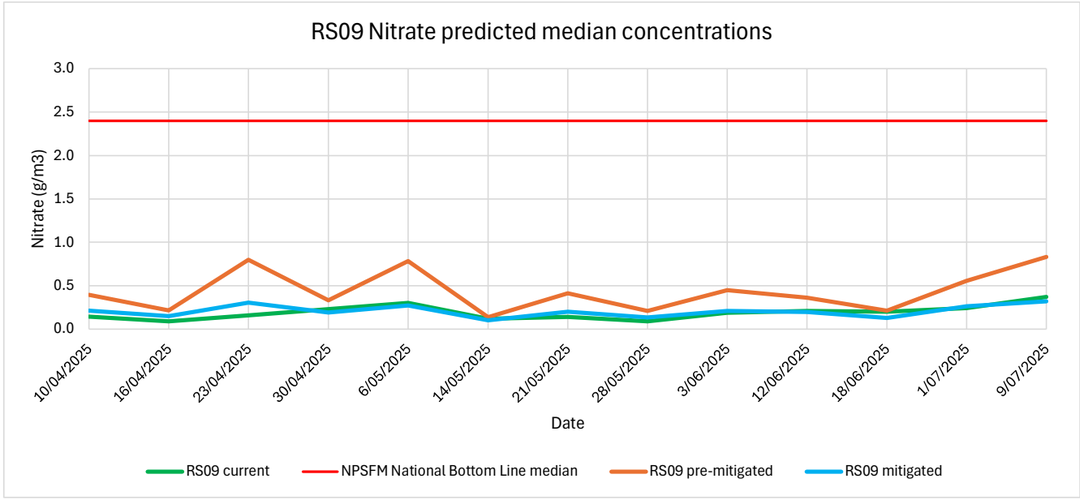
Mitigated - refers to predicted concentrations after Stage 2 upgrades have been completed, including river flow diversion.

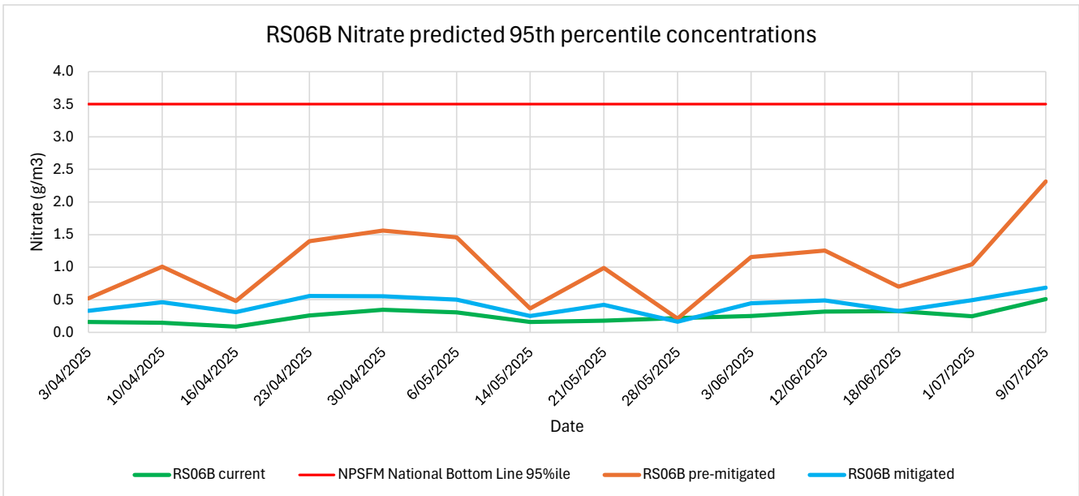
*Mitigated dilutions based on diversion flow of 2500 L/s

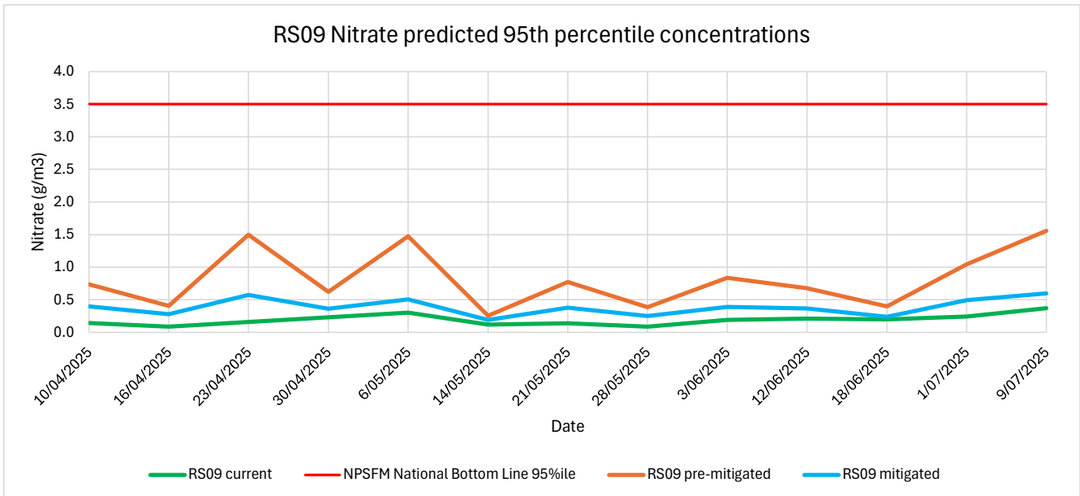
**Based on median nitrate of 8.0 g/m^3

***Based on 95th percentile nitrate of 15 g/m^3









Ammoniacal Nitrogen (AmmN): Comparison with ORP Schedule 15

Date	Current AmmN		Current dilution		Mitigated dilution*		(Stage 2 upgrade complete) Predicted pre-mitigated AmmN 80%ile** (pH 8 at 20°C)		(Stage 2 upgrade complete) Predicted mitigated AmmN 80%ile** (pH 8 at 20°C)	
Location	**RS06B**	**RS09**	**RS06B**	**RS09**	**RS06B**	**RS09**	**RS06B**	**RS09**	**RS06B**	**RS09**
Unit	**g/m^3**	**g/m^3**					**g/m^3**	**g/m^3**	**g/m^3**	**g/m^3**
3/04/2025	0.33	0.005	0.035	-	0.022	-	0.050	-	0.032	-
10/04/2025	0.55	0.39	0.067	0.049	0.031	0.026	0.097	0.071	0.044	0.038
16/04/2025	0.21	0.18	0.032	0.027	0.021	0.019	0.046	0.039	0.030	0.027
23/04/2025	0.65	0.29	0.093	0.100	0.037	0.038	0.134	0.144	0.054	0.055
30/04/2025	0.75	0.25	0.104	0.042	0.037	0.024	0.150	0.060	0.053	0.035
6/05/2025	0.58	0.58	0.097	0.098	0.034	0.034	0.140	0.141	0.048	0.049
14/05/2025	0.01	<0.01	0.025	0.017	0.017	0.013	0.035	0.024	0.024	0.019
21/05/2025	0.47	0.4	0.066	0.052	0.028	0.025	0.095	0.074	0.041	0.036
28/05/2025	0.47	0.24	0.014	0.026	0.011	0.017	0.020	0.037	0.016	0.024
3/06/2025	0.56	0.39	0.077	0.056	0.030	0.026	0.111	0.081	0.043	0.038
12/06/2025	0.86	0.49	0.084	0.045	0.033	0.025	0.120	0.065	0.047	0.036
18/06/2025	0.01	<0.01	0.047	0.027	0.022	0.016	0.068	0.038	0.031	0.023
1/07/2025	0.75	0.70	0.070	0.070	0.033	0.033	0.100	0.100	0.048	0.048
9/07/2025	1.28	0.85	0.154	0.104	0.046	0.040	0.222	0.149	0.066	0.058
Otago Regional Plan: Schedule 15 limit							**0.1**		**0.1**	

Notes:

Definitions in this context:

Pre-mitigated - refers to predicted concentrations after Stage 2 upgrades have been completed, but not including river flow diversion.

Mitigated - refers to predicted concentrations after Stage 2 upgrades have been completed, including river flow diversion.

*Mitigated dilutions based on diversion flow of 2500 L/s

**Based on 80th percentile AmmN (pH 8 at 20°C) of 1.44 g/m^3

Dissolved Reactive Phosphorus (DRP): Comparison with ORP Schedule 15

Date	Current DRP		Current dilution		Mitigated dilution*		(Stage 2 upgrade complete) Predicted pre-mitigated DRP 80%ile**		(Stage 2 upgrade complete) Predicted mitigated DRP 80%ile**	
Location	**RS06B**	**RS09**	**RS06B**	**RS09**	**RS06B**	**RS09**	**RS06B**	**RS09**	**RS06B**	**RS09**
Unit	**g/m^3**	**g/m^3**					**g/m^3**	**g/m^3**	**g/m^3**	**g/m^3**
3/04/2025	0.059	<0.002	0.035	-	0.022	-	0.044	-	0.028	-
10/04/2025	0.098	0.073	0.067	0.049	0.031	0.026	0.084	0.062	0.039	0.033
16/04/2025	0.034	0.03	0.032	0.027	0.021	0.019	0.040	0.034	0.026	0.023
23/04/2025	0.141	0.05	0.093	0.100	0.037	0.038	0.117	0.125	0.047	0.048
30/04/2025	0.109	0.05	0.104	0.042	0.037	0.024	0.130	0.052	0.046	0.030
6/05/2025	0.099	0.101	0.097	0.098	0.034	0.034	0.122	0.123	0.042	0.042
14/05/2025	0.004	0.004	0.025	0.017	0.017	0.013	0.031	0.021	0.021	0.016
21/05/2025	0.077	0.063	0.066	0.052	0.028	0.025	0.082	0.064	0.035	0.032
28/05/2025	0.094	0.046	0.014	0.026	0.011	0.017	0.018	0.033	0.013	0.021
3/06/2025	0.089	0.062	0.077	0.056	0.030	0.026	0.096	0.070	0.037	0.033
12/06/2025	0.122	0.067	0.084	0.045	0.033	0.025	0.105	0.057	0.041	0.031
18/06/2025	0.106	0.065	0.047	0.027	0.022	0.016	0.059	0.033	0.027	0.020
1/07/2025	0.136	0.124	0.070	0.070	0.033	0.033	0.087	0.087	0.041	0.041
9/07/2025	0.193	0.127	0.154	0.104	0.046	0.040	0.193	0.130	0.057	0.050
Otago Regional Plan: Schedule 15 limit							**0.01**		**0.01**	

Notes:

Definitions in this context:

Pre-mitigated - refers to predicted concentrations after Stage 2 upgrades have been completed, but not including river flow diversion.

Mitigated - refers to predicted concentrations after Stage 2 upgrades have been completed, including river flow diversion.

*Mitigated dilutions based on diversion flow of 2500 L/s

**Based on 80th percentile DRP (pH 8 at 20°C) of 1.25 g/m^3

Nitrate: Comparison with ORP Schedule 15

Date	Current Nitrate		Current dilution		Mitigated dilution*		(Stage 2 upgrade complete) Predicted pre-mitigated Nitrate 80%ile**		(Stage 2 upgrade complete) Predicted mitigated Nitrate 80%ile**	
Location	RS06B	RS09	RS06B	RS09	RS06B	RS09	RS06B	RS09	RS06B	RS09
Unit	g/m^3	g/m^3					g/m^3	g/m^3	g/m^3	g/m^3
3/04/2025	0.16	0.01	0.035	-	0.022	-	0.32	-	0.20	-
10/04/2025	0.15	0.14	0.067	0.049	0.031	0.026	0.60	0.44	0.28	0.24
16/04/2025	0.09	0.09	0.032	0.027	0.021	0.019	0.29	0.24	0.19	0.17
23/04/2025	0.26	0.16	0.093	0.100	0.037	0.038	0.84	0.90	0.33	0.34
30/04/2025	0.35	0.23	0.104	0.042	0.037	0.024	0.94	0.37	0.33	0.22
6/05/2025	0.31	0.30	0.097	0.098	0.034	0.034	0.88	0.88	0.30	0.30
14/05/2025	0.16	0.12	0.025	0.017	0.017	0.013	0.22	0.15	0.15	0.12
21/05/2025	0.18	0.14	0.066	0.052	0.028	0.025	0.59	0.46	0.26	0.23
28/05/2025	0.22	0.09	0.014	0.026	0.011	0.017	0.13	0.23	0.10	0.15
3/06/2025	0.25	0.19	0.077	0.056	0.030	0.026	0.69	0.50	0.27	0.24
12/06/2025	0.32	0.21	0.084	0.045	0.033	0.025	0.75	0.41	0.30	0.22
18/06/2025	0.33	0.20	0.047	0.027	0.022	0.016	0.42	0.24	0.20	0.14
1/07/2025	0.25	0.24	0.070	0.070	0.033	0.033	0.63	0.63	0.30	0.30
9/07/2025	0.51	0.37	0.154	0.104	0.046	0.040	1.39	0.93	0.41	0.36
Otago Regional Plan: Schedule 15 limit							**0.075**		**0.075**	

Notes:

Definitions in this context:

Pre-mitigated - refers to predicted concentrations after Stage 2 upgrades have been completed, but not including river flow diversion.

Mitigated - refers to predicted concentrations after Stage 2 upgrades have been completed, including river flow diversion.

*Mitigated dilutions based on diversion flow of 2500 L/s

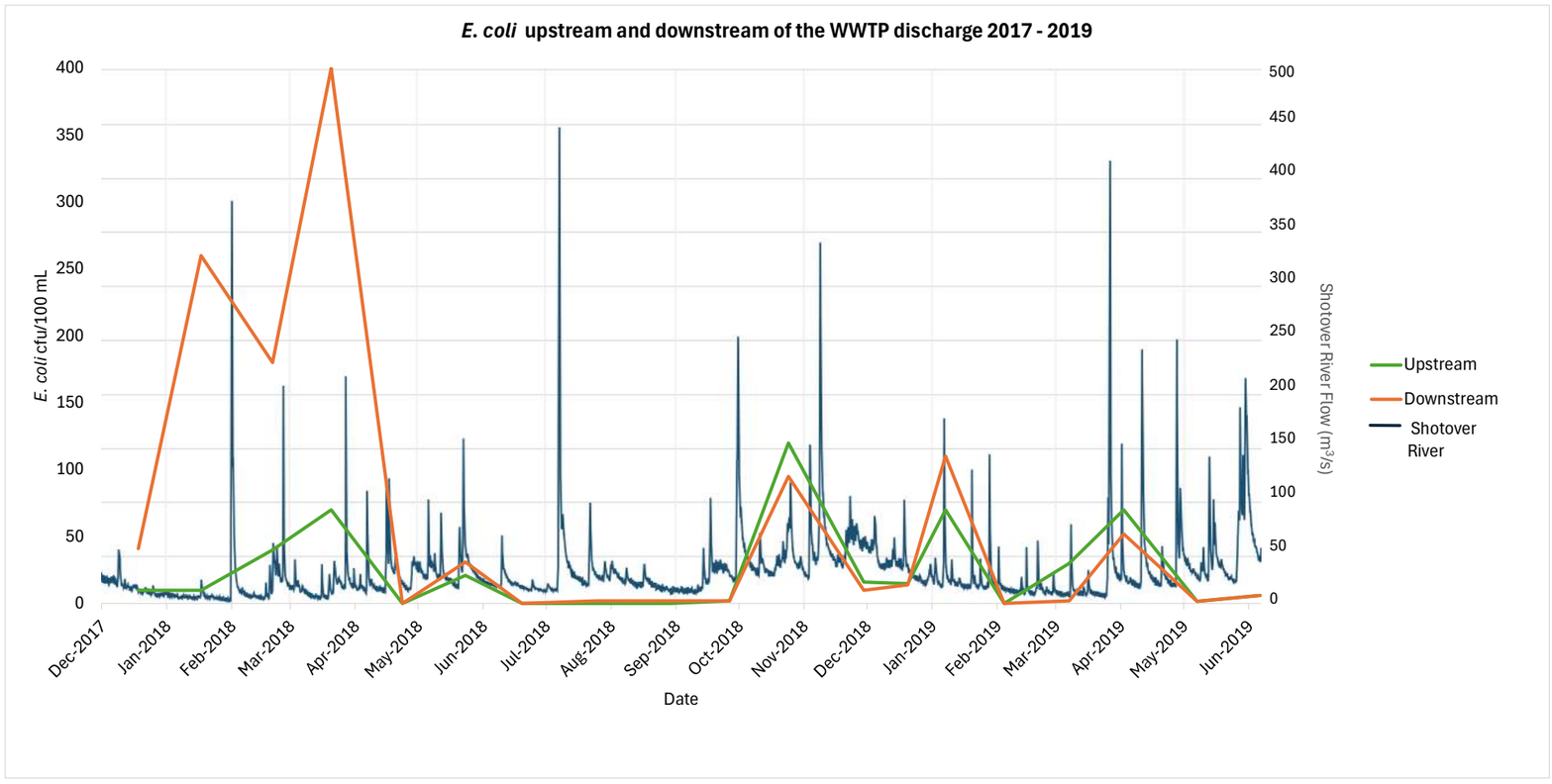
**Based on 80th percentile nitrate (pH 8 at 20°C) of 9.0 g/m^3

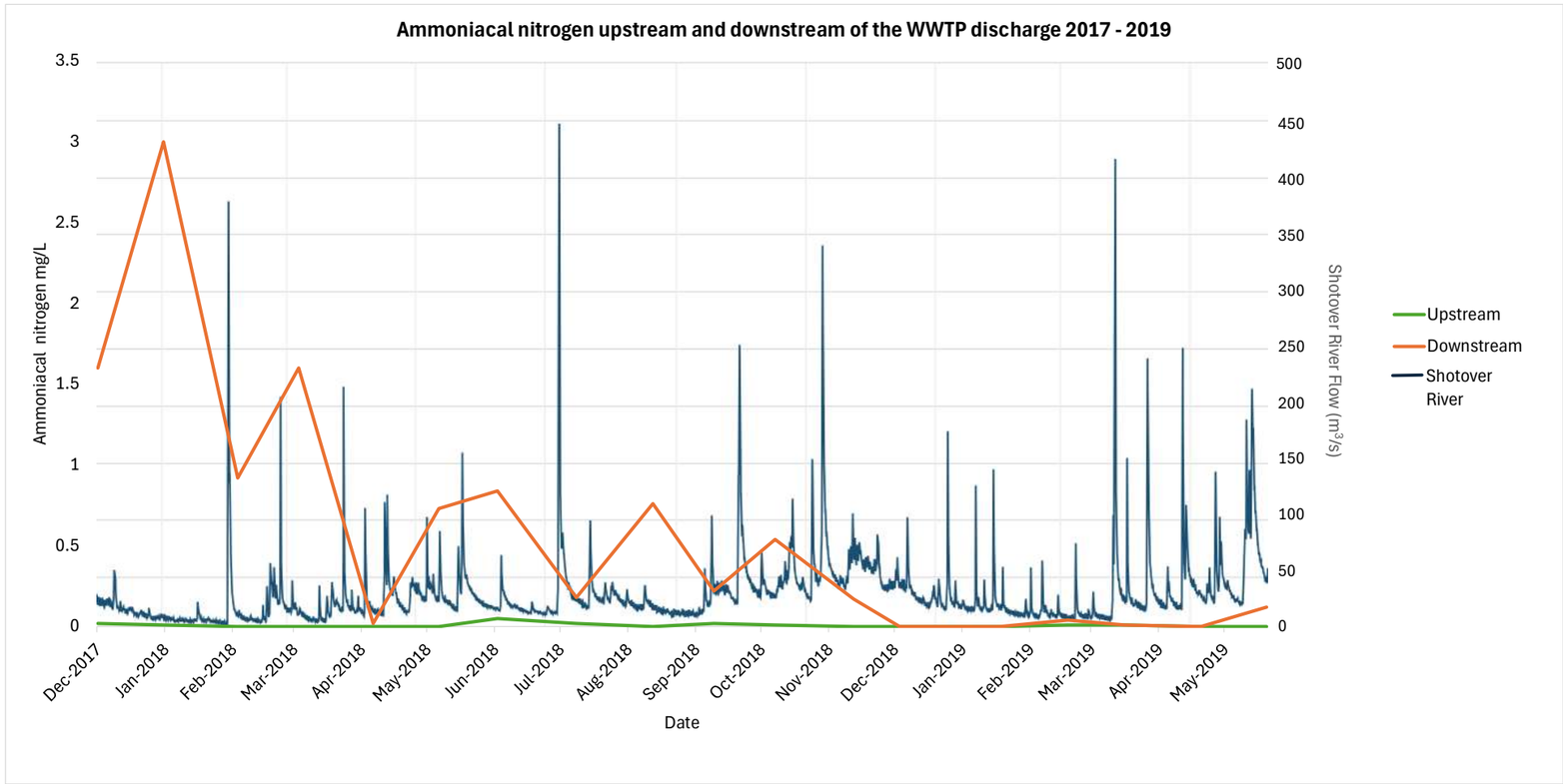
Appendix C

2017-2019 Data and graphs

Shotover River historical data 2017 - 2019

Parameters	Date	18/12/2017	17/01/2018	20/02/2018	20/03/2018	23/04/2018	23/05/2018	19/06/2018	25/07/2018	29/08/2018	26/09/2018	24/10/2018	29/11/2018	20/12/2018	7/01/2019	4/02/2019	7/03/2019	2/04/2019	7/05/2019	6/06/2019	Min.	Max.	Mean	Median	95th percentile
	Unit																								
50m UPSTREAM																									
Ammoniacal Nitrogen (as N)	**mg/L**	0.02	0.01	<0.01	<0.01	<0.01	<0.4	0.05	0.02	<0.01	0.02	0.01	<0.01	<0.01	<0.4	<0.4	0.01	0.01	<0.4	<0.01	0.01	0.05	0.02	0.02	0.04
CBOD5	**mg/L**	<2.0	<2	<2	<2	<2	<0.5	<2	<2	<2	<2	<2	<2	2.7	0.66	<0.5	<2.0	<2.0	0.74	3.4	0.66	3.4	1.88	1.72	3.30
pH (at room temp c. 20 °C)	**pH unit**	7.99	8.01	8.04	7.94	7.99	7.6	7.88	7.83	7.89	7.83	7.75	7.8	7.88	7.9	7.9	8.19	7.91	7.8	7.65	7.6	8.19	7.88	7.89	8.06
Total Nitrogen (as N)	**mg/L**	0.05	0.03	0.1	0.03	0.06	0.11	0.08	0.03	0.03	0.12	0.02	0.07	0.04	0.037	0.032	0.04	0.11	0.057	0.39	0.02	0.39	0.08	0.05	0.15
Total Phosphorus (as P)	**mg/L**	<0.01	<0.01	<0.01	0.02	0.03	0.059	0.02	0.1	0.02	0.02	0.04	0.08	0.04	0.018	0.035	0.04	0.02	0.02	0.02	0.018	0.1	0.04	0.03	0.09
Total Suspended Solids	**mg/L**	4.2	2.5	13	160	54	400	46	150	42	32	110	120	84	190	50	64	120	33	32	2.5	400	89.8	54.0	211.0
E. coli	**cfu/100 mL**	10	10	40	70	<1	21	<2	<2	<1	2	120	16	15	70	<1.6	30	70	1.6	6	1.6	120	34.4	18.5	87.5
50m DOWNSTREAM																									
Ammoniacal Nitrogen (as N)	**mg/L**	1.6	3	0.92	1.6	0.02	0.73	0.84	0.18	0.76	0.22	0.54	0.17	<0.01	<0.4	<0.4	0.04	0.01	<0.4	0.12	0.01	3	0.72	0.54	2.02
CBOD5	**mg/L**	2.1	2.4	<2	<2	<2	0.66	<2	<2	<2	<2	<2	<2	2.6	<0.5	<0.5	<2.0	<2.0	0.58	<2.0	0.58	2.6	1.67	2.10	2.56
pH (at room temp c. 20 °C)	**pH unit**	7.76	7.73	7.88	7.72	7.69	7.7	7.65	7.78	7.96	7.8	7.63	7.8	7.73	7.77	8	8.11	7.86	7.9	7.67	7.63	8.11	7.80	7.77	8.01
Total Nitrogen (as N)	**mg/L**	3.1	6.6	1.6	1.8	0.53	1.3	1.8	0.36	1.1	0.48	0.94	0.38	0.09	0.45	0.037	0.05	0.015	0.075	0.29	0.015	6.6	1.11	0.48	3.45
Total Phosphorus (as P)	**mg/L**	1.1	2.1	0.58	0.51	0.36	0.29	0.46	0.15	0.21	0.07	0.19	0.151	0.05	0.031	0.077	0.03	0.03	0.023	0.04	0.023	2.1	0.34	0.15	1.20
Total Suspended Solids	**mg/L**	5.1	5.5	150	120	51	320	23	110	19	25	92	150	83	290	140	41	130	30	81	5.1	320	98.2	83.0	293.0
E. coli	**cfu/100 mL**	41	260	180	400	<10	31	<2	2	2	2	95	10	14	110	<1.6	2	52	1.6	6	1.6	400	75.5	22.5	295.0




Ammoniacal nitrogen upstream and downstream of the WWTP discharge 2017 - 2019
Ammoniacal nitrogen mg/L
Shotover River Flow (m3/s)
Date
Upstream
Downstream
Shotover River
Total nitrogen upstream and downstream of the WWTP discharge 2017 - 2019
Total nitrogen mg/L
Shotover River Flow (m3/s)
Date
Upstream
Downstream
Shotover River

Appendix D

Figures

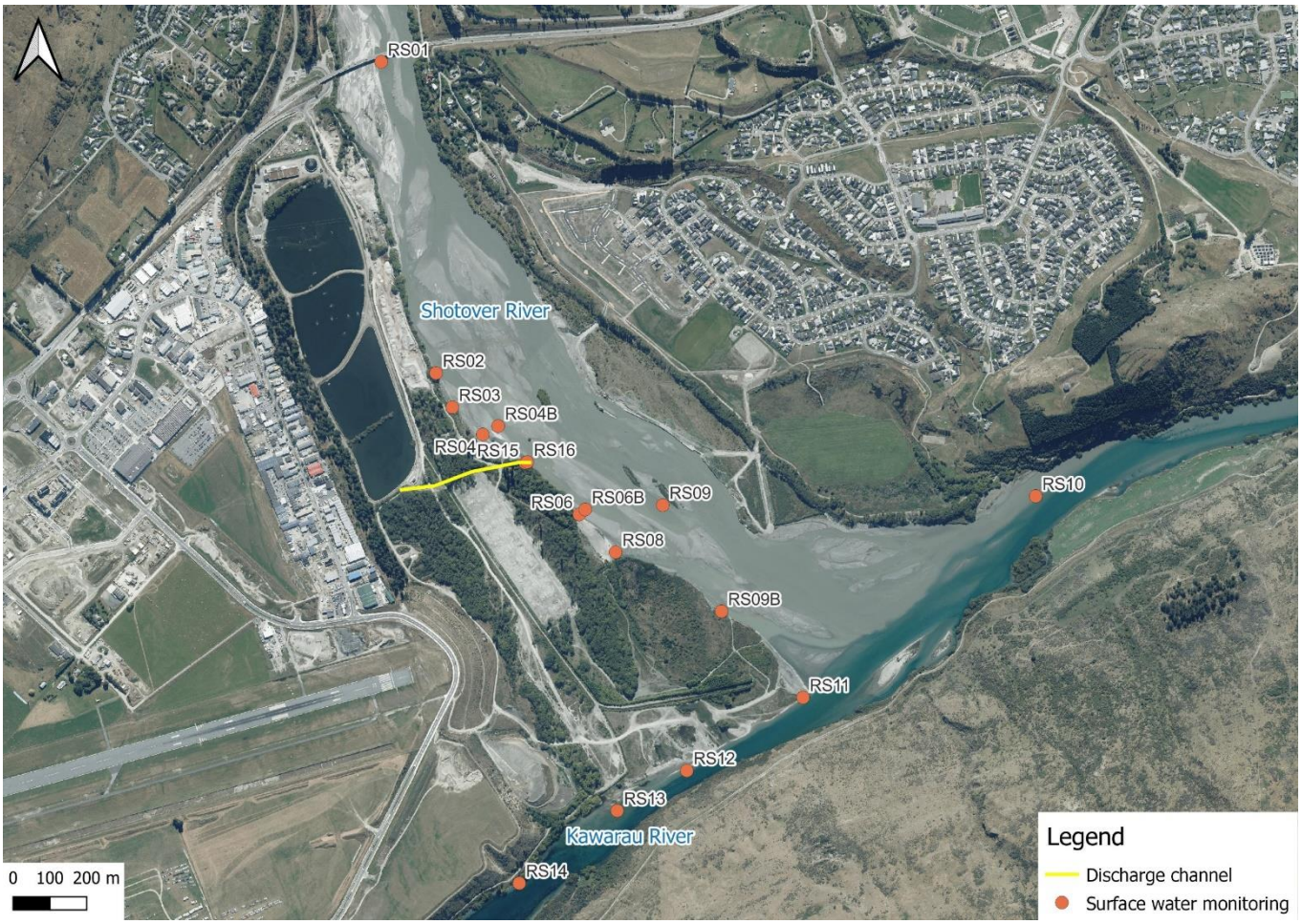


Figure D.1 ***Surface water monitoring locations as listed in Table 3.8 in Shotover WWTP Surface water and groundwater assessment***

Project name		Shotover WWTP Disposal Field Alternative Discharge					
Document title		Report | RM25.206 & RM25.177 Response to S92 questions					
Project number		12645246					
File name		12645246 Response to S92 questions					
Status Code	**Revision**	**Author**	**Reviewer**		**Approved for issue**		
			Name	**Signature**	**Name**	**Signature**	**Date**
S4	P01	Alice Hales, Dusk Mains	Anthony Kirk	On file	Ian Ho	On file	12/08/25
S4	P02	Alice Hales, Dusk Mains	Anthony Kirk	On file	Ian Ho	On file	13/08/25

GHD Limited
Contact: Dusk Mains, Technical Lead - Hydrogeology | GHD
27 Napier Street, GHD Centre Level 3
Freemans Bay, Auckland 1010, New Zealand
T +64 9 370 8000 | **F** +64 9 370 8001 | **E** aklmail@ghd.com | **ghd.com**

Appendix B: River Protection and Diversion – Authored by GHD

Report

August 13, 2025

To	Andrew Hill (QLDC)	**Contact No.**	
Copy to	Helen Barclay	**Email**	ali.ghavidel@ghd.com
From	Ali Ghavidel, Ian Ho, Anthony Kirk	**Project No.**	12645246
Project Name	Shotover WWTP Disposal Field Alternative Discharge		
Subject	Shotover River Protection and Diversion at Discharge Channel – Response to S92 Queries		

1. Introduction and summary

Queenstown Lakes District Council (QLDC) has sought consents from the Otago Regional Council (ORC) to discharge treated wastewater to the Shotover River / Kimiākau via an existing discharge channel for five years while a long-term disposal solution is developed. Subsequently, ORC has requested further information (a Section 92 (S92) request) regarding aspects of the applications.

This Short Report provides a summary of the concept design developed in response to the Section 92 (S92) request under the Resource Management Act (RMA), relating to the proposed temporary discharge of treated effluent from Queenstown's Shotover Wastewater Treatment Plant into the Shotover River. The discharge will occur while a long-term alternative disposal solution is being explored and implemented.

The responses to the relevant S92 queries relating to the proposed river diversion strategy are summarised in Table 1 below:

Table 1 Responses to S92 queries related to the river protection and diversion system

Section	No.	Question	Response
RM25.206: Discharge of treated wastewater and associated works	15	*The following information is requested to validate the technical information provided to support the application for works in the bed of the Shotover River/Kimiākau to construct an outfall structure. Please provide:* *a. plans or schematics of the discharge outlet structure.*	The outlet structure comprises gabion walls, gabion baskets and a riprap basin in front of the discharge channel. Please refer to Sections 3 and 4 for further details and Figure 3 and Figure 4 for a schematic design of the outlet structure.
		b. a description of how construction will be undertaken (i.e: will it require dewatering of the area and will fish salvage be required).	The proposed features interfere minimally with the river system and its habitats. No dewatering and fish salvage is deemed required. Refer to Section 6 for the high-level construction methodology.
RM25.177: Works in the bed for diversion of flow	1	*The Application document does not specify a maximum flow rate intended to be diverted within the Shotover River/Kimiākau. It is understood from the Surface Water and Groundwater Assessment, dated 30 April 2025 prepared by GHD and submitted in support of RM25.206 that is intended*	The diversion flow target is 2.5 m³/s. Refer to Section 4 for details of the hydraulic capacity of the proposed diverting system. Further explanation of the proposed diversion is given below: - The proposed method for diversion is via excavating a shallow channel tying into the

Section	No.	Question	Response
		to direct up to 2m³/s of water past the discharge point. A diversion of this scale represents approximately 11% of the Mean Annual Low Flow (MALF) of the Shotover River/Kimiākau. *a. Please confirm what the design flow rate is anticipated as a result of the diversion and the likely maximum flow rate.*	existing levels at the nearby braid for a relatively short length (400m, approx.) and returning the flow back to the river after diluting the treated effluent discharge. - The diversion flow is proportional to the available head at the river braid; a higher head results in a greater diverted flow rate. Preliminary calculations indicate that when the flow within the braid is approximately 22 m³/s, the diverted flow approaches the target of 2.5 m³/s, this representing about 10% of the total river flow. The availability of sufficient flow in the braid to achieve the target diversion, depends on the river morphology, which can change over time. - Flow in the adjacent flowing braid, which provides dilution downstream of the discharge, will be maintained to no less than 1 m³/s by locally lowering the true right-hand side wall of the braid by approximately 300-400mm and reshaping its cross-section. As the braid changes over time, these works would be undertaken as needed to ensure sufficient mixing is occurring within the reasonable mixing zone (up to 200 m downstream of the discharge). - Ongoing reinstatements will take the form of routine maintenance, with the required volumes depending on the river's condition at the time of the works - Further assessment and mitigation measures will be addressed by more detailed survey, hydrometric measurements and adjusting the geometry of the diversion system during the detailed design.
	2	*The Application proposes a year-round diversion of an unspecified flow rate. The Surface Water and Groundwater Assessment, dated 30 April 2025 prepared by GHD and submitted in support of RM25.206 highlights that while the plant upgrade is expected to significantly reduce the visible influence of the discharge, the pooling of treated wastewater adjacent to the riverbank under very low flow conditions is proposed to be reduced by the proposed diversion. Based on the maximum flow rate proposed in response to Question (1) please provide an assessment of:* *a. Effects on hydrology, morphology and erosion of the bed and bank arising from the proposed diversion of water at the maximum flow rate, including an assessment of effects on the Council's Training Line.*	The proposed work involves excavating a shallow diversion channel from the nearby braid, starting approximately 310m upstream, and tying back into the existing level downstream of the discharge channel, as shown in Figure 5. Reshaping the nearby braid's cross section will further enhance the spread of the flow towards the outlet structure to provide the desired flow rate for diluting the treated effluent. This will be part of maintenance activities. Refer to Section 4 for more detailed description about the proposed diversion strategy. In summary: - This method allows part of the river flow to be diverted to the mixing basin in front of the discharge channel outlet structure, prior to returning to the braid. - The proposed rock riprap or rock bags will be sufficient to protect the riverbed. The highly porous nature of the riprap will allow the flow to spread into the mixing basin. The flexible nature of these features is consistent with the unpredictable nature of a braided river. - If, during low-flow conditions, the target flow rate of approximately 2.5 m³/s is not achieved, this may require deepening and widening the diversion channel, along with local reshaping of the nearby braid to allow

Section	No.	Question	Response
			more flow to spread towards the dilution basin. - There is no anticipated adverse impact on the training line as the diversion works are not close to the training line.

1.1 Purpose of this memorandum

This memorandum describes a preliminary conceptual design for the proposed protective works to be installed at the treated effluent discharge point to the Shotover River, which is intended to provide a temporary solution until a long-term disposal solution is progressed and implemented. This memorandum is intended to be appended to the S92 response collated by LandPro on behalf of QLDC.

1.2 Scope and limitations

This report: has been prepared by GHD for Queenstown Lake District Council (QLDC) and may only be used and relied on by Queenstown Lake District Council (QLDC) for the purpose agreed between GHD and Queenstown Lake District Council (QLDC) as set out in section 1.1 of this report.

GHD otherwise disclaims responsibility to any person other than Queenstown Lake District Council (QLDC) arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report (refer section(s) 1.3 of this report). GHD disclaims liability arising from any of the assumptions being incorrect.

GHD has prepared this memorandum on the basis of information provided by the Client and others who provided information to GHD (which may also include Government authorities), which GHD has not independently verified or checked for the purpose of this memorandum. GHD does not accept liability in connection with such unverified information, including errors and omissions in the memorandum which were caused by errors or omissions in that information.

1.3 Assumptions

The key assumptions are as follows:

- The location and geometry of the river cross-section and the nearby braid are based on the available survey data from a limited number of cross-sections, as well as recent and historical aerial imagary.
- No survey data along the riverbed is available. Consequently, it is assumed that the river slope is linear and constant between the surveyed sections.
- No water surface and flow measurements at the area of the project is available. The flow rates in this report are estimated using Manning equation. Roughness values are obtained from the descriptive sources including NZBC E1.
- Other assumptions as stated and described in the different sections in this report.

2. Project overview and objectives

The proposed discharge utilises an existing earth channel, which is reinstated and modified through minor earthworks to meet the hydraulic and environmental performance required for a temporary discharge with a nominated flow rate of 400 L/s. This discharge is understood to be an interim measure until the long term infrastructure becomes operational.

The Shotover River is a braided river, and its geomorphology and hydraulic characteristics are likely to change over time, especially following flood events. The geomorphology of the river has a distinguishable natural curvature with the concavity on the side of the discharge channel. The river cross sections at 11 different locations were surveyed in 2024 (Landpro). Section 'XSect MWD4' is the closest one to the location of the discharge channel, and its data has been used in this assessment (Figure 1).

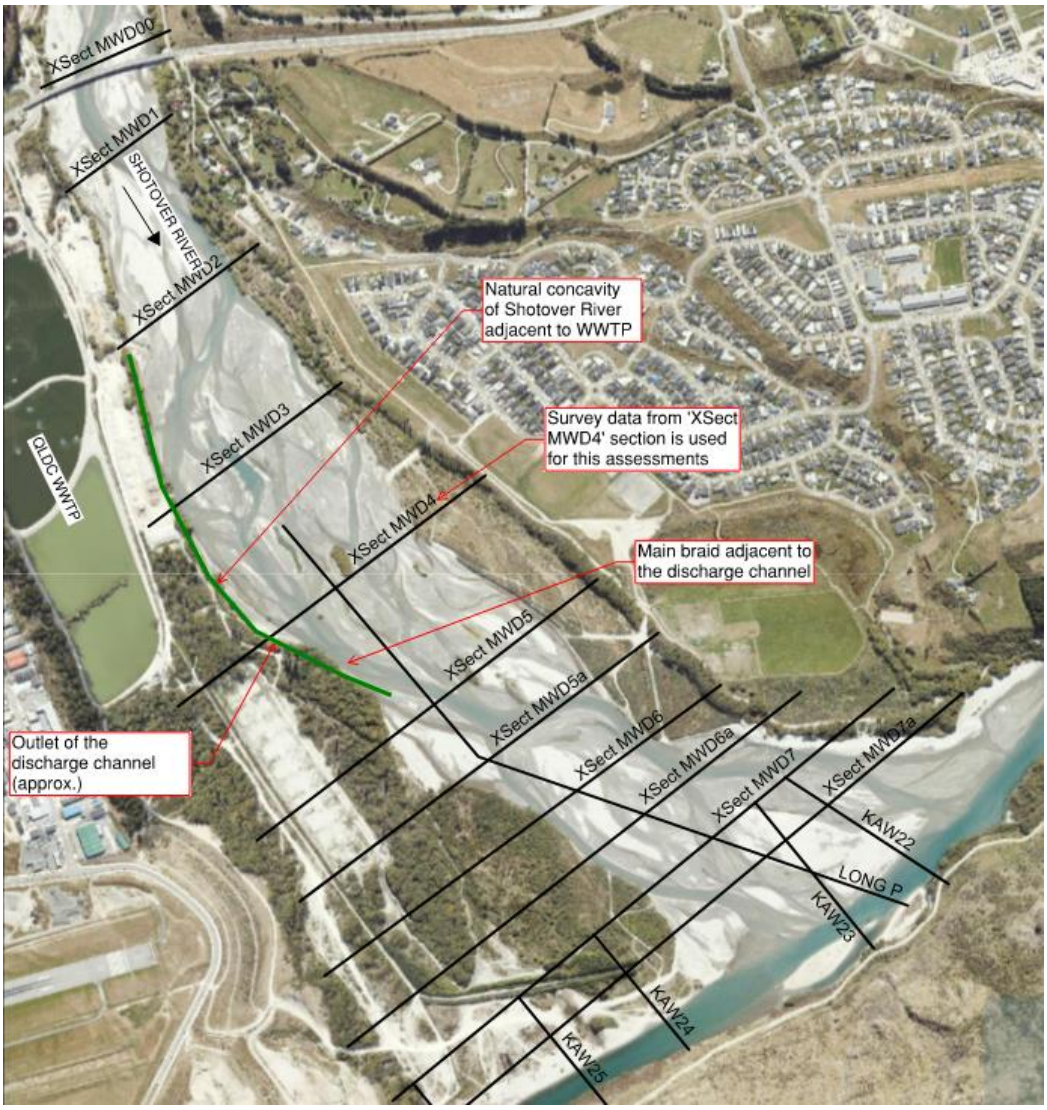


Figure 1 Shotover River and the key geomorphological features around the discharge channel

The WWTP treated effluent from the UV system discharges through an existing channel, which has been reshaped to restore its cross-section and flow capacity. The existing discharge channel has a bottom width of approximately 1.0m and near-vertical earthen walls with a height of approximately 0.8m. The capacity of this existing discharge channel has been separately assessed (GHD, 2025). The channel outlet is at 298.8 mIL, (approx.) which is roughly 0.8 m higher than the toe of the bank at this location, which is at 298.0 mRL, (approx.). A nearby braid (Figure 1) is formed approximately 10-20m away from the discharge channel. The riverbed has a gentle fall towards the nearby braid. The river has an average longitudinal grade of 0.3 to 0.4% around the discharge channel.

The main components of the discharge system to the river comprise the following:

1. **Discharge channel and erosion protection system**: A tie-in between the existing discharge channel and the river at the discharge point will minimise the risk of erosion and provide a smooth transition between the channel and the river system. Sufficient protection features should also be placed to mitigate the risk of erosion from the effluent discharge to the river system (including the riverbank and riverbed), while also minimising the risk of scour from the river flow to the channel and the proposed erosion control system. These elements collectively form the erosion protection system. The design should establish an equilibrium between low-flow and high-flow conditions within the proposed erosion protection system.
2. **Diversion system**: As part of the discharge consent, the effluent should mix with the river water to achieve dilution and meet water quality criteria within the reasonable mixing zone. This mixing zone is assumed to be within 200 m of the discharge. To ensure sufficient dilution is achieved under low river flow conditions, a diversion of river water directing additional water towards the mixing zone should be provided. The diversion of 2.5 m^3/s is proposed for this purpose. This diversion system, however, should not impose major disturbance to the river's natural flow and hydraulics.
3. **Maintenance of flow**: To ensure a minimum flow of 1 m^3/s in the adjacent flowing braid and achieve sufficient downstream mixing in the reasonable mixing zone (within 200 m of the discharge). These maintenance works would comprise minor lowering of the true right-hand side wall of the flowing braid to maintain flow.

Initial installation of the proposed diversion channel is predicted to require an excavation and redistribution of up to 1,000 m^3 (Refer to Section 6 for a more detailed discussion) of materials in the river environment This memorandum provides a conceptual design for the proposed works.

3. Discharge channel and erosion protection system

The proposed discharge and erosion protection system consists of gabion baskets and a riprap apron. Two arrays of 1500mm high retaining gabion walls will be placed on both sides of the discharge channel to contain the flow and minimise the energy via highly resistive flow paths through the rocks before discharging to the riverbed and riverbanks. A second layer of gabion walls will be configured 500mm offset from the first layer to widen the flow path and reduce the flow velocity and energy. These will retain the channel alignment and resist lateral movement or erosion during higher flow periods.

The bottom of the discharge channel will align with a 500mm high gabion basket falling to the next 500mm high gabion basket cascading the flow smoothly to the riverbed. The second gabion basket will widen the channel to match the side gabion walls.

This cascading gabion structure creates a gradually stepped drop from the discharge channel to the riverbed. This configuration is intended to dissipate flow energy and reduce the velocity of the discharged water, thereby minimising erosion to the riverbed and preventing jetting into the main river stream.

A further layer of protection consists of a rock riprap apron. The apron will extend to the edge of the nearby river braid, 3-4m, approximately. The rock sizes are estimated to be 300mm to 350mm as D_{50} and the thickness of the riprap apron is estimated to be 500mm to 600mm to create a stable layer to withstand the river flow during flood events. A 300mm deep basin at the centre of the riprap apron is proposed to create a mixing environment for diluting the effluent with the river flow. The riprap apron will be extended parallel to the river braid for 3-4m to create a smooth diversion from the braid to the mixing basin in front of the discharge channel. Figure 2 shows the current condition of the riverbank and riverbed at the location of existing discharge channel. Figure 3 and Figure 4 show the cross section and front view of the proposed protection and diversion system.

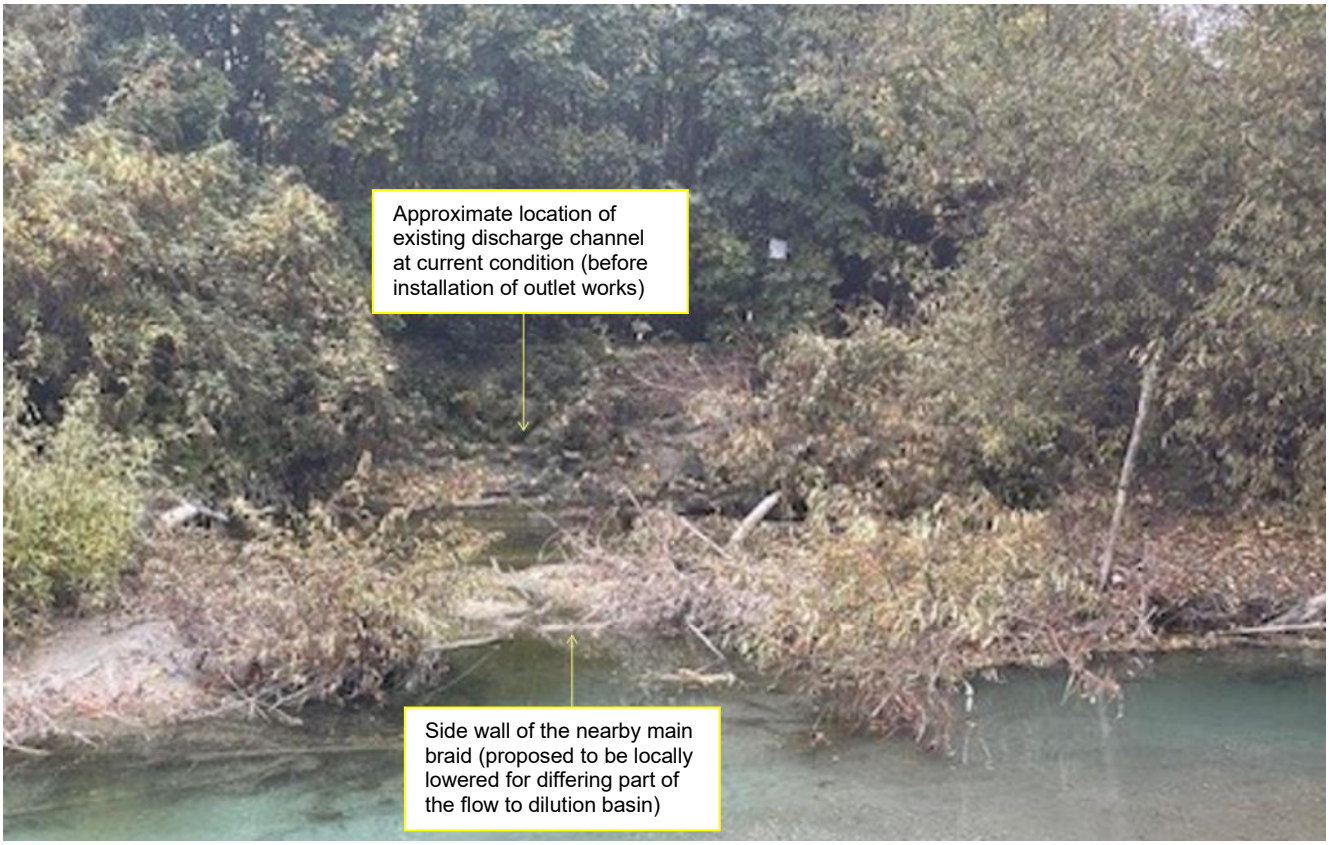


Figure 2 Current condition of Shotover River at the location of existing discharge channel

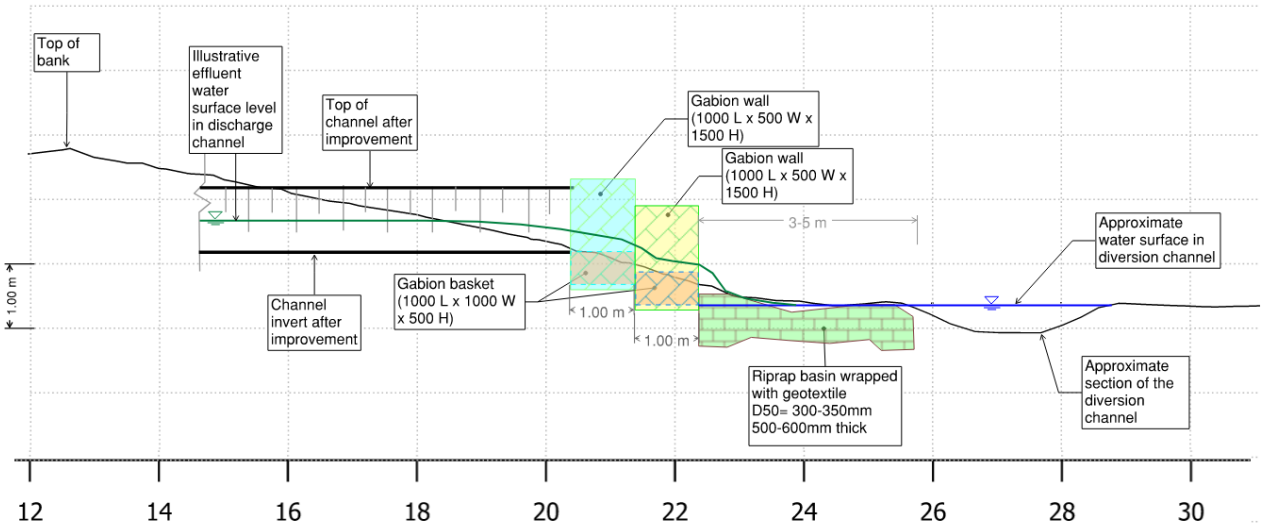


Figure 3 Longitudinal section of the proposed protection and diversion system at the discharge point to Shotover River

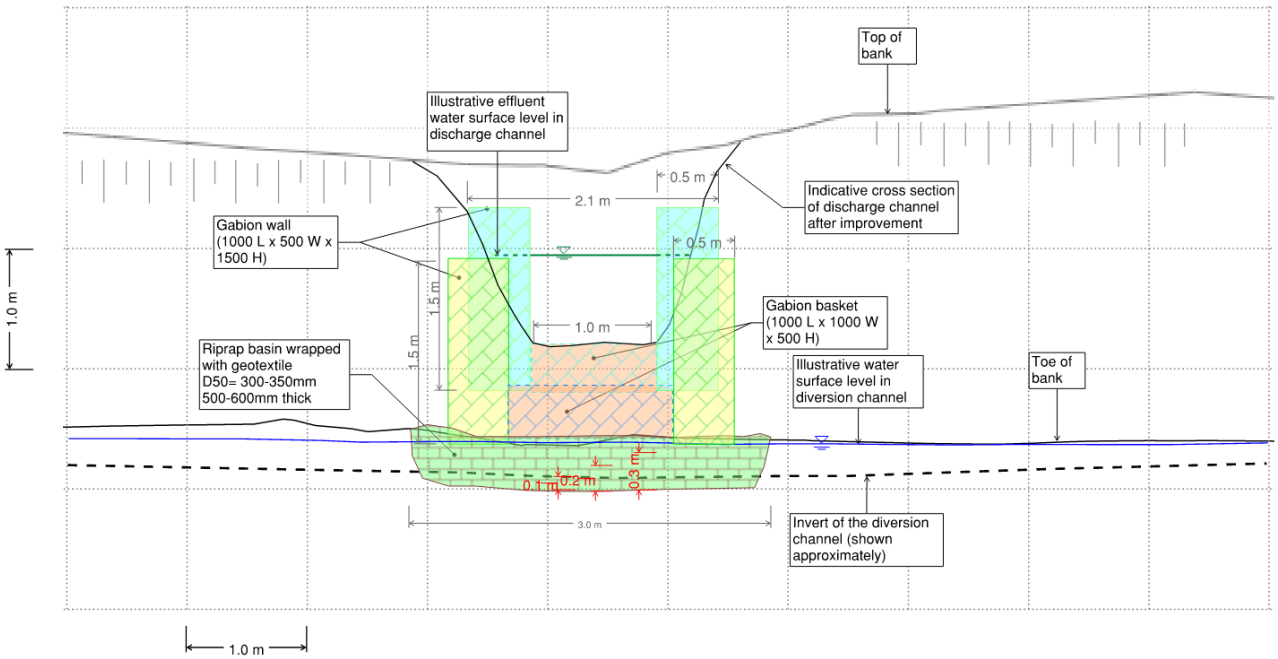


Figure 4 *Front view of the proposed protection and diversion system at the discharge point to Shotover River*

Alternatives to the rock riprap apron are Reno mattresses and rock bags. The selection of the preferred method depends on the site conditions and constructability considerations, and will be determined during the forthcoming design stage.

4. River conditions and proposed diversion strategy

The Shotover River is a braided river and is subject to morphological changes, particularly after high flow events. Survey data confirms the cross-section and slope characteristics at the proposed discharge point; however, the location of the main river channel and braids are continuously changing due to natural river braiding dynamics.

To maximise dilution and reduce environmental effects, the design proposes excavation of a shallow channel to divert the flow from a nearby branch of the braided river, directing additional river water toward the discharge point at riprap basin. This diversion will start approximately 300m upstream of the discharge location and may extend up to approximately 200 m downstream of the same. Figure 5 shows the indicative alignment of the proposed diversion channel.

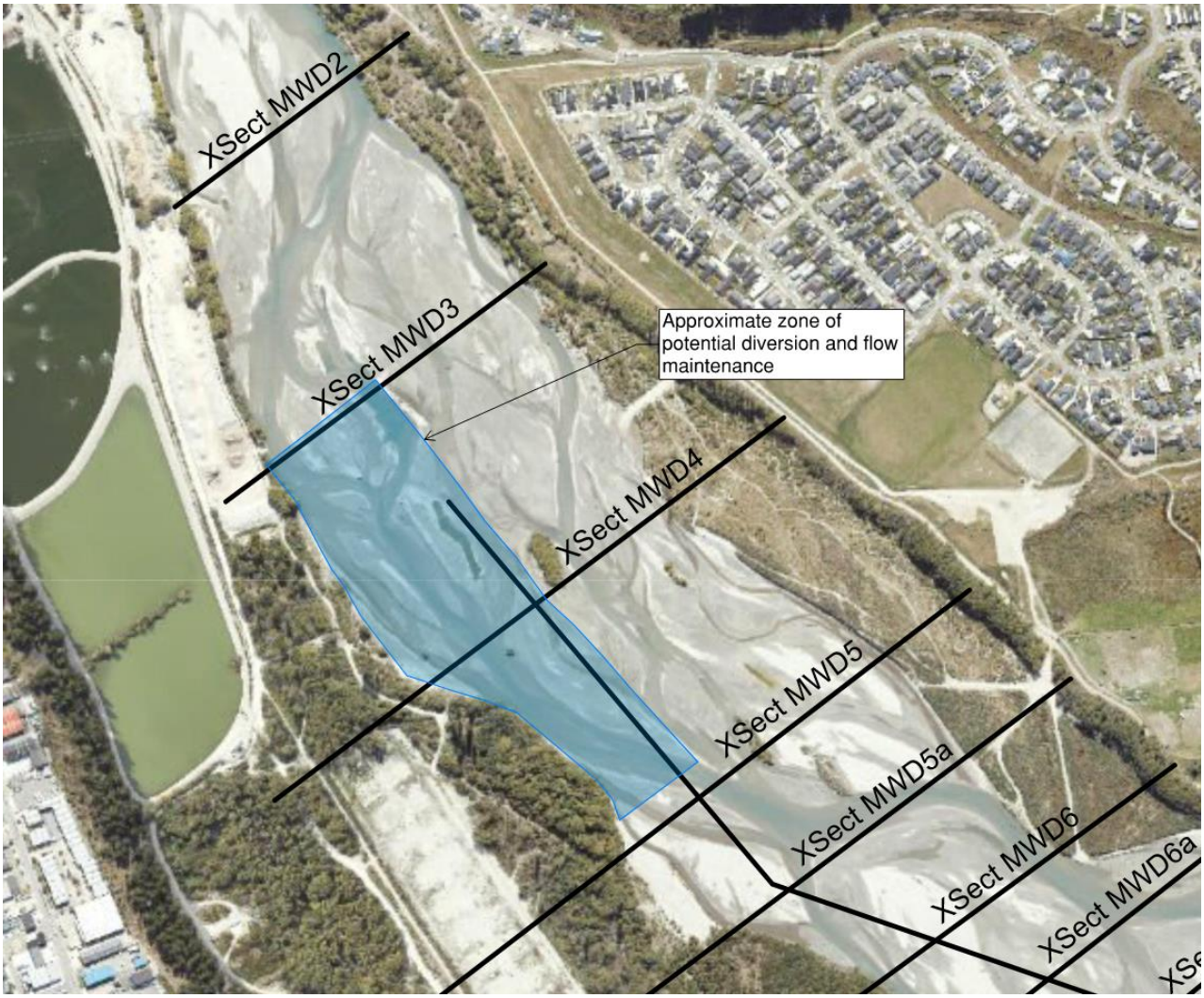


Figure 5 *Indicative zone of the proposed diversion and flow maintenance*

The invert of the proposed diversion channel will tie to the invert of the existing braid at both ends. Then the invert will be gradually lowered by adjusting its grade at the maximum invert difference of 350mm at the location of the discharge channel. The cross section of the diversion channel is proposed to be trapezoidal with a bottom width of 1 m battered at 1:2 to increase its stability and capacity and minimise the volume of earthworks. The cross section of the nearby braid and the proposed diversion channel at the location of the discharge channel are shown in Figure 6 and Figure 7.

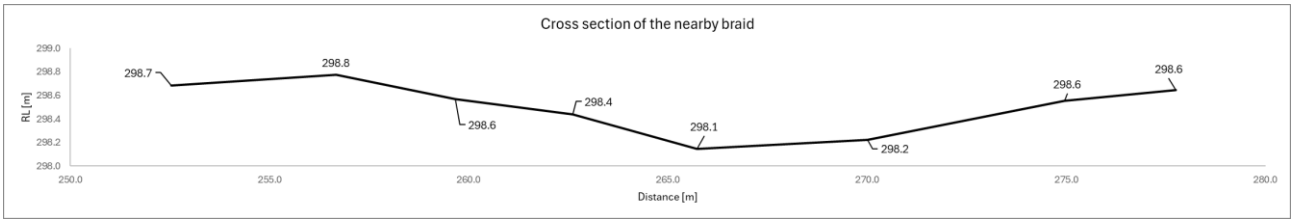


Figure 6 *Cross section of the nearby braid at the location of the discharge [Cross-section 4 in Figure 5]*

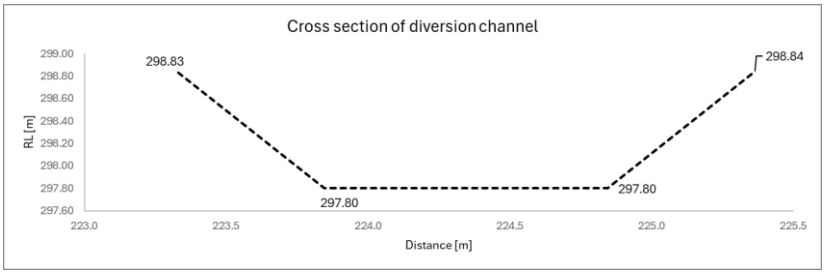


Figure 7 Cross section of the proposed diversion channel at the location of the discharge

The normal flow depths for diverting 2.5m³/s are calculated using Manning equation and the estimated water surface profiles are shown in Figure 8 for those flow rates.

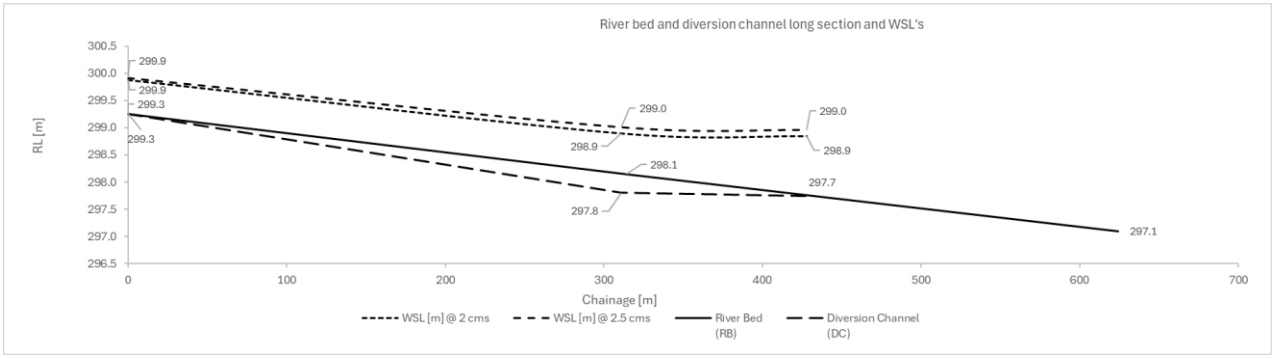


Figure 8 Longitudinal section and water surface levels at the proposed diversion channel

The required water depth at the upstream end of the diversion channel is estimated to be roughly 600mm to deliver approximately 2.5 m³/s through the diversion channel. The downstream water depth will be slightly more than 1m. These depths are approximate and based on-site observations. However, further hydrometric data at this location is recommended to confirm these as part of detailed design. If, during low flow conditions, the target flow rate of approximately 2.5 m³/s is not achieved, this might require deepening and widening of the diversion channel, along with local reshaping of the nearby braid to allow more flow to spread towards the dilution basin.

Maintenance activities are expected to maintain sufficient flows in the adjacent flowing braid to maintain effective dilution in the reasonable mixing zone (within 200 m of the discharge). The proposed reshaping is minor, local and only on true right-hand side of the flowing braid. The reshaping comprises lowering of right-hand side of the braid by 300-400mm. These maintenance works would be within the zone outlined in Figure 5. This is anticipated to support the diversion works and ensure a minimum flow in the adjacent braid of 1 m^3/s. The reshaping will be part of the maintenance activity to be undertaken, dependent to the river condition, and most likely during low flow condition and when the braiding pattern realigns the nearby braid away from the diversion channel.

5. Environmental considerations

5.1 River Diversion Hydrological effects

The preliminary hydraulic calculations show that the shallow channel is sufficient to bring enough river flow to the discharge channel outlet, however further details of the river morphology, bathometric data and flow measurements will be collected at the time of works to confirm the adequacy of the proposed dimensions and configuration.

The concavity of the nearby main braid at the location of the discharge channel, increases the efficiency of the diversion system even in low flow conditions and likely sustains the main braid at its current location or close to the discharge channel even after flood-induced rebraiding.

The proposed diversion system is localised, and the diverted flow, which constitutes less than 20% of MALF, remains in the river system. i.e. the water diversion is non-consumptive. Hence, the impact and disruption to the river environment and its hydraulic characteristics will remain minimal. The design of the diversion channel generally mimics a river braid, and over time movement of the river gravels are expected to provide a more natural form and likely establishment of the channel as a natural braid. Movement of minor braids within the broader river bed is an ongoing occurrence, with gravel extraction activities by third parties already promoting localised river braid movement and entrainment of braids. In this context, the diversion channel, and any maintenance works, are not expected to result in a changes to the river morphology or hydrology that are out of character with the current river environment. As such, potential adverse effects associated with the diversion works are predicted to be limited to potential ecological effects. These are discussed in detail in the Boffa Miskell memorandum[1] accompanying the Section 92 Response.

The short term requirement for diversion works, through the duration of the proposed activity, are expected to end with the development of a long term wastewater disposal solution or demonstration that diversion is no longer required to manage water quality effects. No long term effects of diversion are expected to occur, as high flow events will effectively remove the remnant diversion channel.

To accommodate the movement of the river over time, while meeting the dilution needs in the reasonable mixing zone, the location of the diversion channel and its extent are expected to also change over time. A zone of works, rather than a specific channel location, is therefore proposed. While it is expected that the diversion system will require periodic reinstatement due to river sediment deposition or channel migration, such maintenance is temporary in nature and akin to the existing sand extraction and river management operations in the area. Any sediment mobilisation during these works is likewise consistent with current occurrences in the river and within the natural range of effects for river.

5.2 Discharge Channel and erosion protection – Hydrological effects

All materials proposed for construction of the discharge channel protection structure, including gabions and riprap are designed to integrate with the dynamic characteristics of the braided river. These structures will prevent localised scouring, protect both the channel structure and riverbank, and allow adaptation as needed following major flow events.

Construction of the structure will occur under low river flow conditions, allowing works to remain outside of river braid channels. Works on the river bed at this location, being minor in extent, are expected to be completed over a short period of time. The potential for adverse sediment discharges associated with the works are therefore predicted to be limited, with a first flush mobilisation of residual sediment during a high flow event expected to have minimal influence on the sediment load in the river during such events. No on ongoing sediment discharges relating to the construction or the structures are expected to occur.

Similarly, no change in the hydrology of the river is expected to result from these minor river bank works.

Adverse environmental effects associated with construction of the erosion protection is expected to be limited to the potential localised ecological effects. These are discussed in detail in the Boffa Miskell memorandum[2] accompanying the Section 92 Response.

[1] Boffa Miskell, 11 August 2025. Draft S92 response for Treated Wastewater discharge to Shotover River,
[2] Boffa Miskell, 11 August 2025. Draft S92 response for Treated Wastewater discharge to Shotover River,

6. Construction methodology

This is a high-level construction methodology for the proposed works at the outlet structure and diversion system:

- **Access:** access will be from Shotover Delta Rd, Queenstown Trail, and via multiple tracks to the river. Some minor surface levelling might be needed to facilitate construction machinery. All minor surface reshaping would need to be reinstated to original condition.
- **Machinery:** the required machines are to be kept to a minimum and include 2x 15 tonne excavators, 1 truck, 2x utes, and standard hand tools for earthworks, e.g., jumper jack, shovels, etc.
- **Vegetation clearance:** No significant trees are located in this area, hence no allowance made for significant vegetation clearance. Consultation with anarborist would be undertaken in the design stage if needed.
- **Earthworks:** the required earthworks include:
  - Excavation and reshaping the side slopes of the riverbank for the discharge channel erosion protection with an approximate footprint of 4m x 4m and height of 2m with a batter slope of 1:3 with a total volume of 10m³ on either side of the discharge channel for construction of the proposed river protection system (total 35m² and 20m³).
  - Excavation of 5m x 5m footprint to the depth of 700mm (approx. 18m³) in the riverbed in front of the gabion outlet to install the riprap basin.
  - The volume of the earthwork for excavation of the diversion channel is estimated to be –up to 1,000m³ with a footprint of the less than 750 m².
  - The volume of earthwork for maintenance of the nearby braid is difficult to estimate, given the ongoing movement of the river bed, but is expected to be small in the context of the river diversion.. Further reshaping and reinstatement of the braid's cross section should be undertaken as the river braids and flow condition vary during time.
- **Dewatering:** no dewatering for constructing the outlet structure (gabion walls and riprap) is expected. Given the depth and volume of the earthwork in the riverbed is limited, no dewatering is anticipated for completing the diversion works. Installation of riprap rocks or alternative rock bags and Reno mattress' can be managed to be at the same period when the earthworks are being undertaking. The works on riverbed can be managed to be completed in low flow conditions for ease of construction.
- **Environmental considerations:** part of the proposed discharge channel protection works are in the riverbed and away from the main braids. The minor works in this area will be organised to undertaken in low flow conditions to minimise environmental interference.
- **Construction period:** given the majority of works is in the form of the flexible structures, the installation period is expected to be minimal. The physical works are expected to be completed in six to eight weeks.

7. Summary and path forward

The proposed design represents a practical and low-impact solution for temporarily discharging of treated effluent from the WWTP while long-term upgrades are implemented. The solution balances hydraulic performance, erosion control, dilution effectiveness and environmental protection.

To prepare for detailed design, the following next steps are recommended:

- Conduct detailed morphological and hydraulic surveys of the river near the discharge point to understand variability in flow and channel locations.
- Undertake flow measurements upstream and downstream of the discharge location to better assess dilution potential and adjust the design if needed.
- Undertake soil and substrate testing in the riverbank along the proposed diversion channel and outlet structure to validate the protection design, riprap sizing and slope stability.
- Proceed to detailed engineering design, including construction staging, adaptive management plan (e.g. planned maintenance and reinstatement after flood events) and monitoring requirements.

Best Regards

Ali Ghavidel
Lead Engineer (Water)

Anthony Kirk
Environmental Lead

Project name		Shotover WWTP Disposal Field Alternative Discharge					
Document title		Shotover River Protection and Diversion at Discharge Channel – Response to S92 Queries					
Project number		12645246					
File name		12645246_MEM_DEL-RiverProtection&DiversoinSystem.docx					
Status Code	**Revision**	**Author**	**Reviewer**		**Approved for issue**		
			Name	**Signature**	**Name**	**Signature**	**Date**
S3	P01	A Ghavidel	I Ho A Kirk		I Ho (On file)		6/08/25
S4	P02	A Ghavidel Sarah Browne	I Ho A Kirk		I Ho (On file)		12/08/25
S4	P02 (Minor edits)	Sarah Browne	I Ho	(On file)	I Ho (On file)	(On file)	13/08/25

Appendix C: Freshwater Ecology – Authored by Boffa Miskell

Boffa Miskell

Memorandum

Christchurch
Level 1
141 Cambridge Terrace
Christchurch 8013
PO Box 110
Christchurch 8140

+643 366 8891

Whangarei	15 Porowini Avenue, Morningside, Whangarei 0110	+649 358 2526
Auckland	PO Box 91250, Auckland 1142	+649 358 2526
Hamilton	PO Box 1094, Hamilton 3240	+647 960 0006
Tauranga	PO Box 13373, Tauranga 3141	+647 571 5511
Wellington	PO Box 11340, Wellington 6142	+644 385 9315
Nelson	27 Vanguard Street, Nelson 7010	+643 548 8551
Queenstown	PO Box 1028, Queenstown 9348	+643 441 1670
Dunedin	49 Water Street, Dunedin 9016	+643 470 0460

Attention:	Claire Perkins and Anthony Kirk
Company:	Landpro and GHD
Date:	12 August 2025
From:	Tanya Cook (reviewed by Tanya Blakely)
Message Ref:	S92 response for Treated Wastewater discharge to Shotover River
Project No:	BM250359

Landpro Limited has applied for two resource consents on behalf of Queenstown Lakes District Council for the short-term discharge of wastewater to the Shotover River, including for the discharge and outfall structure (RM25.206) and for the proposed diversion (RM25.177). The s92 request from Otago Regional Council raises several freshwater ecology related matters set out below.

We have relied on reports and information provided by others; we have not collected any freshwater ecology information ourselves or visited the site.

RM25.206

In relation to RM25.206, Question 12 relates to the effects of the treated wastewater discharge on aquatic ecology in the Shotover and Kawarau Rivers and Question 15c relates to the effects on ecological values from the placement of large boulder rip-rap around the outfall of the discharge channel. The questions (in italics) and our response following each question are provided below.

12) In relation to Sections 3.9 and 4.8 of the Surface Water and Groundwater Assessment:

a. confirm whether macroinvertebrate monitoring data are available for the period considered representative of the future discharge (2017-2019).

Various consultants have surveyed the macroinvertebrate communities at sites upstream and downstream of the discharge. These results have been presented in reports. We confirm that macroinvertebrate data are available for 2017 and 2018 but not 2019. Refer to b. below.

b. provide a spreadsheet with all of the ecological data referenced in Section 3.9.

The macroinvertebrate community has been surveyed by others in late summer / early autumn in 2010, 2011, 2013, 2015, 2016, 2017 and 2018. There are also eDNA results available from a sample collected in the Shotover River by Landpro, in 2024.

Due to changes in sampling site locations and changes in river morphology temporal trends should not be assessed.

We have compiled the available macroinvertebrate data, in accordance with the National Environmental Monitoring Standards – Macroinvertebrates (NEMS-M) taxonomic list (Ministry for the Environment,

2022), and provided in the attached spreadsheet: ***QLDC WWTP Macroinvertebrate Periphyton Master data 2010 - 2018.***

c. confirm whether standard equivalence testing can be conducted on the QMCI data to statistically test the potential effects of the discharge.

We confirm that equivalence testing can be conducted on the QMCI data. However, we note that equivalence testing results can be inconclusive if insufficient samples have been collected, and we do not recommend equivalence testing be conducted on data from years where very low taxa diversity was recorded (such as 2015 and 2016).

We have completed equivalence testing on QMCI scores, comparing the upstream site to the downstream 1 and 2 sites, in both 2017 and 2018. The test results are all inconclusive because there is insufficient power to differentiate between a Type II error (failure to detect a real effect), or possibly due to the absence of a discernible ecological effect.

We carried out further statistical analyses of the macroinvertebrate community dataset to investigate whether there were statistically significant differences between the sites in each of 2017 and 2018, using a non-metric multi-dimensional scaling (nMDS) ordination on the untransformed coded-abundance data.

The nMDS ordination plot for 2017 shows there does seem to be some difference in the macroinvertebrate community composition at the downstream sites compared to the upstream site but there is also substantial variation in the community composition between some replicates within each site (Figure 1).

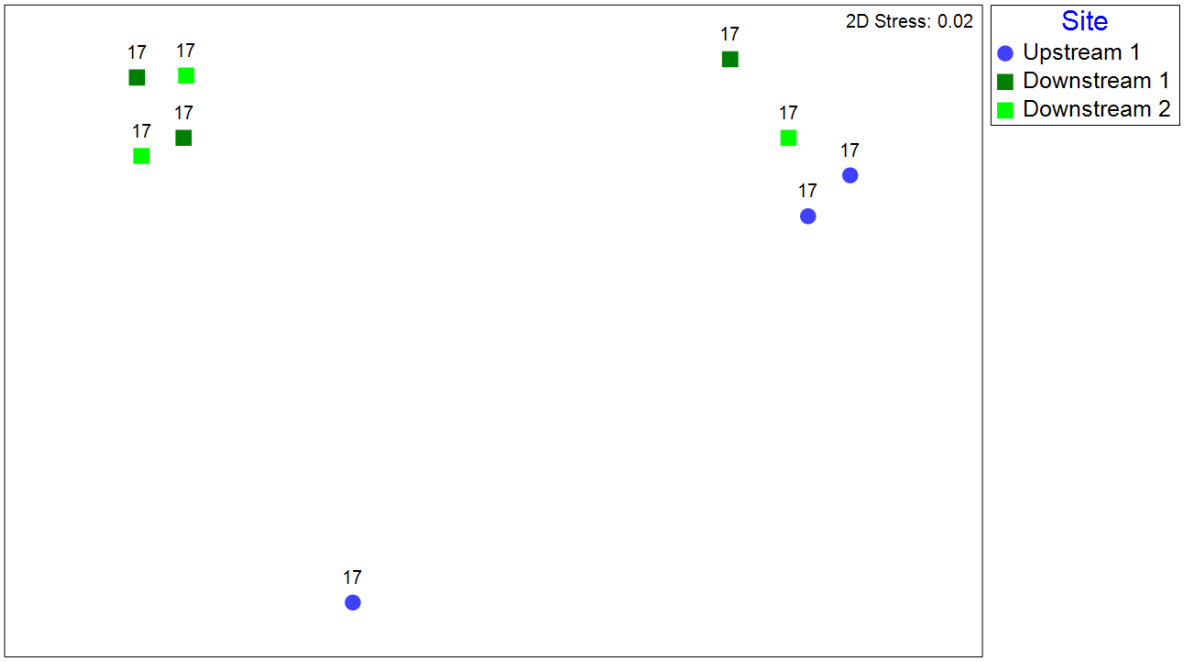


Figure 1: nMDS ordination plot for the 2017 untransformed macroinvertebrate data by site and replicate for the Shotover River. Axes are identically scaled so that site replicates closest together are more similar in macroinvertebrate composition, than those further apart.

The nMDS ordination plot for 2018 shows there is a clear difference in the macroinvertebrate community composition at the upstream site compared to the downstream sites (Figure 2).

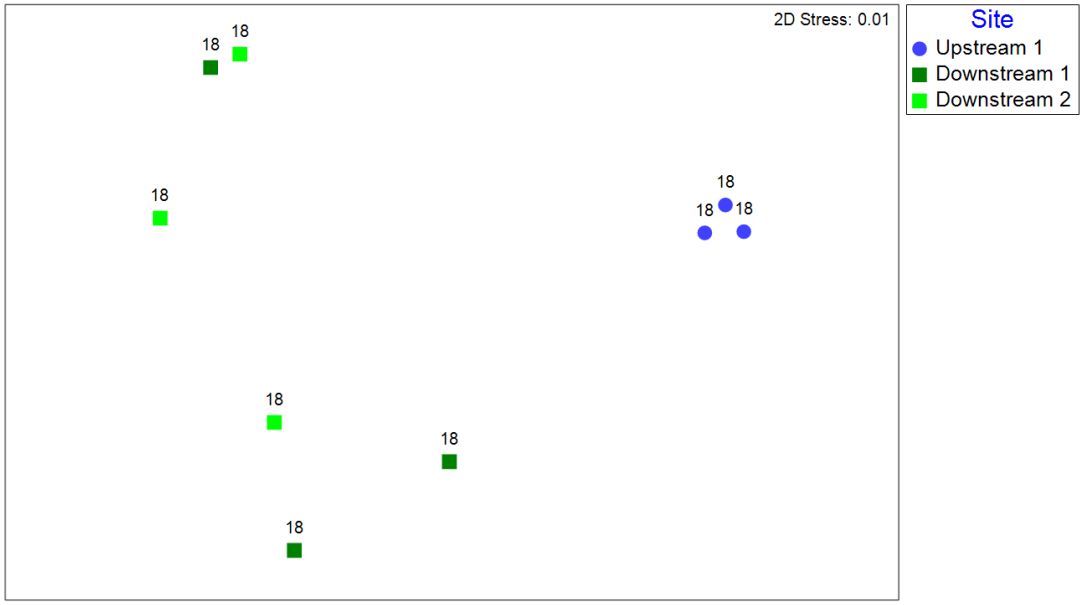


Figure 2: nMDS ordination plot for the 2018 untransformed macroinvertebrate data by site and replicate for the Shotover River. Axes are identically scaled so that site replicates closest together are more similar in macroinvertebrate composition, than those further apart.

It is important to note that nMDS ordinations rank sites such that distance in ordination space represent community dissimilarity, where site repliacates that are closer in ordination space are more similar in macroinvertebrate community composition, than those further apart. However, further analyses are required to determine if differences in community composition are significant and, where significant, what taxa are driving these differences in community composition.

As such, separate permutational multivariate analysis of variance (PERMANOVA) tests, and a similarity percentages analysis (SIMPER) test, where significant differences were detected, were performed on the untransformed coded-abundance data.

The PERMANOVA showed there was no significant difference in the macroinvertebrate community between the three sites in 2017 ($p = 0.32$) (as can be seen in Figure 1). However, PERMANOVA showed a significant difference in community composition at the upstream site compared to the downstream sites in 2018 ($p = 0.03$; Figure 2)[1]. A similarity percentages analysis (SIMPER) on the 2018 data indicated that these differences were largely due to differences in the number of occurrences of some taxa (i.e., greater or lesser numbers of individuals). For example, the downstream site replicates typically had higher abundances of *Deleatidium* mayflies, *Zelandobius* stoneflies, Hydropsyche-Aoteapsyche caddisflies and true fly larvae belonging to Orthocladiinae, Empididae and Tanytarsini. The higher abundances of these macroinvertebrate taxa at the downstream sites in 2018 may be associated with the slightly higher thin periphyton and short filamentous algae cover also recorded at the downstream sites in 2018 compared to the upstream site (refer to response d. below and Figure 3), which could influence the macroinvertebrate community.

Ryder (2018) reported that MCI and SQMCI were both lower at the downstream sites compared to the upstream site in 2018, but that the differences were not statistically significant. Ryder (2018) also concluded that the subtle differences recorded in 2018 were likely as a result of the prolonged stable conditions prior to monitoring and the change in the river in the vicinity of the discharge, with the discharge entering a smaller side channel in 2018 compared to the main river channel in previous years.

[1] Community composition at the upstream site was significantly different to the community composition at the downstream 1 site ($p = 0.02$) and the community composition at the upstream site was significantly different to the community composition at the downstream 2 site ($p = 0.01$), but there was no significant difference between the two downstream sites ($p = 0.59$). Monte Carlo test results used due to low number of unique permutations.

d. provide all available periphyton data and an explanation on whether heterotrophic growths have been monitored and if they have, whether they have been detected. I note that this is specifically mentioned in the Kawarau River Water Conservation Order (WCO).

Periphyton monitoring was conducted by others in late summer / early autumn in 2010, 2011, 2013, 2015, 2016, 2017 and 2018. The data have been compiled and provided in the attached spreadsheet: ***QLDC WWTP Macroinvertebrate Periphyton Master data 2010 - 2018***. In each of these years, monitoring included a visual assessment of periphyton cover and the collection of periphyton samples to identify the most common taxa present.

The New Zealand periphyton guidelines (Biggs, 2000) recommend the use of the Autotrophic Index (AI) to measure the proportion of heterotrophic growth compared to autotrophic growth. The AI is calculated from measurements of chlorophyll-α and ash free dry mass (AFDM). However, the Guidelines state that the AI should only be determined on samples with a reasonable biomass (e.g., AFDM >2 g / m^2), due to sampling error in the AFDM measurement method often being larger than the actual AFDM measurement when periphyton biomass is low.

As noted in reports by others, periphyton cover is often low in the Shotover River due to the highly mobile substrates, cooler water temperatures, frequent flood events and generally low nutrient levels (GHD, 2025; E3 Scientific, 2024), therefore, it is unlikely to be appropriate to calculate the AI. Also, the Guidelines state that some mucilaginous diatom and cyanobacterial communities (autotrophic dominated communities) can have naturally high AI values, i.e., not as a result of organic discharges. The presence of didymo at the upstream site and cyanobacteria at the downstream sites may, therefore, result in mis-leading AI values.

The historical monitoring shows that periphyton cover is also often low downstream of the discharge. The percentage cover of diatoms / cyanobacteria and filamentous algae recorded during the monitoring has consistently been well below the guideline values (Biggs, 2000), as can be seen for the 2017 and 2018 results included below (Figure 3).

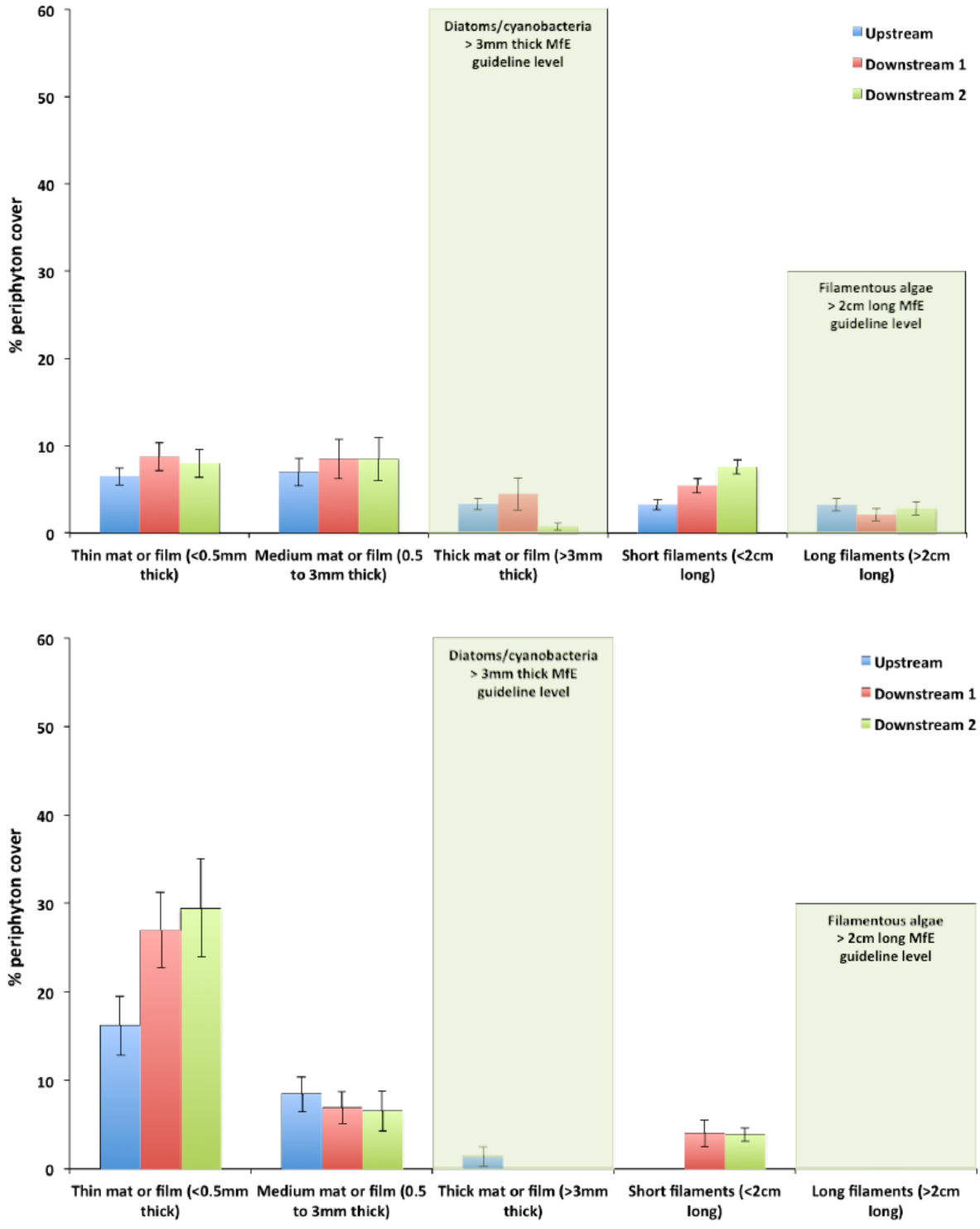


Figure 3: Periphyton percentage cover at the upstream, downstream 1 and downstream 2 sites in the Shotover River compared to the Biggs (2000) guideline values in February 2017 (top) and January 2018 (bottom), copied from Ryder (2017) and Ryder (2018), respectively.

Heterotrophic growth has not been reported in the visual assessments conducted by others during this annual monitoring in late summer / early autumn and is not apparent in photographs taken during the monitoring (Figure 4 and Figure 5).

Figure 4: Ryder (2016) has not reported any heterotrophic growth visible on the bed substrate in February 2016 at the Downstream 1 site (left) and Downstream 2 site (right), copied from Ryder (2016).

Figure 9 Photographs of substrates scrubbed for periphyton at Upstream (top), Downstream 1 (bottom left) and Downstream 2 (bottom right) sites in the Shotover River, February 2017.

Figure 8 Photographs of substrates scrubbed for periphyton at Upstream (top), Downstream 1 (bottom left) and Downstream 2 (bottom right) sites in the Shotover River, January 2018.

Figure 5: Ryder (2017) and Ryder (2018) did not report that any heterotrophic growth was visible on the bed substrate and reported low periphyton growth at all sites. Photographs show the substrates used for periphyton sample collection in February 2017 (left) and January 2018 (right) sourced from Ryder (2017) and Ryder (2018).

Given the annual monitoring results associated with historical discharge, the factors limiting periphyton growth in the Shotover River (e.g., highly mobile substrates, cooler water temperatures, frequent flood events and generally low nutrient levels, described above), the proposed diversion to ensure adequate mixing and the upgrades to the WWTP process planned for later 2025, we would not expect there to be "*undesirable levels of biological growth*" in the Shotover River as a result of the discharge, as required for the Shotover River by the WCO.

15) The following information is requested to validate the technical information provided to support the application for works in the bed of the Shotover River/Kimiākau to construct an outfall structure. Please provide:

c. An assessment undertaken by a freshwater ecologist of effects on aquatic ecosystems as a result of the construction and design of the discharge outlet structure.

Our assessment is solely based on information provided to us by GHD and limited to freshwater ecological values. Based on the information provided to us, we understand that the existing channel and outlet structure is being used for the short-term discharge but that some improvements are needed due to erosion of the bank around the existing structure.

Ecological values

E3 Scientific (2024) considers the ecological values of the periphyton and macroinvertebrate communities in the vicinity of the discharge location are low and the ecological value for fish is

considered high for the Shotover River. Based on the photographs provided to us by GHD (Figure 6) and information in previous reports (Landpro, 2025; E3 Scientific 2024), we consider:

- the vegetation on the riverbanks within the proposed footprint to be dominated by exotic species, including willow, sycamore, poplar, sumac and buddleia, some of which are environmental weeds, and providing limited buffering function for the Shotover River in the vicinity of the proposed works area;
- the wetted channel edge is set back from the proposed works area, which we understand to be consistent under baseflow conditions with the current river morphology;
- the river substrates in the area of the proposed works appear to be dominated by silt/sand, which one might expect to naturally be deposited in areas such as this as high river flows recede;
- there is no or very limited freshwater habitat in the vicinity of the proposed works area.

Given the above, and taking into account the previous monitoring results and reports, we expect the freshwater ecological values within the proposed footprint to be Negligible to Low.

Figure 6: Exotic vegetation around discharge structure (left) and riverbed adjacent to discharge location (right).

Proposed works

Based on the information provided to us by GHD, we understand the proposed works, include the following:

- Approximately 30 – 40 m^2 of vegetation clearance on the riverbank around the discharge channel
- Installation of gabion walls on the side of the channel for bank protection and gabion baskets and riprap basin wrapped with geotextile on the riverbed for bed protection
- Use of 2 x 15-ton excavators located on the riverbed using ground protection mats, to undertake the earthworks and install the gabion baskets and rip-rap.
- Approximately 25m^2 of excavation and reshaping of the side slopes of the riverbank on either side of the discharge channel (total area and volume of 50 m^2 and 20-30 m^3) to install the gabion baskets and rip-rap basin.
- Any works required in "wet areas or areas with flow will be isolated using sheet piling and/or appropriate erosion and sediment control measures.
- The total proposed footprint of the works area is 120-150 m^2 and the total duration of works is expected to be 4-6 weeks. Works in the riverbed will be less than 10 hours.

Ecological effects and recommended effects management

Based on the proposed design and construction methodology provided to us, the actual and potential effects of the proposed works on freshwater ecological values are:

- disturbance to the bed of the River;
- removal of exotic riparian vegetation
- potential for sediment inputs into the River.

Disturbance to the bed of the River

It is our understanding that disturbance to the bed of the river will be restricted to a small footprint (~ 25 m^2) in the immediate vicinity of the outlet structure, and will be limited to the works phase (less than 10 hours). Works will be completed in a period of low river flows and the discharge will be controlled as required, so that the majority of works will be completed in the dry. All erosion and sediment control should be implemented in accordance with the Auckland Council Erosion and Sediment Control Guide 2016/005 (Leersnyder et al., 2016) or suitable equivalent standard and ground protection mats will be used to minimise disturbance to the riverbed from the excavator movements. Once works is completed, the gabion baskets and riprap basin will reduce erosion locally and also have the potential to provide a stable refugia for freshwater fauna in periods of high flow. Based on the available information, and the proposed construction management described above, we consider the potential effects on freshwater ecology values from disturbance to the bed of the River as Very low[2].

Removal of exotic riparian vegetation

The exotic riparian vegetation immediately adjacent to the proposed works area is providing limited buffering function for the freshwater ecosystems of the Shotover River, due to the wide and dynamic River channel and distance to main River channel. It is expected that exotic vegetation of similar structure will naturally re-establish within the area in 2-4 years. As the main factors influencing the periphyton and macroinvertebrates communities in the Shotover River appear to be the high natural sediment load, mobile substrate and frequent high flow events, it is expected that 30 – 40 m^2 of

[2] Following the Environment Institute of Australia and New Zealand's Ecological Impact Assessment guideline, we consider the magnitude of effect of riverbed disturbance as Negligible to Low. A Low magnitude of effect on Negligible to Low freshwater ecological values equates to a Very Low level of effect.

vegetation removal will result in no discernible change in the freshwater condition. We consider the potential effects of removal of the exotic riparian vegetation as a Very Low level of effect on freshwater ecology values[3].

Sediment discharge

As the duration of works in the riverbed is less than 10 hours, works can easily be undertaken in the dry, e.g., when river flows are low and weather conditions are dry. As covered above, any works required in "wet areas" will be isolated using sheet piling and/or other appropriate erosion and sediment control measures. Therefore, potential sources of sediment to the river will be limited to the first flush of loose material when the discharge recommences, which will be short-lived and sediment that would naturally be resuspended in a high flow event. As long as works in the riverbed are restricted to a dry period and the discharge to the works area is temporarily ceased, the potential risk of sediment entering the River is nil to very low.

RM25.177

In relation to RM25.177, Question 2b relates to the potential effects on instream values from the reduction in flowing water within the main braid after the diversion has occurred. Question 2b and our response is provided below.

2) The Application proposes a year-round diversion of an unspecified flow rate. The Surface Water and Groundwater Assessment, dated 30 April 2025 prepared by GHD and submitted in support of RM25.206 highlights that while the plant upgrade is expected to significantly reduce the visible influence of the discharge, the pooling of treated wastewater adjacent to the riverbank under very low flow conditions is proposed to be reduced by the proposed diversion. Based on the maximum flow rate proposed in response to Question (1) please provide an assessment of:

b. Effects on aquatic ecosystem particularly habitat availability within the extent of the Shotover River (anticipated to be between 200 and 300 metres) that will have less flow under low flow and very low flow conditions as a result of the proposed diversion at the maximum flow rate.

We have received limited information from GHD on the predicted changes to hydrology and river morphology due to the water diversion. Based on the information provided by GHD we understand that 2-2.5 m^3/s will be diverted from the main river channel into the diversion channel, then returned back to the main channel about 430 m downstream. We understand from GHD that they do not expect this diversion volume to have any discernible effect on hydrology during moderate to high flows. The diversion is not a consumptive water take (i.e., surface water is returned to the river some 430 m downstream) and the diversion volume (of 2-2.5 m^3/s) is below minimum flow and take limits/standards for the Shotover River. Based on this technical advice by GHD, we can expect minimal effects on ecological values during moderate to high flows.

Shotover River naturally experiences low flows, but these appear to be for short periods of time with flushes / higher flow events being relatively frequent. The proposed diversion will be most noticeable during and preceding naturally occurring low flow periods. Research undertaken to develop national interim limits for ecological flows for rivers showed that a loss in flow of less than 20% of the mean annual low flow (MALF) is likely to result in a low degree of hydrological alteration (Ministry for the Environment 2008). A presumptive flow standard developed from a review of international research states that "a high level of ecological protection will be provided when daily flow alterations are no greater than 10%" and "a moderate level of protection is provided when flows are altered by 11–20%", meaning there may be measurable changes in ecosystem structure but minimal changes in ecosystem functions (Richter et al., 2012). The proposed maximum diversion of 2.5 m^3/s equates to approx. 14% of the MALF for the Shotover River[4] meaning that a low degree of hydrological alteration and a moderate to high level of ecological protection, with minimal changes in ecosystem function can be expected.

[3] A Negligible magnitude of effect on Low ecological values equates to a Very Low level of effect.
[4] MALF for the Shotover River is 18.1 m^3/s. Source: Table 3.2 in GHD 2025.

The more conservative Otago Regional take limit for catchments with mean flow of greater than 5 m^3/s, which considers Richter et al.'s (2012) presumptive standard, is 30% of 7-day MALF and a minimum flow of 80% of 7-day MALF (Hayes et al., 2021). The proposed maximum diversion of 2.5 m^3/s equates to approx. 18% of the 7-day MALF for the Shotover River[5].

During low and very low flow conditions, there is potential for the following changes to occur:

- a slight reduction in the wetted width and total wetted area of the main channel and a reduction in depth in areas that remain wet. This may lead to changes in water velocity and changes in habitat availability for macroinvertebrates and fish.
- warmer water temperatures and increased periphyton growth in the main channel for short periods between high flow events.
- Slight increase in the frequency and duration of low flow events.

The above changes may lead to both increases and decreases in water velocity and habitat availability for macroinvertebrates and fish. A reduction in water depth can lead to an increase in habitat availability for some species due to habitat preferences (e.g., water depth and velocity). For example, some macroinvertebrate taxa, such as midges and oligochaetes, prefer lower water velocities, whereas other taxa, such as stoneflies, Aoteapsyche-Hydropsychidae caddisflies and *Deleatidium* mayflies, prefer higher velocities (Biggs et al., 2008, Collier, 1993).

Therefore, if there is a measurable change in water velocities, water temperatures and/or periphyton biomass, there will likely also be a discernible change in the macroinvertebrate community composition in the 430 m length of the main channel. Based on the results from previous annual sampling we would expect to see an increase in overall diversity and increase in abundance of some macroinvertebrate taxa but not necessarily a decline in biotic metrics, such as MCI or QMCI. For example, flow conditions were relatively stable for several months prior to sampling in 2018, compared to 2016 and 2017 when high flows events occurred a few weeks before sampling. There was a higher diversity of taxa present in 2018, compared to in 2016 and 2017, and several taxa were more abundant, including stoneflies, caddisflies and dipteran larvae.

The magnitude and duration of these potential changes to hydrology, and subsequent effects on ecology, due to the diversion cannot be determined from the information available. However, we expect that these changes in community composition will be similar to that seen in 2018 and those that naturally occur in any given year in response to lower flows. While we expect that the 'low-flow' macroinvertebrate composition (and habitat conditions driving these) will be 'reset' following a flood event, it is possible that these 'low-flow conditions' will be brought on earlier and, therefore, occur for a longer period of time until the next fresh resets the system.

References

Biggs, B. J. F. (2000). *New Zealand periphyton guideline: Detecting, monitoring and managing enrichment of streams.* Prepared by NIWA for the Ministry for the Environment.

Biggs, B. J. F., Ibbitt, R. P. and Jowett, I. G. (2008). Determination of flow regimes for protection of in-river values in New Zealand: an overview. *Ecohydrology & Hydrobiology, Vol 8 (1), 17 – 29.*

Cameron, D. (2010). *Biological survey of the Shotover River adjacent to the Shotover Oxidation Ponds.* Report prepared for Queenstown Lakes District Council by MWH. February 2010.

Collier, K. (1993). *Flow preferences of aquatic invertebrates in the Tongariro River.* Department of Conservation Science and Research Series No. 60.

[5] 7-day MALF for the Shotover River ~ 14 m^3/s. Source: https://www.orc.govt.nz/consents-and-compliance/compliance/shotover-wastewater-treatment-plant/

E3 Scientific. (2024). *Project Shotover, Wastewater Treatment and Disposal System Environmental Impact Assessment*. Document ID: 24091. Prepared for Otago Regional Council.

GHD (2025). *Shotover WWTP Surface Water and Groundwater Assessment.* Report prepared for Queenstown Lakes District Council by GHD. April 2025.

Golder Associates. (2011). *Shotover River Wastewater Treatment Plant Discharge and Hawea River Closed Landfill Biological Monitoring.* Report prepared for Queenstown Lakes District Council by Golder Associates. March 2011.

Golder Associates. (2013). *Shotover River Wastewater Treatment Plant Discharge Resource Consent Biological Monitoring.* Report prepared for Queenstown Lakes District Council by Golder Associates. March 2015.

Golder Associates. (2015). *Shotover River Wastewater Treatment Plant Discharge Resource Consent Biological Monitoring. Report prepared for Queenstown Lakes District Council by Golder Associates. March 2015.*

Hayes, J., Booker, D., Singh, S. and Franklin, P. (2021). *Default minimum flow and allocation limits for Otago* Letter to Otago Regional Council from Cawthron Institute dated 17 September 2021.

Landpro Ltd. (2024). *Water Quality Baseline Snapshot for Queenstown Wastewater Treatment Plan and Surrounds.* Prepared for Queenstown Lakes District Council Monitoring by LandPro Limited.

Landpro Ltd. (2025). *Resource Consent Application to Otago Regional Council for Discharge of Treated Effluent to Kimi-ākau/Shotover River.* Prepared for Queenstown Lakes District Council Monitoring by LandPro Limited.

Leersnyder, H., Bunting, K., Parsonson, M., & Stewart, C. (2016). *Erosion and sediment control guide for land disturbing activities in the Auckland Region: Incorporating Amendment 1 (Auckland Council Guideline Document GD2016/005)*. Auckland Council.

Ludgate, B. (2016). Queenstown WWTP Discharge to the Shotover River. Biological survey February 2016. Report prepared for Queenstown Lakes District Council by Ryder Consulting.

Ludgate, B. (2017). Queenstown WWTP Discharge to the Shotover River. Biological survey February 2017. Report prepared for Queenstown Lakes District Council by Ryder Consulting.

Ministry for the Environment. (2008). *Proposed National Environmental Standard on Ecological Flows and Water Levels: Discussion Document.* Publication number: ME 868. 61 p.

Ministry for the Environment. (2022). *National Environmental Monitoring Standards macroinvertebrates: Collection and processing of macroinvertebrate samples from rivers and streams. Version 1.0.0.* Ministry for the Environment. https://www.nems.org.nz/documents/macroinvertebrates/

Richter, B.D., Davis, M.M., Apse, C., Konrad, C. (2012). A presumptive standard for environmental flow protection. *River Research and Applications 28: 1312-1321*.

Wildlands. (2024). *Desktop Freshwater Ecological Assessment of the Shotover and Kawarau Rivers at the Shotover Wastewater Treatment Plant*. Wildland Consultants Contract Report No. 7344. Prepared for Landpro Limited. 18pp.

Appendix D: Draft Conditions of Consent for Discharge

RM25.206 – Discharge to Water Permit

Purpose: To discharge treated wastewater to water for the purpose of operating the Shotover Wastewater Treatment Plant

Duration: 31 December 2030

Location: Shotover Delta Road, 1.1km south east of State Highway 6, Queenstown

Legal description of treatment plant location: Lot 4 DP 421841, Area A SO 24812

Legal description of discharge location: Section 4 SO 409393

Map reference at point of discharge: 1266096E 5007045N

Limits

1) The discharge shall only be treated wastewater from the Shotover Wastewater Treatment Plant, located on Lot 4 DP 421841 and Area A SO 24812, at or about map reference 1265465E 2007842N, as shown on the map attached as Appendix A, which forms part of this consent.

2) Treated wastewater from the Shotover Wastewater Treatment Plant shall be discharged to the Shotover River on Section 4 SO 409393 at or about map reference 1266096E 5007045N, via the approximately 270m long discharge channel, as shown in the map attached as Appendix A.

3) The rate and volume of treated wastewater discharged shall not exceed the following:
    a. 400 litres per second;
    b. Annual average daily flow of 16,900 cubic metres per day;
    c. Peak dry weather flow of 19,700 cubic metres per day; and
    d. Peak wet weather flow of 29,100 cubic metres per day.

4) The treated wastewater quality shall comply with the following limits:

	Discharge quality up to 31st December 2025		Discharge quality from 1st January 2026 onwards (or when MLE2 is fully operational & no oxidation pond discharge occurs)	
Parameter (in mg/L unless stated otherwise)	**Annual Mean**	**Annual 95%ile***	**Annual Mean**	**Annual 90%ile***

	Discharge quality up to 31st December 2025		Discharge quality from 1st January 2026 onwards (or when MLE2 is fully operational & no oxidation pond discharge occurs)	
$cBOD_5$ (Biochemical oxygen demand)	30	50	10	20
TSS (Total suspended solids)	30	50	10	20
TN (Total nitrogen)	23	35	10	15
Ecoli in cfu/100mL	260	-	10 (geometric mean)	100 (95th percentile)
TAN (Total Ammoniacal Nitrogen)	-	-	1.5	5

* *The 90th and 95th percentile applies to a rolling 12 calendar month period*

5) For the purposes of compliance with condition (4), the location at which the limits must be met is after UV treatment at the autosampler prior to discharge into the discharge channel.

6) After 31 December 2025, the exercise of this consent shall not result in visible discolouration of the Shotover River at a distance of 200 metres or more from the point of discharge.

7) The discharge, after reasonable mixing at a distance of 200 metres downstream of the point of discharge, shall not give rise to all or any of the following effects in the receiving water:
   a. The production of any conspicuous oil or grease films, scums or foams, or floatable or suspended materials; or
   b. Any emission of objectionable odour; or
   c. Any significant adverse effects on aquatic life.

Performance Monitoring

8) The consent holder shall install a flow meter on the outlet pipe(s) from the treatment plant at both the clarifier outlet and oxidation pond outlet and continually measure and record the combined daily volume of treated wastewater being discharged to the Shotover River. The consent holder shall report the daily discharge volume for the previous calendar month in writing, or in electronic form, to the Consent Authority, within two weeks after the end of each calendar month. These daily volumes shall be used to determine compliance with condition (3).

9) From the commencement of this consent, the consent holder shall collect a representative sample of the treated wastewater every week, at the location in condition (5). Each sample collected shall be analysed for:
   a. Five day carbonaceous biochemical oxygen demand (cBOD5)

b. Total suspended solids
c. Total nitrogen
d. Total ammoniacal nitrogen
e. Total phosphorous
f. Dissolved reactive phosphorous
g. *E.Coli*

***NOTE**: for the purposes of this condition, samples collected for the analysis of parameters in (a) to (f) are 24hr composite samples, while the sample for analysis of E.Coli (g) is collected as a grab sample.*

10) All samples must be analysed at a laboratory that meets ISO 17025 or IANZ standards. The consent holder must provide the Consent Authority with weekly sampling results within two weeks of receipt of the results from the laboratory..

11) Within three months of the commencement of this consent, the consent holder shall prepare and forward to the Consent Authority an Operations and Management Manual for the treatment and disposal system to ensure its effective and efficient operation at all times. The system shall be operated in accordance with this manual, which may be updated as appropriate. The manual shall be to the satisfaction of the Consent Authority and include, but not be limited to:
    a. a description of the entire treatment and disposal system, including a site map indicating the location of the various components of the treatment and disposal system, discharge locations and monitoring sites;
    b. specific management procedures for key components of the system;
    c. procedures to be utilised to monitor the operation and performance of the system;
    d. identification of potential equipment malfunctions and environmental situations that may lead to treatment system failure;
    e. monitoring and reporting procedures, including, but not limited to:
        i. contingency plans including methods for monitoring and detecting out of specification influents/effluents, contingency procedures for managing the same, contingency procedures to manage system component malfunctions and breakdowns for both the treatment and disposal system;
        ii. contingency plans for ensuring consistent effluent quality during periods of peak flows including proactive maintenance prior to peak flow seasons to achieve the same.
        iii. Monitoring plans for monitoring receiving environment quality.
    f. design flow;

g. reporting population growth and influent volumes and their consistency with the forecasts supplied at the time of granting;
h. a complaints recording system and malfunction recording system including actions and responses undertaken to rectify any system malfunction;
i. details of the measures to be taken to ensure the attainment of the treated wastewater quality requirements set out in Condition (4);
j. procedures for continuous reviewing and improving of the manual; and
~~j.~~k. be drafted in consultation with Te Ao Marama and Aukaha.

12) The consent holder shall submit the record of complaints and malfunctions to the Consent Authority within two weeks after any complaint or malfunction occurring, together with the details of the remedial measures taken. At all times, the consent holder shall ensure that the Consent Authority has a copy of the up to date Operations and Management Manual.

13)

a. The consent holder shall provide to the Consent Authority, within one month of this consent commencing, a Receiving Environment Monitoring Plan (REMP) for approval.

b. The purpose of the REMP is to monitor the effects of the discharge on the water quality and instream ecology of the Shotover and Kawarau Rivers and nearby groundwater quality.

c. The REMP must include monitoring of groundwater quality, surface water quality and instream ecology.

d. The REMP must include the following:

    i. Sample locations – as a minimum including one upstream location, and one downstream location 200 metres from the point of discharge.

    ii. Sample methods

    iii. Sample frequency – as a minimum monthly for surface quality samples and six monthly for instream ecological surveys.

    iv. Parameters to be measured

e. The REMP, and any updates, shall be provided to Aukaka and Te Ao Marama Inc for comment.

~~e.~~f. Aukaha and Te Ao Marama shall be invited to attend when monitoring is undertaken.

~~f.~~g. Any updates to the REMP shall be provided to the Consent Authority for approval at least 1 month prior to implementation.

14) The analytical sampling results for each sample collected under Condition (13) shall be reported in writing to the Consent Authority, within two weeks of receipt of the results from the laboratory by the consent holder, together with a reading of the 24-hour wastewater discharge volume for the day of sampling.

15) The consent holder shall by 15 February each year forward an annual report in writing to the Consent Authority, with a copy provided to Aukaha and Te Ao Marama Inc. The annual report shall cover the period 1 January to 30 December in the previous 12-month period and shall report on compliance with this discharge permit, including, but not limited to:
    a. Copies of the laboratory analytical results of all monitoring undertaken;
    b. Summary of the year's monitoring results, in context of previous year's results;
    c. Comments on the wastewater treatment plant's operation;
    d. Summary of volumes of treated wastewater discharged to water;
    e. Summary of quality of treated wastewater discharged to water;
    f. Summary of all analytical results from the monitoring for the previous year, and an interpretation of the results, particularly with regard to the discharge of treated wastewater to water;
    g. Summary of trends in receiving environment, any areas of concern and outlining any changes to the system or operation to mitigate concerns;
    h. Comments on compliance with the conditions of this discharge permit;
    i. Summary of any complaints received, the validity of each complaint and the corrective action taken; and
    j. Any other issues considered relevant by the consent holder.

16) The consent holder shall, at least monthly, undertake a visual inspection of the discharge channel and outfall and keep photographic records of each inspection, to determine there is no scour or erosion within the channel, as a result of the discharge of treated wastewater.

Long-term solution

17) The consent holder shall achieve the following milestones within the term of this consent:

    a. Lodge an application for the approvals required under the Resource Management Act 1991 to commission a new long-term solution for the disposal of treated wastewater by 31 May 2026.

b. Complete the engineering design for a new disposal system by 31 December 2027, if the application in (a) is approved by 31 December 2026, or within 12 months of the application in (a) being approved, whichever is the later.

18) The Consent Holder must, every 6 months, submit a progress report to the Consent Authority, Aukaha and Te Ao Marama Inc, by 15 February and 15 August each year detailing progress made towards meeting the deadlines in Condition (17).

General

19) The consent holder shall surrender discharge permit RM13.215.03.V2 within 1 month of the first exercise of this consent.

20)

a. The consent holder shall construct a treated wastewater emergency storage pond by 31 December 2027. The treated wastewater emergency storage pond shall be for wastewater to be re-directed to if there are process failures at the wastewater treatment plant and the consent holder considers that its use is necessary to mitigate potential adverse effects on the receiving environment or to ensure compliance with the conditions of this consent.

b. If the consent holder directs treated wastewater to the treated wastewater emergency storage pond, it shall notify the Consent Authority within 24 hours with reasons for the re-direction and expected duration.

21)

a. Warning notices which can be read from a distance of five metres in both English and Te Reo Māori, shall be installed and maintained at the following locations:

i. At the points where there is a public track crossing the discharge channel; ~~and~~

ii. Beside the outfall on the Shotover Riverbanks; and~~.~~

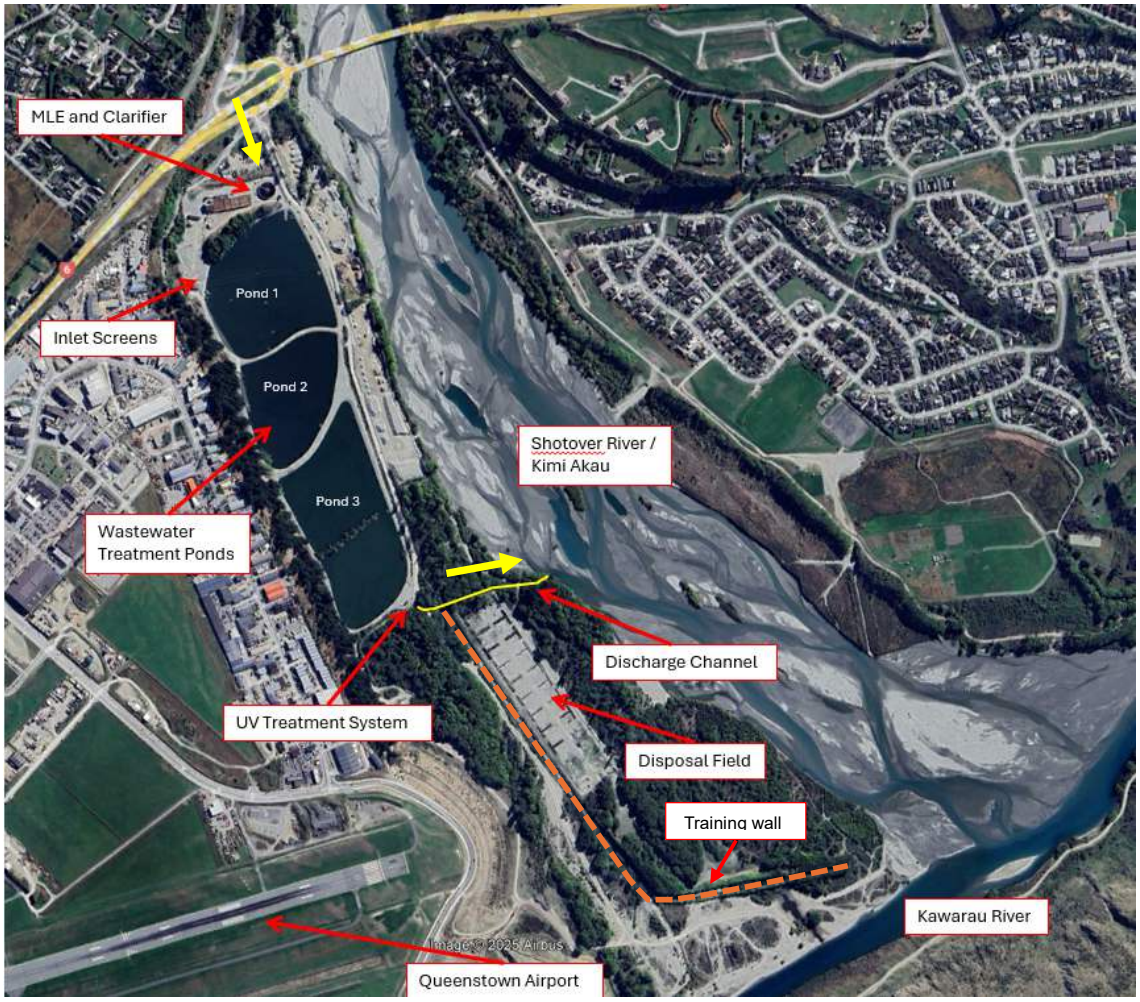
~~ii.~~iii. At the downstream end of the mixing zone, approximately 200m downstream of the outfall.

b. The warning notices shall advise the public of the existence of a wastewater outfall and the potential risk of swimming in the immediate vicinity downstream.

22) The Consent Authority may, in accordance with sections 128 and 129 of the Resource Management Act 1991, serve notice on the consent holder of its intention to review the conditions of this consent within three months of each anniversary of the commencement of this consent, for the purpose of:
    a. Determining whether the conditions of this consent are adequate to deal with any adverse effect on the environment which may arise from the exercise of the consent and which it is appropriate to deal with at a later stage, or which become evident after the date of commencement of the consent; or
    b. Ensuring the conditions of this consent are consistent with any National Environmental Standards or the relevant rule in an operative regional plan; or
    c. Requiring the consent holder to adopt the best practicable option to remove or reduce any adverse effect on the environment arising as a result of the exercise of this consent.

ADVICE NOTE: *This permit does not authorise the discharge of sludge to land or water.*

Appendix A – Location Map



Site layout of Shotover WWTP (Imagery from Google Earth, April 2023). Yellow arrows show direction of flow into and out of treatment process.

Note 1: Pond 1 is now empty and being decommissioned in line with the planned upgrades of the WWTP site.

Note 2: The Wastewater Treatment Ponds will be decommissioned after 31 December 2025 when the second MLE and Clarifier is operational.

Appendix E: Cultural Impact Assessments or Statement

TE AO MĀRAMA INC.

Queenstown Lakes District Council Cultural Impact Assessment

QLDC Wastewater Treatment Plant Discharge Consent

"Toitū te marae o Tāne, Toitū te marae o Tangaroa, Toitū te Iwi"
"Protect and strengthen the realms of the land and sea and they will protect and strengthen the people"

TE AO MĀRAMA INC.

The compilation of the report has been greatly assisted by whānau who have upheld kaitiaki responsibilities in the Murihiku Takiwā, within which the proposed project is located, over decades and contributed to the foundations of the report.

Disclaimer: Information contained within this report cannot be distributed or used without the permission of Ngāi Tahu ki Murihiku. This assessment is to be used for the current consenting process only. If decisionmakers require any information for other purposes they need to contact either Te Ao Mārama Inc. or Papatipu Rūnanga. Use of the report by decisionmakers, or any other party, in any other circumstances (for example, subsequent applications for other projects) will be subject to written approval by Papatipu Rūnanga via Te Ao Mārama Inc.

Table of Contents

Executive Summary

To provide a Short Form Cultural Impact Assessment to identify relevant values and associations to this Takiwā for Nga Rūnanga ki Murihiku and to assess the likely impacts of a proposal on those values and associations.

Ngāi Tahu has a long association with the Murihiku and Otago region. Ngāi Tahu led a seasonal lifestyle, following resources throughout the region. Generally, the use of the areas was extensive rather than intensive.

Ngāi Tahu values, rights and interests need to be respected when dealing with any activity that poses risks because these values and beliefs are central to Ngāi Tahu existence

The potential adverse effects are associated with Kaitiakitanga, Hauora, mauri, ki uta ki tai and mahinga kai. Ngāi Tahu values need to be respected when dealing with any activity that poses risks or seeks opportunities. These values and beliefs are central to Ngāi Tahu existence. An impact upon one value may impact upon all and inevitably put the health and wellbeing of humans at risk. Through proper planning and management risks may be reduced or mitigated and opportunities obtained.

Te Ao Mārama on behalf of Nga Rūnanga ki Murihiku have identified the potential risks of the proposal that are to be avoided to ensure the sustainability of the whenua and wai. Te Ao Mārama have identified ways in which the applicant is able to reduce or mitigate these risks. Te Ao Mārama wish to see draft consent conditions that reflect the recommendations made in this Short Form Cultural Impact Assessment.

Te Ao Mārama Inc on behalf of Nga Rūnanga ki Murihiku recognise the complexity of the current wastewater treatment plant and subsequent discharge issues that Queenstown District Lakes Council are facing and would like to continue to work towards a viable solution in partnership with the council.

Queenstown Lakes District Council are working with Te Ao Mārama, Aukaha and Ngāi Tahu to ensure the cultural interests of the project area are well represented and addressed to the best of their ability. The continuation of these relationships are encouraged throughout the duration of the proposed activity to ensure the appropriate outcomes are achieved for Iwi, communities and future generations.

Issues and Recommendations

Key Issue one: Associations and connections to cultural landscapes

The proposed works within the bed of the Kimikākau / Shotover River for the purpose of creating and maintaining a flowing channel past the Wastewater Treatment Plant point of discharge will have **adverse effects on the cultural landscape**. The proposed works will

impact the associated connections and relationship that Ngāi Tahu whānui have with the awa and its surrounding area.

Recommendations:

An attempt to address the above issue whanau seek the following measures to be reflected in conditions of consent:

- Condition of consent requiring consultation with Mana whenua and other experts on the development of management plans for the site.
- Condition of consent that requires the removal of direct discharge to the Kimikākau / Shotover river as a consideration for the long-term solution.
- Condition of consent that requires the removal of the proposed river diversion channel at the conclusion of the consent term.

Key Issue two: Mauri

It is important that the awa and surrounding environment is restored back, overtime, to its natural state, protected where necessary, and improved for cultural well-being and use. Such restoration and remediation of the awa will go some way to restoring mauri and environmental equilibrium.

Recommendations:

An attempt to address the above issue whanau seek the following measures to be reflected in conditions of consent:

- Condition of consent requiring consultation with Mana whenua and other experts on the development of management plans for the site.
- Condition of consent that requires the removal of direct discharge to the Kimikākau / Shotover river as a consideration for the long-term solution.
- Condition of consent that requires the removal of the proposed river diversion channel at the conclusion of the consent term.

Key Issue three: Mahingakai, access and Wāhi Tapū

Ngā Rūnanga seek to ensure that there are no further adverse effects on; mahinga kai species and habitat; the ability to use and access these areas; and water quality such that it is being maintained, improved, or enhanced. Ngā Rūnanga also seek to ensure there is no impact on any wāhi tapū, wāhi Ingoa or archaeological sites.

Recommendations:

An attempt to address the above issue whanau seek the following measures to be reflected in conditions of consent:

- Condition of consent requiring consultation with Mana whenua and other experts on the development of management plans for the site.

- Condition of consent that requires the removal of direct discharge to the Kimikākau / Shotover river as a consideration for the long-term solution.
- Condition of consent that requires the removal of the proposed river diversion channel at the conclusion of the consent term.
- Thorough baseline monitoring undertaken to ensure no reduction in water quality
- Condition of consent that reflects changing the activity if there is an issue with the water quality.
- Condition of consent requiring taonga species and their associated habitat is to be protected and enhanced.
- Condition of consent requiring mana whenua to be actively involved in any monitoring programme associated with the activity.

Purpose

The purpose of the short form Cultural Impact Assessment is to:

- Provide a narrative of the Ngāi Tahu cultural values and associations of the Kimikākau / Shotover River and surrounding landscape.
- Assess the likely impact of the proposal on Ngāi Tahu cultural values and associations.
- Provide recommendations to the applicant on how those impacts may be mitigated.
- Where unable to be mitigated, support further discussions on the ability to mitigate significant impacts.

Limitations

We acknowledge the following limitations that impact this short form Cultural Impact Assessment.

- QLDC are under a time constraint that does not allow for a full form CIA that would contain a much more extensive assessment.
- This report is being compiled with limited information as a complete resource consent application is not yet available. This assessment is only based on the information provided on or before 02 July 2025.
- It is known there are likely to be effects yet to be verified by scientific reporting (for example ecological assessments and taonga species).

Methodology - Āpiti Hono Tātai Hono Assessment

To undertake the Cultural Impact Assessment the methodology of Āpiti Hono Tātai Hono as outlined in *Apiti Hono Tatai Hono: Nga Whenua o Ngai Tahu ki Murihiku Stage 1 Southland Cultural Landscape Assessment Study, 2021,* has been utilized.

In Murihiku, Ngai Tahu have developed Apiti Hono Tatai Hono to assess and consider what is held within a land or seascape, drawing their understanding from whakapapa, mana, kawa, tikanga, matauranga, identity, connections, practices, history, and future aspirations. These considerations then build the context or foundation in which to determine what is appropriate at place and the relationships Ngāi Tahu ki Murihiku have with their whenua and moana.

Background

Queenstown Lakes District Council (QLDC) is responsible for the conveyance, treatment, and disposal of wastewater generated by the district in a manner that protects the health of its communities and the environment and is in accordance with the requirements of all relevant resource consents.

The current consented disposal system for treated effluent requires disposal through a dose and drain field. Due to significant issues and failures with the disposal field, emergency works were undertaken on 31 March 2025 to commence the discharge of treated effluent through the historic discharge channel.

These emergency works were undertaken by QLDC to address increased waterfowl presence from ponded water within and outside of the existing disposal field, which was determined to potentially be an aircraft safety concern following reports from Queenstown airport to QLDC. This has necessitated the discharge of treated wastewater through the previous discharge channel to the Kimikākau/Shotover River.

As the discharge of treated effluent and the adverse effects of the activity will continue, QLDC have now submitted a resource consent application with ORC to undertake the current activity of discharging via the historic discharge channel.

Waste Water Treatment Plant

The WWTP was established in the 1970s. Before 2017 wastewater treatment at the WWTP was basic, consisting of an aerated septage treatment lagoon and treated wastewater disposed directly to the lower Kimikākau /Shotover River.

Over the years, QLDC has undertaken, upgrades of the WWTP site. In its present state, the WWTP, and specifically the DAD disposal field, no longer operates as designed and is struggling to cope with existing flows. Therefore in October 2024 QLDC commenced developing a new long-term disposal solution for treated effluent produced at the WWTP to address the emerging performance issues.

The solution will replace the existing DAD disposal field and cater to the WWTP's long-term effluent disposal requirements in a culturally appropriate, environmentally friendly, and operationally effective manner.

Current Resource Consent

Queenstown Lakes District Council is seeking authorisation to undertake works within the bed of the Kimikākau/Shotover River as part of the current resource consent application lodged with the ORC. Consent is sought to create and maintain a flowing channel past the WWTP's point of discharge, to create a more dynamic mixing zone. See **Appendix 1** – proposed activity location. This work will include:

- A water permit to divert water flow as needed
- A Land use consent to undertake works within the Kimikākau/Shotover riverbed to create a new river diversion channel
- A Discharge consent for the remobilization of the bed material from the Kimikākau/Shotover riverbed during the diversion works

Te Ao Mārama Inc. has provided a Short Form Cultural Impact Assessment to help inform the above consents from a Te Ao Māori perspective. Te Ao Mārama Inc. have undertaken this mahi on behalf of Ngā Rūnanga.

Mana Whenua

The peoples of Waitaha, Kati Mamoe and Ngāi Tahu are nowadays collectively referred to as Ngāi Tahu. Waitaha settled in the South Island approximately 800 years ago and were later followed by Kati Mamoe and Ngāi Tahu in the major domestic migrations between 1500s and 1700s.1 Ngāi Tahu means the 'people of Tahu', linking to the eponymous ancestor Tahu Pōtiki, 'Within the iwi there are five primary hapū being Kāti Kurī, Ngāti Irakehu, Kāti Huirapa, Ngāi Tūāhuriri and Ngāi Te Ruahikihiki.[1]

Ngāi Tahu now has an extensive territory that includes most of the South Island 'except for the Blenheim and Nelson areas.[2]

The territory includes offshore islands such as Rakiura, Raratoka and Whenua Hou. Across its takiwā, Ngai Tahu constantly travelled 'as they worked the resources of their area and traded their surplus with people from other areas. This created a complex and far-flung network of relationships which in turn were strengthened by marriage.[3]

The Te Rūnanga o Ngāi Tahu Act 1996 establishes Te Rūnanga o Ngāi Tahu (Te Rūnanga), consisting of each of the Papatipu Runanga of Ngāi Tahu Whānui (section 9).

In Murihiku there are four Papatipu Rūnanga whose members hold mana whenua status within the region. Te Ao Mārama Inc. represents the interests of these four Rūnanga on matters pertaining to the management of natural resources under the Resource Management Act 1991 and the Local Government Act 2002.

Te Rūnanga o Ngāi Tahu (Declaration of Membership) Order 2001 describes the respective takiwā of Papatipu Rūnanga representing Ngāi Tahu ki Murihiku, as being particular to Te Rūnanga o Awarua, Hokonui Rūnanga, Te Rūnanga o Ōraka-Aparima and Waihōpai Rūnaka.

Relationship/Association to place

To Ngāi Tahu, the land and water confers dignity and rank, provides the means of manaakitanga, is the resting place for the dead, a spiritual base for traditional beliefs, and a heritage for future generations.

The Ngāi Tahu whānui associations with this area and many of the Purakau for this rohe are reflected in the landscape and creation stories such as ngā atua being, Ranginui, Pāpātuānuku, Tangaroa and Tāwhirimātea. This rohe brings a connection to our tupuna knowing they traversed, gathered and recreated here. The association to this rohe is historical and contemporary and includes, whakapapa, place names, ara tawhito, mahinga kai, and wāhi tapu.

---

[1] Ngai Tahu (1996) Ngai Tahu – the iwi, http://ngaitahu.iwi.nz/ngai-tahu/
[2] Dacker, B. (1990) Te People of the Place: Mahika Kai, p. 6
[3] Dacker (1990) p. 6

The name Whakatipu-Wai-Māori originates from the earliest expedition of discovery made many generations ago by the tupuna Rakaihautu and his party from the Uruao waka. Rakaihautu is traditionally credited with creating the great waterways of the interior of the island with his famous kō (a tool similar to a spade), known as Tū Whakaroria and renamed Tuhiraki at the conclusion of the expedition.

Ngāi Tahu moved around Te Waipounamu hunting and gathering the island's resources. Movements were, and still are, according to the seasons following the breeding cycles, migration times and feeding habits of animals and plants. Seasonal hunting of moa and weka by highly mobile coastal communities were common in the central lakes area and mobile moa butchery sites were quite common.

Historically Mana Whenua supported nohoanga and villages which were the seasonal destinations of Otago and Southland whānau and hapū for many generations to exercise ahikā, access mahinga kai and providing a route to access the treasured pounamu located beyond the head of the lake.

Māori would travel to the sacred Pounamu fields, following particular land features such as mountain ranges for guidance while utilising waterbodies.

Tribal history is embedded in the landscape, rivers and the lands that it flows through. This association is expressed through the metaphorical understanding of land and waters as our ancestors – our whakapapa, which connects us to place.

After colonisation, Ngāi Tahu were predominantly removed from this landscape, however some Ngāi Tahu whānui have remained connected to this place through Mahinga kai harvesting, Taonga harvesting (Pounamu) and reclaimed Nohoanga sites. The Ngāi Tahu Claims Settlement Act 1998 process saw Ngāi Tahu fighting and succeeding in having areas recognised as important to mana whenua.

To date Ngāi Tahu continue to argue that the Whakatipu area was never sold, Ta Tipene O'Regan refers to the area as "the hole in the middle".

Due to disrupted presence in Whakatipu and the surrounding area, key mechanisms such as the Ngai Tahu Claims Settlement Act 1998 and Te Tangi a Tauira 2008 help to uphold Mana Whenua aspirations in the area.

The Ngāi Tahu whakataukī/ proverb: Mō tātou, ā, mō ngā uri ā muri ake nei (For all of us and the generations that follow) – Te Tangi a Tauira 2008, articulates the aspirations for Mana Whenua, to:

- Protect the ability for our future generations to engage with ancestral land and the surrounding environment as their ancestors did and continue to do.

- Ensure that water quality continues to be protected to a standard that allows for mahinga kai to be diverse, abundant, and safe to eat.
- Be able to exercise rangatiratanga over Whakatipu and the surrounding environment.

Ngāi Tahu is today and was at the time of the signing of the Treaty of Waitangi in 1840, the tangata whenua that hold manawhenua and manamoana within the takiwā of Ngāi Tahu Whānui, which includes all of Murihiku. See **Appendix 2** for early map of Lake Whakatipu, Lake Hawea and Lake Wānaka

Te Tangi a Tauira

In 2008, Te Tangi a Tauira – the Cry of the People: Ngāi Tahu ki Murihiku Natural Resource and Environmental Iwi Management Plan was published. This plan consolidates Ngāi Tahu ki Murihiku values, knowledge, perspectives, outcomes and aspirations for natural resource and environmental management issues. It builds on earlier documents, including Te Whakatau Kaupapa ki Murihiku 1997 and Ngāi Tahu Freshwater Policy 1999.

The primary purpose of Te Tangi a Tauira is to assist Ngāi Tahu ki Murihiku in carrying out kaitiaki roles and responsibilities, and as such is relied upon by Te Ao Mārama to support Papatipu Rūnanga.

Te Tangi a Tauira Outcomes

The following are the outcomes in which Ngāi Tahu ki Murihiku want to achieve through the implementation and use of this Plan.

The desired outcomes are divided into three:

1. Kaitiakitanga, Tino Rangatiratanga and Treaty related outcomes;
2. environmental outcomes;
3. social, economic, health and well-being outcomes.

1. Kaitiakitanga, Tino Rangatiratanga and Treaty related outcomes

- That Ngāi Tahu ki Murihiku is involved at a level that allows for effective and proactive management of natural resources, wāhi tapu and wāhi taonga in a manner that upholds the kaupapa of this Plan.
- That there is mutual understanding of iwi and local authority values and responsibilities with respect to the environment, effective management of resources by councils, and effective performance of kaitiaki by Ngāi Tahu ki Murihiku.
- That the principle of Tino Rangatiratanga is enhanced and partnerships formed and extended.

2. Environmental Outcomes

- To ensure environmental outcomes accommodate for cultural and traditional spiritual values held by Ngāi Tahu ki Murihiku.

- To ensure the protection, restoration and enhancement of the productivity and life supporting capacity of mahinga kai, indigenous biodiversity, air, water, land, natural habitats and ecosystem, and all other natural resources valued by Ngāi Tahu ki Murihiku.

3. Social, economic, health and well-being outcomes

That a sense of belonging and social responsibility with respect to the surrounding environments is encouraged. This includes supporting activities and events that engage communities with their local environments.

To ensure that economic development and growth do not have implications for Ngāi Tahu ki Murihiku in exercising Kaitiakitanga or have adverse impacts on the environment and communities.

A policy assessment of Te Tangi a Tauira that are relevant to the proposal can be found in **Appendix 3**. The most relevant policies and issues to this proposal are found in Table 1: Analysis and Recommendations, below.

Frameworks, values and practices

Understanding the implications of the Wastewater discharge and channelling within riverbeds on cultural values, historic and contemporary associations, requires a comprehensive analysis of the framework of knowledge that underpins these values, otherwise known as Mātauranga Māori.

For Ngāi Tahu, the potential effects of activities on cultural values, rights and interests are both tangible and intangible. Tangible cultural effects, in this instance for example, relate to the physical discharge of contaminants entering the Kimikākau, which can be verified by western science as affecting water quality and the species that reside within the water.

Intangible cultural effects reflect the spiritual connection between mana whenua and the Kimikākau. These effects are not necessarily verified by western science yet form the rich basis of evidence for decision making relating to resource management by mana whenua. In the context of this proposal, Human waste is tapu and therefore it should not be directly interacted with by living beings, and in the realm of Te Ao Māori, Rivers are their own spiritual living being with their own Mauri. For the Tapu to be lifted from treated wastewater it must be brought to a state of Noa, this would require the discharge to pass through Papatuanuku, the earth mother.

The frameworks, values and practices identified are related to the project area and the surrounding area. Mana Whenua frameworks, values and practices do not exist only within a defined resource management area. They extend beyond and encompass the entire whenua.

See **Appendix 4** for a detailed explanation of values.

Analysis and Recommendations

The following Table 1 provides an analysis of the proposal against the Ngāi Tahu values along with suggested recommendations or expectations of Ngāi Tahu whānui to address the likely impacts.

Table 1: Analysis and Recommendations				
Ngāi Tahu value and/or framework	**Element of proposed activity**	**Impact on Value**	**Te Tangi issue/policy**	**Recommended mitigation/expectation**
Kaitiakitanga	The application in its entirety.	Inability for mana whenua to fulfill our duty as Kaitiaki and ensure the appropriate use of the environment and its limited resources. Pollution of the site causing severance between Mana Whenua as Kaitiaki.	To ignore the detrimental effects is contrary to the concept of Kaitiakitanga – the holistic concept of environmental care. Specific provisions within the RMA & LGA require the recognition and provision for the relationship of Māori and their culture and traditions with their ancestral lands, water, sites, wāhi tapu and other taonga, to have particular regard to Kaitiakitanga and take into account principles of the Treaty of Waitangi. A number of statutes, regulations, policies and associated legal mechanisms, make provision for incorporating Ngāi Tahu ki Murihiku values into the management of natural resources, including provision for kaitiakitanga.	Consent condition requiring consultation with Mana Whenua and other experts on the development of management plans for the site. Consent condition that requires the removal of direct discharge to the Kimikākau / Shotover river as a consideration for the long-term solution. Consent condition that requires the removal of the proposed river diversion channel at the conclusion of the consent term.

			Ngāi Tahu ki Murihiku acknowledge and support appropriate and existing management regimes that strive to enhance and maintain the natural landscape, promote Kaitiakitanga and provide access for sustainable customary use. Ensure that economic development and growth do not have implications for Ngāi Tahu ki Murihiku in exercising Kaitiakitanga, or have adverse impacts on the environment and communities. For Ngāi Tahu ki Murihiku, customary use is consistent with conservation of species. The concept of Kaitiakitanga is an integral component of resource use. Customary use comes with management responsibilities to care and protect natural resources.	

Ki uta ki tai	Where the application is dissecting ki uta from ki tai	The application in its entirety causes a disruption of the chain from Ki Uta to Ki Tai. This is of heightened concern due to its location at the top of the Clutha / Mata-Au and the potential adverse effects on the entire catchment below.	Promote the management of freshwater according to the principle of ki uta ki tai, and thus the flow of water from source to sea. Promote catchment management planning (ki uta ki tai), as a means to recognise and provide for the relationship between land and water Promote river management that adopts the priorities established in the Te Rūnanga o Ngāi Tahu Freshwater Policy 1997. The priorities are: 1. Sustain the mauri of the waterbodies within the catchment. 2. Meet the basic health and safety needs of humans (drinking water) 3. Protect cultural values and uses 4. Protect other instream values (indigenous flora and fauna). 5. Meet the health and safety needs of humans (sanitation).	Consent conditions requiring consultation with Mana Whenua and other experts on the development of management plans for the site. Consent condition that requires the removal of direct discharge to the Kimikākau / Shotover river as a consideration for the long-term solution. Consent conditions requiring the removal of the proposed river diversion channel at the conclusion of the consent term.

			6. Provide for other uses. Ensure that all native fish species have uninhibited passage from the river to the sea at all times, through ensuring continuity of flow, ki uta ki tai	
Mauri	The altering / channeling of the river Inappropriate disposal of wastewater directly into the river.	The Mauri of the river is disrupted due to its inappropriate use as a disposal site. Water quality is affected by the entire activity, impeding Mana Whenua ability to use the river as a space to recharge their Mauri. Alters the river in an unnatural way causing potential risks for future generations and the lower catchment.	Wastewater disposal options that propose the direct discharge of treated or untreated effluent to water need to be assessed by the kaitiaki rūnanga on a case by case, individual waterway, basis. The appropriateness of any proposal will depend on the nature of the proposal, and what waterway is involved. Individual waterways possess their individual mauri and values, and kaitiaki rūnanga are in the best position to assess the potential impacts of a proposal on such values Wastewater Disposal – "For Ngāi Tahu ki Murihiku, discharge to land is considered a better option than discharge to water, as discharging to land allows Papatūānuku to filter and cleanse contaminants from the	Consent conditions requiring consultation with Mana Whenua and other experts on the development of management plans for the site. Consent condition that requires the removal of direct discharge to the Kimikākau / Shotover river as a consideration for the long-term solution. Consent conditions requiring the removal of the proposed river diversion channel at the conclusion of the consent term.

			discharge in a natural way, before the discharge enters the hydraulic system Water Quality – "Water is held in the highest esteem because the welfare of the life that it contains determines the welfare of the people reliant on those resources. Ensuring that water that is meant for drinking is of drinking water quality, and that water where mahinga kai is harvested is safe to eat from, and the water where our kids swim is safe for them to swim in, is our kaitiaki responsibly as Ngāi Tahu ki Murihiku" Strive for the highest possible standard of water quality that is characteristic of a particular place/waterway, recognising principles of achievability. This means that we strive for drinking water quality in water we once drank from, contact recreation in water we once used for bathing or swimming, water quality capable of sustaining healthy mahinga kai in waters we use for providing kai	

			Avoid the use of water as a receiving environment for the direct, or point source, discharge of contaminants. Even if the discharge is treated and therefore considered "clean", it may still be culturally unacceptable. Generally, all discharge must first be to land Avoid compromising freshwater fishery values as a result of diversion, extraction, or other competing use for water, or as a result of any activity in the bed or margin of a lake or river	
Mahinga Kai	The application in its entirety.	Water quality is affected by the activity and therefore affects the quality and quantity of mahinga kai. The activity provides for an Inappropriate discharge directly into the river and therefore Mahinga Kai cannot be sourced from or around the discharge site.	Freshwater Fisheries – "Fish are of great cultural, social and economic significance to Ngāi Tahu ki Murihiku. Fish from Murihiku rivers formed an essential part of the Ngāi Tahu economy prior to the Treaty. The importance of such fisheries remains today" All Ngāi Tahu Whānui, current and future generations, must have the capacity to access, use and protect native fisheries, and the history and traditions that are part of	Consent conditions requiring consultation with Mana Whenua and other experts on the development of management plans for the site, in particular the Ecological Management Plan. Consent condition that requires the removal of direct discharge to the Kimikākau / Shotover river as a consideration for the long-term solution.

		Displacement of taonga species due to the degraded nature of the river as a direct result of the activity.	customary use of such fisheries, as guaranteed by the Treaty of Waitangi Ensure that all native fish species have uninhibited passage between lakes, rivers and sea, where such passage is a natural occurrence, through ensuring continuity of flow ki uta ki tai, and fish passageways Mahinga kai is about mahi ngā kai – it is about places, ways of doings things, and resources that sustain the people. The loss of mahinga kai is attributed, in part to habitat degradation and resource depletion.	Consent condition that requires the removal of the proposed river diversion channel at the conclusion of the consent term. Thorough Baseline monitoring undertaken to ensure no reduction in water quality. Condition that reflects changing the activity if there is an issue with water quality. Require that taonga species are protected and habitat is enhanced. Require that we are invited to do or be part of any monitoring.

Conclusion

Ngāi Tahu has a long association with the Murihiku region. Ngāi Tahu led a seasonal lifestyle, following resources throughout the region. Generally, the use of the areas was extensive rather than intensive.

The potential adverse effects are associated with kaitiakitanga, mauri, ki uta ki tai and mahinga kai. Ngāi Tahu values need to be respected when dealing with any activity that poses risks. These values and beliefs are central to Ngāi Tahu existence. Any impact upon one value will impact upon all including and inevitably put the health and wellbeing of humans at risk. Through proper planning and management these risks may be reduced or mitigated. Te Ao Mārama on behalf of Te Rūnanga o Ōraka Aparima have identified the potential risks that are to be avoided to ensure the sustainability of the whenua and have identified ways in which the applicant is able to reduce and mitigate these risks. Te Ao Mārama wish to see draft consent conditions that reflect the recommendations made.

Queenstown Lakes District Council are working closely with Te Ao Mārama Inc and other experts to work through the complexities of this application and subsequent short-term solution as well the future long-term solution.

The continuation of the relationship is encouraged throughout the duration of the proposed activity and to ensure the appropriate cultural sensitivity is achieved.

Appendix 1 – Location of proposed activity

Appendix 2 – early map of Lake Whakatipu, Lake Wānaka and Lake Hawea

Te Huruhuru Map of Whakatipu Waimāori, Wānaka and Hāwea, 1842. Hocken Library. [4]

[4] Jock Phillips, European exploration – Otago and Southland, Te Ara – the Encyclopedia of New Zealand, https://teara.govt.nz/en/zoomify/11271/te-huruhurus-map (accessed 28 July 2025).

Appendix 3 – Te Tangi a Tauira

"Toi tū te marae a Tāne,
Toi tū te marae a Tangaroa,
Toi tū te iwi"

"If the world of Tāne (deity of all living things) endures,
If the marae of Tangaroa (deity of the sea) endures,
The people endure"

3.3.10 General Water Policy

Nga Take – Issues

- Management of waters - ki uta ki tai
- Protection of the mauri of all water
- Impacts of discharges of contaminants on water resources and the relationship of Ngāi Tahu ki Murihiku to such resources

Nga Kaupapa – Policy

- Manage our freshwater resources wisely, mō tātou, ā, mō ngā uri ā muri ake nei, for all of us and the generations that follow.

3.5.10 General Water Policy

Nga Take – Issues

- participation of iwi in freshwater management
- Access to freshwater resources for cultural and customary use
- Maintenance of water quality and water quantity
- Protection of the mauri and wairua of rivers, lakes and wetlands
- Protection, maintenance and enhancement of mahinga kai
- Protection of wāhi tapu and wāhi taonga associated with rivers, lakes and wetlands
- Recognition of the special significance of particular water bodies to Ngāi Tahu ki Murihiku
- The aspirations of iwi to develop, use and protect water resources
- Enhancing waterways, in addition to ensuring no adverse effects
- Direct and indirect discharges to water

Nga Kaupapa – Policy

- The role of Ngāi Tahu ki Murihiku as kaitiaki of freshwater must be given effect to in freshwater policy, planning and management

- Protect and enhance the mauri, or life supporting capacity, of freshwater resources throughout Murihiku

- Manage our freshwater resources wisely, mō tātou, ā, mō ngā uri ā muri ake nei, for all of us and the generations that follow

- Promote the management of freshwater according to the principle of ki uta ki tai, and thus the flow of water from source to sea

- Protect and enhance the customary relationship of Ngāi Tahu ki Murihiku with freshwater resources

3.5.11 Rivers

Nga Take – Issues

- Ensuring that water is valued as a taonga for all of New Zealand
- Effects on the mauri of Murihiku Rivers due to land use and discharge activities, and water abstractions
- Poor water quality in some Murihiku Rivers: our children are not able to swim in some rivers
- Ngāi Tahu development rights pertaining to water resources

Nga Kaupapa – Policy

- Promote river management that adopts the priorities established in the Te Rūnanga o Ngāi Tahu Freshwater Policy 1997. The priorities are:

- Priority 1: Sustain the mauri of the waterbodies within the catchment.

- Priority 2: Meet the basic health and safety needs of humans (drinking water).

- Priority 3: Protect cultural values and uses.

- Priority 4: Protect other instream values (indigenous flora and fauna).

- Priority 5: Meet the health and safety needs of humans (sanitation).

- Priority 6: Provide water for stock.

- Priority 7: Provide for economic activities including abstractive uses.

- Priority 8: Provide for other uses.

- Management of our rivers must take into account that each waterway has its own mauri, guarded by separate spiritual guardians, its own mana, and its own set of associated values and uses.

- The establishment of river flow regimes (e.g. minimum flows) must reflect the principles of ki uta ki tai, and thus river flow requirements from source to sea, including the wetlands, tributaries and waipuna that are associated with that river flow.

- Ensure that all native fish species have uninhibited passage from the river to the sea at all times, through ensuring continuity of flow ki uta ki tai

- Promote, where appropriate, the use of Freshwater Mātaitai9 , Water Conservation Orders (WCO), rāhui, and similar tools to protect the rivers of Murihiku, where those rivers are under threat from competing water uses, and/or when there are outstanding cultural, amenity or intrinsic values that require protection

- Avoid the use of rivers as a receiving environment for the discharge of contaminants (e.g. industrial, residential, recreational or agricultural sources)

- Prioritise the restoration of those waterbodies of high cultural value, both in terms of ecological restoration and in terms of restoring cultural landscapes

- Ensure that activities in upper catchments have no adverse effect on mahinga kai, water quality and water quantity in lower catchments

3.5.20 Freshwater Fisheries

Nga Take – Issues

- Effects of poor water quality and degraded habitat on customary fisheries

Nga Kaupapa – Policy

- Avoid compromising freshwater fishery values as a result of diversion, extraction, or other competing use for water, or as a result of any activity in the bed or margin of a lake or river

- Ensure that all native fish species have uninhibited passage from the river to the sea at all times, through ensuring continuity of flow ki uta ki tai

<u>Indicators used by tangata whenua to assess stream health:</u>

- Shape of the river

- Sediment in the water
- Water quality in the catchment
- Flow characteristics
- Flow variations
- Flood flows
- Sound of flow
- Movement of water
- Fish are safe to eat
- Uses of the river
- Safe to gather plants
- Natural river mouth environment
- Water quality
- Abundance and diversity of species
- Temperature
- Water is safe to drink
- Clarity of the water

Appendix 4 – Frameworks, values and practices

Ki Uta Ki Tai

"Ki Uta Ki Tai" or "mountains to the sea" is a fundamental pillar of the strategy employed by Ngai Tahu within the environmental space, this philosophy emphasises the holistic nature of our environment, elements interact and affect one another.

Following is an excerpt from Te Tangi a Tauira that outlines the fundamental concept of Ki Uta Ki Tai:

"Ki Uta Ki Tai is based on the idea that if the realms of Tāwhirimatea (God of the winds), Tāne Mahuta (God of all living things), Papatūānuku (mother earth) and Tangaroa (god of the sea) are sustained, then the people will be sustained. The kaupapa reflects the knowledge that resources are connected, from the mountains to the sea, and must be managed as such. Furthermore, the kaupapa reflects that we belong to the environment and are only borrowing the resources from our generations that are yet to come. It is considered our duty to leave the environment in as good or even better condition than received from our tūpuna. The historical practices were established by our tūpuna and must be passed on to ngā uri kei te heke mai, the generations to come."

Whakapapa

Whakapapa establishes links that maintain relationships between our people, language and their environment. All things whether animate or inanimate are connected and have mauri, a life force. Therefore, the welfare of any part of our environment determines the welfare of our people.

The cultural identity of Ngāi Tahu ki Murihiku stems from their relationship with their whenua, maunga, awa, and taonga species. These relationships originate in whakapapa. People are from a junior line (Ira Tangata line) from Ranginui (sky father) and Papatūānuku (earth mother). The environment and all the flora and fauna are from the senior line (Ira Atua line) from this union. This relationship between tangata (people) and the environment requires respect and appropriate behaviour in gathering resources otherwise negative consequences can result.

With the alienation of Māori from ancestral land, mana whenua connection has relied on the inanimate and spiritual connection we have to the landscapes and water bodies.

Mauri

Protecting and restoring mauri is the responsibility of Kaitiaki Papatipu Rūnanga, as described in Te Tangi a Tauira as follows:

The central component of the Māori perspective on the environment is the recognition of mauri, the life principal in all objects, animate and inanimate. The presence of mauri in all things entrusts people to appreciate and respect that resource. In this way, overuse, depletion or desecration of natural resources is not an accepted practice. Tikanga regulates activities concerning the conservation and sustainable use of natural resources in order to protect the mauri.

Hauora

Hauora is not just a reference to one's health but to a state of health. Hauora is defined in English as meaning 'fit, well, healthy, vigorous, robust.' A human analogy for Hauora is that you can take a knock, such as have a cold, and have the resilience to bounce back to a healthy and vigorous state

Taonga Species

Taonga species were part of the cultural redress for mahinga kai, to give practical effect for Ngāi Tahu to undertake kaitiaki obligations. Through the settlement, the Crown acknowledged the relationship Ngāi Tahu has with these species. Not all species that are considered taonga were listed because of various reasons. All indigenous species are taonga to Ngāi Tahu because of their contribution to ecosystem health.

Rangatiratanga

Rangatiratanga is by definition; chieftainship, the powers and qualities of chiefly leadership, and exercise of tribal authority or self-determination. Tino rangatiratanga is defined as full Tribal Authority, of the Iwi in respect to their natural, physical and metaphysical resources. Tino rangatiratanga is a concept deeply rooted in te ao Māori and can be traced back to the very principles of Te Tiriti o Waitangi.

Tapu

Tapu is defined as something or someone being sacred, restricted, set apart, prohibited or forbidden.

Appendix 5 – Rohe of Papatipu Rūnanga

Awarua Rūnaka – centres on Awarua and extends to the coasts and estuaries adjoining Waihopai sharing an interest in the lakes and mountains between Whakatipu-Waitai and Tawhititarere with other Murihiku Rūnanga and those located from Waihemo southwards.

Hokonui Rūnanga – centres on the Hokonui region and includes a shared interest in the lakes and mountains between Whakatipu-Waitai and Tawhitarere with other Murihiku Rūnanga and those located from Waihemo southwards.

Te Rūnanga o Oraka Aparima – centres on Oraka and extends from Waimatuku to Tawhititarere sharing an interest in the lakes and mountains from Whakatipu-Waitai to Tawhititarere with other Murihiku Rūnanga and those located from Waihemo southwards.

Waihōpai Rūnaka – centres on Waihopai and extends northwards to Te Mata-au sharing an interest in the lakes and mountains to the western coast with other Murihiku Rūnanga and those located from Waihemo southwards. [5]

[5] *Te Runanga o Ngai Tahu (Declaration of Membership) Order 2001section 4*

Schedule 40 Statutory acknowledgement for Mata-au (Clutha River)

ss 205, 206

Statutory area

The statutory area to which this statutory acknowledgement applies is the river known as Mata-au (Clutha River), the location of which is shown on Allocation Plan MD 122 (SO 24727).

Preamble

Under section 206, the Crown acknowledges Te Rūnanga o Ngāi Tahu's statement of Ngāi Tahu's cultural, spiritual, historic, and traditional association to the Mata-au, as set out below.

Ngāi Tahu association with the Mata-au

The Mata-au river takes its name from a Ngāi Tahu whakapapa that traces the genealogy of water. On that basis, the Mata-au is seen as a descendant of the creation traditions. For Ngāi Tahu, traditions such as this represent the links between the cosmological world of the gods and present generations, these histories reinforce tribal identity and solidarity, and continuity between generations, and document the events which shaped the environment of Te Wai Pounamu and Ngāi Tahu as an iwi.

On another level, the Mata-au was part of a mahinga kai trail that led inland and was used by Ōtākou hapū including Ngāti Kurī, Ngāti Ruahikihiki, Ngāti Huirapa and Ngāi Tuahuriri. The tūpuna had considerable knowledge of whakapapa, traditional trails and tauranga waka, places for gathering kai and other taonga, ways in which to use the resources of the river, the relationship of people with the river and their dependence on it, and tikanga for the proper and sustainable utilisation of resources. All of these values remain important to Ngāi Tahu today.

The river was also very important in the transportation of pounamu from inland areas down to settlements on the coast, from where it was traded north and south. Thus there were numerous tauranga waka (landing places) along it. The tūpuna had an intimate knowledge of navigation, river routes, safe harbours and landing places, and the locations of food and other resources on the river. The river was an integral part of a network of trails which were used in order to ensure the safest journey and incorporated locations along the way that were identified for activities including camping overnight and gathering kai. Knowledge of these trails continues to be held by whānau and hapū and is regarded as a taonga. The traditional mobile lifestyle of the people led to their dependence on the resources of the river.

The Mata-au is where Ngāi Tahu's leader, Te Hautapunui o Tū, established the boundary line between Ngāi Tahu and Ngāti Mamoe. Ngāti Mamoe were to hold mana (authority) over the lands south of the river and Ngāi Tahu were to hold mana northwards. Eventually, the unions

between the families of Te Hautapunui o Tū and Ngāti Mamoe were to overcome these boundaries. For Ngāi Tahu, histories such as this represent the links and continuity between past and present generations, reinforce tribal identity, and document the events which shaped Ngāi Tahu as an iwi.

Strategic marriages between hapū further strengthened the kupenga (net) of whakapapa, and thus rights to travel on and use the resources of the river. It is because of these patterns of activity that the river continues to be important to rūnanga located in Otago and beyond. These rūnanga carry the responsibilities of kaitiaki in relation to the area, and are represented by the tribal structure, Te Rūnanga o Ngāi Tahu.

Urupā and battlegrounds are located all along this river. One battleground, known as Te Kauae Whakatoro (downstream of Tuapeka), recalls a confrontation between Ngāi Tahu and Ngāti Mamoe that led to the armistice established by Te Hautapunui o Tū. Urupā are the resting places of Ngāi Tahu tūpuna and, as such, are the focus for whānau traditions. These are places holding the memories, traditions, victories and defeats of Ngāi Tahu tūpuna, and are frequently protected by secret locations.

The mauri of Mata-au represents the essence that binds the physical and spiritual elements of all things together, generating and upholding all life. All elements of the natural environment possess a life force, and all forms of life are related. Mauri is a critical element of the spiritual relationship of Ngāi Tahu Whānui with the river

Purposes of statutory acknowledgement
Pursuant to section 215, and without limiting the rest of this schedule, the only purposes of this statutory acknowledgement are—

(a)to require that consent authorities forward summaries of resource consent applications to Te Rūnanga o Ngāi Tahu as required by regulations made pursuant to section 207 (clause 12.2.3 of the deed of settlement); and

(b)to require that consent authorities, Heritage New Zealand Pouhere Taonga, or the Environment Court, as the case may be, have regard to this statutory acknowledgement in relation to the Mata-au, as provided in sections 208 to 210 (clause 12.2.4 of the deed of settlement); and

(c)to empower the Minister responsible for management of the Mata-au or the Commissioner of Crown Lands, as the case may be, to enter into a Deed of Recognition as provided in section 212 (clause 12.2.6 of the deed of settlement); and
(d)to enable Te Rūnanga o Ngāi Tahu and any member of Ngāi Tahu Whānui to cite this statutory acknowledgement as evidence of the association of Ngāi Tahu to the Mata-au as provided in section 211 (clause 12.2.5 of the deed of settlement).

Limitations on effect of statutory acknowledgement
Except as expressly provided in sections 208 to 211, 213, and 215,—

(a)this statutory acknowledgement does not affect, and is not to be taken into account in, the exercise of any power, duty, or function by any person or entity under any statute, regulation, or bylaw; and
(b)without limiting paragraph (a), no person or entity, in considering any matter or making any decision or recommendation under any statute, regulation, or bylaw, may give any greater or lesser weight to Ngāi Tahu's association to the Mata-au (as described in this statutory acknowledgement) than that person or entity would give under the relevant statute, regulation, or bylaw, if this statutory acknowledgement did not exist in respect of the Mata-au.

Except as expressly provided in this Act, this statutory acknowledgement does not affect the lawful rights or interests of any person who is not a party to the deed of settlement.
Except as expressly provided in this Act, this statutory acknowledgement does not, of itself, have the effect of granting, creating, or providing evidence of any estate or interest in, or any rights of any kind whatsoever relating to, the Mata-au.

Schedule 40: amended, on 20 May 2014, by section 107 of the Heritage New Zealand Pouhere Taonga Act 2014 (2014 No 26)
[6]

[6] Ngāi Tahu Claims Settlement Act 1998 No 97 (as at 01 July 2022), Public Act Schedule 40 Statutory acknowledgement for Mata-au (Clutha River) – New Zealand Legislation

Aukaha
KIA KAHA, AU KAHA

Aukaha ref: MTP6415

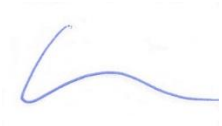
13th August 2025
Queenstown Lakes District Council
Email: andrew.hill@qldc.govt.nz

Tēna koe Andrew,
Please find the Cultural Position Statement regarding discharge of treated wastewater as endorsed by the Aukaha Ltd Wai Māori representatives:

The direct discharge of human waste to natural water, almost regardless of the extent of treatment, is considered abhorrent by mana whenua.
In traditional Māori knowledge, wai (water) was classified in accordance with its characteristics and ceremonial use. These categories determined how the water could or could not be used. The mixing of water from separate categories was, and still is, considered unacceptable to Māori. In this regard, wastewater which is classified as wai-kino (polluted water) should not be mixed with other categories of water. Instead, natural mixing of wastewater through land, or a similar environment that provides a natural buffer or transition zone is supported by mana whenua. To reiterate, the wastewater leaving a treatment plant is considered tapu (prohibited, restricted, forbidden, to be approached with caution). Treatment through natural processes in the land to reach a state of being noa (free from extensions of tapu, ordinary, unrestricted) is the preferred option.
This natural process is important, because in order for the mauri of the water to be fully restored it needs to be cleaned and revitalised through interactions with the forces of nature and Papatūānuku:

- Water passes through Papatūānuku (the earth) to transform and cleanse the polluted water which feeds the surrounding biota and in turn begins to re-invigorate its mauri.
- Tāne (The Atua of the forest and all that dwells within it), uses plants, roots, micro-organisms, birds, and insects that form the natural biological processes to absorb and remove contaminants with the added benefit of significant carbon sequestration and a natural increase in biodiversity.
- Tāwhirimātea (the wind) acts to oxygenate and agitate the water; and
- Tama- nui-te-Rā (the sun) acts to add UV light.

Nāku noa, nā



Chris Rosenbrock
Interim Chief Executive, Aukaha

Appendix F: Updated Policy Assessment

RM25.177 – s92 question (3)

3. *An assessment of the relevant objectives and policies to the proposal as a whole is contained in Section 6 of the Application document. The following additional information is requested:*
    a. *The assessment of the National Policy Statement for Freshwater Management 2020 (NPSFM) appears to only relate to the bed disturbance works. Please provide an updated assessment of the NPSFM 2020 based on the updated assessments requested under Question (2).*

The following policies from the NPSFM were identified as being relevant to this application.

Policy 1: Freshwater is managed in a way that gives effect to Te Mana o te Wai.

Policy 2: Tangata whenua are actively involved in freshwater management (including decision making processes), and Māori freshwater values are identified and provided for.

Policy 3: Freshwater is managed in an integrated way that considers the effects of the use and development of land on a whole-of-catchment basis, including the effects on receiving environments.

Policy 5: Freshwater is managed through a National Objectives Framework to ensure that the health and well-being of degraded water bodies and freshwater ecosystems is improved, and the health and well-being of all other water bodies and freshwater ecosystems is maintained and (if communities choose) improved.

Policy 7: The loss of river extent and values is avoided to the extent practicable.

Policy 8: The significant values of outstanding water bodies are protected.

Policy 9: The habitats of indigenous freshwater species are protected.

Policy 10: The habitat of trout and salmon is protected, insofar as this is consistent with Policy 9.

Policy 12: The national target (as set out in Appendix 3) for water quality improvement is achieved.

Policy 13: The condition of water bodies and freshwater ecosystems is systematically monitored over time, and action is taken where freshwater is degraded, and to reverse deteriorating trends.

Policy 14: Information (including monitoring data) about the state of water bodies and freshwater ecosystems, and the challenges to their health and well-being, is regularly reported on and published.

Policy 15: Communities are enabled to provide for their social, economic, and cultural wellbeing in a way that is consistent with this National Policy Statement.

In respect of the diversion of water sought under this consent, this activity is considered to be broadly consistent with the NPSFM policies for the following reasons:

- The outstanding river values will be maintained as the nature of the diversion is consistent with the natural braids within the river;
- The overall river extent will not be changed;
- Instream habitats may be modified for longer or earlier during low flows within the affected reach, but overall are not dissimilar to naturally occurring changes that have been observed and will reset with freshes through the system;
- Water quality will not be changed as a result of the diversion;
- This diversion activity will enable achievement of NPSFM water quality objectives from the associated discharge activity and ensure the significant community infrastructure of the Shotover WWTP can continue operating;
- Iwi have been consulted through the consent process and this is ongoing.

b. Please provide an updated assessment of any additional assessments in Section 6 on the basis of the updated assessment requested under Question (2).

Where additional assessment of the policies within the Regional Policy Statements or Regional Plan: Water over those included in Section 6 of the application are considered necessary, they have been included below.

Additional assessment of the proposed flow diversion against the relevant objectives and policies in the ORPS 2019

PART B Chapter 3 Otago has high quality natural resources and ecosystems	
Objective	
Objective 3.1 The values (including intrinsic values) of ecosystems and natural resources are recognised and maintained, or enhanced where degraded.	
Objective 3.2 Otago's significant and highly-valued natural resources are identified and protected, or enhanced where degraded.	
Policy	**Assessment**
Policy 3.1.2 Beds of rivers, lakes, wetlands, and their margins Manage the beds of rivers, lakes, wetlands, their margins, and riparian vegetation to: a) Safeguard the life supporting capacity of fresh water;	The design of the channel to target a diversion flow of 2.5 m^3/s will ensure that the bed and bank stability and natural form and function of the river are maintained, while ecological values may be affected for slightly longer periods that would naturally

b) Maintain good quality water, or enhance it where it has been degraded; c) Maintain or enhance bank stability; d) Maintain or enhance ecosystem health and indigenous biological diversity; e) Maintain or enhance, as far as practicable: i. Their natural functioning and character; and ii. Amenity values; f) Control the adverse effects of pest species, prevent their introduction and reduce their spread; and, g) Avoid, remedy or mitigate the adverse effects of natural hazards, including flooding and erosion.	occur, but not to a greater extent. The flows within the river as a whole will not be decreased.
<u>Policy 3.1.9 Ecosystems and indigenous biological diversity</u> Manage ecosystems and indigenous biological diversity in terrestrial, freshwater and marine environments to: a) Maintain or enhance: i. Ecosystem health and indigenous biological diversity including habitats of indigenous fauna; ii. Biological diversity where the presence of exotic flora and fauna supports indigenous biological diversity; b) Maintain or enhance as far as practicable: i. Areas of predominantly indigenous vegetation; ii. Habitats of trout and salmon unless detrimental to indigenous biological diversity; iii. Areas buffering or linking ecosystems; c) Recognise and provide for: i. Hydrological services, including the services provided by tall tussock grassland; ii. Natural resources and processes that support indigenous biological diversity; d) Control the adverse effects of pest species, prevent their introduction and reduce their spread.	Ecosystems and indigenous biological diversity of the Shotover River in the affected reach will be maintained as a result of the diversion of flow, and natural processes will still occur to reset the river ecosystems as already occurs now with freshes and floods.
<u>Policy 3.2.2 Managing significant indigenous vegetation and habitats</u> Protect and enhance areas of significant indigenous vegetation and significant habitats of indigenous fauna, by all of the following:	

a) In the coastal environment… …b) Beyond the coastal environment, and in the coastal environment in significant areas not captured by a) above, maintaining those values that contribute to the area or habitat being significant; c) Avoiding significant adverse effects on other values of the area or habitat; d) Remedying when other adverse effects cannot be avoided; e) Mitigating when other adverse effects cannot be avoided or remedied; f) Encouraging enhancement of those areas and values that contribute to the area or habitat being significant; g) Controlling the adverse effects of pest species, preventing their introduction and reducing their spread.	
<u>Policy 3.2.14 Managing outstanding freshwater bodies</u> Protect outstanding freshwater bodies by all of the following: a) Maintaining the values that contribute to the water body being outstanding; b) Avoiding, remedying or mitigating other adverse effects on the water body; c) Controlling the adverse effects of pest species, preventing their introduction and reducing their spread; d) Encouraging enhancement of those values that contribute to the water body being outstanding.	Some of the key contributing factors for the Shotover River's status as an outstanding water body are: a) its natural characteristics and scientific value, in particular the high natural sediment load and active delta at confluence with Kawarau River; b) recreational values, in particular rafting, kayaking and jet boating; c) historical values, in particular gold mining. The proposed diversion of flow will not be inconsistent with the general nature of the Shotover River at the delta; that is, highly dynamic, regular shifting of active river channels. In this respect, the proposal is not expected to adversely affect the key natural characteristics and scientific value of the Shotover River. Recreational values will be managed by ensuring that sufficient flow is left

	in the current active river channel subject to the diversion.
PART B Chapter 5 People are able to use and enjoy Otago's natural and built environment	
Objective	
Objective 5.1 Public access to areas of value to the community is maintained or enhanced.	
Objective 5.4 Adverse effects of using and enjoying Otago's natural and physical resources are minimised.	
Policy	**Assessment**
Policy 5.4.5 Pest plants and animals Control the adverse effects of pest species, prevent their introduction, reduce their spread and enable the removal and destruction of material for biosecurity purposes, to safeguard all of the following: a) The viability of indigenous species and habitats for indigenous species; b) Ecosystem services that support economic activities; c) Water quality and water quantity; d) Soil quality; e) Human and animal health; f) Recreation values; g) Landscapes, seascapes and natural character; h) Primary production.	The ability for natural freshes and floods to continue to function within the Shotover River will mean the diversion will control the effects of pest species establishment within the affected reach.

Additional assessment of proposed flow diversion against the PORPS

LF–FW – Fresh water	
Objectives	
LF–FW–O10 – Natural character The natural character of wetlands, lakes and rivers and their margins is preserved and protected from inappropriate subdivision, use and development.	
Policies	**Assessment**
LF–FW–P13 – Preserving natural character and instream values Preserve the natural character of lakes and rivers and their beds and margins by: 1) avoiding the loss of values or extent of a river, unless: a) there is a functional need for the activity in that location, and	Due to the emergency treated effluent discharge from the WWTP, there is a functional need for the proposal diversion in order to achieve adequate mixing in the Shotover River – this is essential for both ecological and public health reasons.

b) the effects of the activity are managed by applying the effects management hierarchy (in relation to natural inland wetlands and rivers), 2) not granting resource consent for activities in (1) unless the consent authority is satisfied that: a) the application demonstrates how each step of the effects management hierarchy (in relation to natural inland wetlands and rivers) will be applied to the loss of values or extent of the river, and b) any consent is granted subject to conditions that apply the effects management hierarchy (in relation to natural inland wetlands and rivers) in respect of any loss of values or extent of the river, c) if aquatic offsetting or aquatic compensation is applied, the applicant has complied with principles 1 to 6 in Appendix 6 and 7 of the NPSFM, and has had to regard to the remaining principles in Appendix 6 and 7 of the NPSFM, as appropriate, and d) if aquatic offsetting or aquatic compensation is applied, any consent granted is subject to conditions that will ensure that the offspring or compensation will be maintained and managed over time to achieve the conservation outcomes, 3) establishing environmental flow and level regimes and water quality standards that support the health and well-being of the water body, 4) to the extent practicable, sustaining the form and function of a water body that reflects its natural behaviours, 5) recognising and implementing the restrictions in Water Conservation Orders, 6) preventing the impounding or control of the level of Lake Wanaka, 7) preventing modification that would reduce the braided character of a river, 8) controlling the use of water and land that would adversely affect the natural character of the water body, and 9) maintaining or enhancing the values of riparian margins to support habitat and	The nature of the diversion will be in keeping with the natural character and amenity of the braided Shotover River delta. While the proposal will modify the riverbed, this modification will generally sustain the form and function of the river, and is not expected to reduce the braided character of the river. River extent will not be reduced and offsetting is not considered necessary. The Kawarau WCO values have been considered within the assessment and the flow diversion will not detract from the outstanding values identified for the Shotover River.

biodiversity, reduce contaminant loss to water bodies and support natural flow behaviour.	
ECO – Ecosystems and indigenous biodiversity	
Objectives	
ECO–O1 – Indigenous biodiversity Otago's indigenous biodiversity is healthy and thriving and any overall decline in condition, quantity and diversity is halted.	
Policies	**Assessment**
ECO–P6 – Maintaining indigenous biodiversity Outside the coastal environment and excluding areas protected under ECO-P3, manage Otago's indigenous biodiversity by: (1) applying the effects management hierarchy (in relation to indigenous biodiversity) to manage significant adverse effects on indigenous biodiversity), and (2) requiring the maintenance of indigenous biodiversity for all other adverse effects of any activity, and (3) notwithstanding (1) and (2) above, for regionally significant infrastructure and nationally significant infrastructure that is either renewable electricity generation or the National Grid avoid, remedy or mitigate adverse effects to the extent practicable.	The ecology assessment provided in Appendix C confirms that the effects of the flow diversion are likely to be similar to those experienced natural during times of low flow when some braids will experience changes in flow velocity and habitat availability. Albeit they may occur earlier or for longer before being reset by freshes and floods.

Additional assessment of the diversion of flow against the relevant objectives and policies in the RPW

Chapter 5 Natural and human use values of lakes and rivers
Objective
Objective 5.3.1 To maintain or enhance the natural and human use values, identified in Schedules 1A, 1B and 1C, that are supported by Otago's lakes and rivers.
Objective 5.3.2 To maintain or enhance the spiritual and cultural beliefs, values and uses of significance to Kai Tahu, identified in Schedule 1D, as these relate to Otago's lakes and rivers.
Objective 5.3.3 To protect the natural character of Otago's lakes and rivers and their margins from inappropriate subdivision, use or development.
Objective 5.3.4 To maintain or enhance the amenity values associated with Otago's lakes and rivers and their margins.
Objective 5.3.5

To maintain or enhance public access to and along the margins of Otago's lakes and rivers.	
Objective 5.3.6 To provide for the sustainable use and development of Otago's water bodies, and the beds and margins of Otago's lakes and rivers.	
Objective 5.3.8 To avoid the exacerbation of any natural hazard or the creation of a hazard associated with Otago's lakes and rivers.	
Policy	**Assessment**
Policy 5.4.2 In the management of any activity involving surface water, groundwater or the bed or margin of any lake or river, to give priority to avoiding, in preference to remedying or mitigating: (1) Adverse effects on: (a) Natural values identified in Schedule 1A; (b) Water supply values identified in Schedule 1B; (c) Registered historic places identified in Schedule 1C, or archaeological sites in, on, under or over the bed or margin of a lake or river; (d) Spiritual and cultural beliefs, values and uses of significance to Kai Tahu identified in Schedule 1D; (e) The natural character of any lake or river, or its margins; (f) Amenity values supported by any water body; and (2) Causing or exacerbating flooding, erosion, land instability, sedimentation or property damage.	The design of diversion channel and quantity of flow will maintain the values attributed to the Shotover River, including its natural character and contribution to amenity. Affects on ecology values have been assessed in Appendix C and are mitigated by the reset of the system provided by natural freshes and floods after extended periods of low flows. The proposed diversion is not expected to have any significant or lasting adverse effect in relation to flooding, erosion, land instability, sedimentation or property damage.
Policy 5.4.3 In the management of any activity involving surface water, groundwater or the bed or margin of any lake or river, to give priority to avoiding adverse effects on: (a) Existing lawful uses; and (b) Existing lawful priorities for the use, of lakes and rivers and their margins.	There are a range of other existing lawful recreational users of the lower Shotover River, however the localised nature of the flow diversion means that there is unlikely to be any adverse effect on these other uses.

Policy 5.4.5 To recognise the Water Conservation (Kawarau) Order 1997 by: (a) Preserving, as far as possible, the waters set out in Schedule 1 of the Water Conservation Order in their natural state; (b) Protecting the outstanding characteristics of waters set out in Schedule 2 of the Water Conservation Order; and (c) Sustaining the outstanding amenity and intrinsic values set out in Schedules 1 and 2 of the Water Conservation Order.	As identified in the application and response to s92 questions, the values attributed to the Shotover River will be maintained as a result of this proposed diversion of flow.
Policy 5.4.8 To have particular regard to the following features of lakes and rivers, and their margins, when considering adverse effects on their natural character: (a) The topography, including the setting and bed form of the lake or river; (b) The natural flow characteristics of the river; (c) The natural water level of the lake and its fluctuation; (d) The natural water colour and clarity in the lake or river; (e) The ecology of the lake or river and its margins; and (f) The extent of use or development within the catchment, including the extent to which that use and development has influenced matters (a) to (e) above.	The natural flow characteristics of the river will be maintained, and any adverse effects on water clarity will be highly localised and temporary, and minimised to the extent practicable. Ecology is expected to be adequately managed via the control on the channel design for the target flow and naturally occurring freshes and floods which will continue to occur.
Policy 5.4.9 To have particular regard to the following qualities or characteristics of lakes and rivers, and their margins, when considering adverse effects on amenity values: (a) Aesthetic values associated with the lake or river; and (b) Recreational opportunities provided by the lake or river, or its margins.	Amenity values attributed to the Shotover River will be maintained and recreational opportunities, e.g. jet boating, kayaking and hiking, will continue to be enabled, with the control of the design of the flow diversion to the target flow rate of 2.5 m^3/s.

Chapter 8 The beds and margins of lakes and rivers	
Objective	
Objective 8.3.1 To maintain: (a) The stability and function of existing structures located in, on, under or over the bed or margin of any lake or river; (b) The stability of the bed and bank of any lake or river; and (c) The flood and sediment carrying capacity of any lake or river.	
Objective 8.3.2 To minimise reduction in water clarity caused by bed disturbance.	
Policy	**Assessment**
Policy 8.4.1 When managing activities in, on, under or over the bed or margin of any lake or river, to give priority to avoiding changes in the nature of flow and sediment processes in those water bodies, where those changes will cause adverse effects: (a) On the stability and function of existing structures located in, on, under or over the bed or margin of any lake or river; (b) Arising from associated erosion or sedimentation of the bed or margin of any lake or river, or land instability; or (c) Arising from any reduction in the flood carrying capacity of any lake or river.	The proposed diversion channel is not expected to have a significant detrimental impact on the natural flow and sediment processes of the Shotover River, for the reasons provided in the s92 response. The diversion of flow will not result in any erosion of sedimentation of the bed, or reduce the flood carrying capacity of the river.