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Southland Regional Council Reference: APP-201088-V1

30 April 2018

Southland Regional Council
Private Bag 90116
Invercargill 9840

Attn: Stephen West

Dear Stephen,

RESPONSE TO REQUEST FOR FURTHER INFORMATION UNDER SECTION 92(1) OF THE RESOURCE MANAGEMENT ACT 1991 - APPLICATION TO AMEND CONDITIONS OF EXISTING RESOURCE CONSENT 201088

With respect to Pioneer Energy Limited's application to amend consent conditions of existing resource consent 201088, and in accordance with the further information requested by Southland Regional Council under Section 92 of the Resource Management Act 1991 and received by Pioneer Energy Limited on the 10th of April 2018, Dr Ruth Goldsmith (Ryder Environmental Limited) has addressed each of the requests in turn as follows.

A. Information requested:

"*An assessment of the effect of the lower minimum flow in the Lower Monowai River on the instream habitat of adult trout in accordance with Policy 16(c) and Appendix I of the Regional Water Plan and Policy 42(5) and Appendix K of the proposed Water & Land Plan. In particular, assessing the habitat of adult trout at Q95, the existing minimum flow and at the proposed minimum flow. The habitat should be assessed in terms of river conditions since willow eradication*."

Response:

It is not clear to us how the policies and appendices referred to above apply in this instance since in both plans the Monowai River is classified as being within the 'Waiau' surface water management unit. This surface water management unit is not addressed in the appendices referred to above.

Despite the above, an assessment of the habitat for adult trout at Q95, the existing minimum flow and at the proposed minimum flow has been requested. The proposed Southland Water and Land Plan (April 2018) defines 'Q95' as the naturalised flow that is exceeded 95% of the time during the year. The Monowai HEPS dates from the early 1920s and there is therefore no flow data available prescheme. NIWA however calculate Lake Monowai inflow for Pioneer Energy (based on outflow measured downstream of lake control structure and change in lake level) and this data was used to provide an estimate of the naturalised Q95 as 2.4 m^3/s. The accuracy of this calculation is not expected to be high, especially at low flows, but it is the best information available.

Two instream habitat models have been developed for the Monowai River (Jowett 1997 and Ryder and Hollows 2000). The Ryder and Hollows (2000) model is most relevant to the lower river, however, as this model was developed to predict the habitat available at low flows it does not include an estimate for the amount of adult trout habitat at the naturalised Q95 (i.e., 2.4 m^3/s). Jowett (1997) however noted that at flows of greater than 1 m^3/s water velocities were probably too high to provide good habitat for native fish and juvenile trout (Jowett 1997 did not include provision of adult brown trout habitat in his assessment of the lower river).

Using the Ryder and Hollows (2000) model and extrapolating downwards it is possible to compare the amount of adult trout habitat available at 0.50 m^3/s (existing minimum flow) and 0.30 m^3/s (proposed minimum flow). At the higher flow instream habitat for adult brown trout is predicted to be approximately 11% (as a proportion of stream width), decreasing to 5.71% at the lower flow (calculated from Figure 5, Ryder and Hollows 2000). The reduction in flow from 0.50 m^3/s to 0.30 m^3/s would therefore result in a reduction in adult brown trout habitat of 48%.

Despite this assessment, it is important to be clear that the lower river is naturally limited in suitable habitat for adult trout to ‘permanently reside’ within. This is generally due its steep gradient and relatively shallow water depth.

Rather the lower river provides (and will continue to do so under the proposed minimum flow) sufficient habitat for adult trout to move upstream to access the more suitable habitat in the upper river and Lake Monowai.

The lower river habitat is more suitable for ‘resident’ juvenile brown trout and native fish. The existing amount of brown trout fry and juvenile habitat is 46% and 31.4% respectively (compared to 11% for adults). Brown trout fry habitat only decreases slightly (by 1.5%) with the proposed flow reduction, although juvenile habitat decreases by 27%. Applying the same comparison to native fish habitat finds that longfin eel and common bully habitat increases under the proposed minimum flow by 16 and 17%, respectively (from approximately 31.4 to 36.4% and 21.4 to 25.0%).

It has been requested that the instream habitat should be assessed in terms of river conditions since willow eradication. The Ryder and Hollows (2000) model was developed prior to willow eradication so it is not possible to use the model for this purpose. However, it can be assumed that where willows were present alongside the river channel their removal has resulted in the channel becoming less constrained, and therefore wider and shallow. This is likely to have made the instream habitat less suitable for adult brown trout, which prefer deep water.

B. Information requested:

"*An assessment of whether flushing flows in the Lower Monowai River during the October to February period provide environmental benefits other than providing for eel migration (such as removing high periphyton biomass or reducing bed armoring) and whether the change would reduce those environmental benefits*."

Response:

The potential benefit of the existing 1 m^3/s flushing flow during the October to March period to remove periphyton was considered in Section 4.3 of the AEE (Ryder Consulting 2017). The change to the timing of the 1 m^3/s flow release to assist downstream eel migration is not expected to have any effect on periphyton removal. An analysis of five years of flow records (October 2011 to April 2017) confirmed that during the October to March period flows greater than 1 m^3/s already occur 10% of the time (in the absence of artificial flushing flow releases), and flows greater than 3 m^3/s occur 4% of the time. The frequency of these high flow events, which can flush periphyton from the river bed will not be affected by the decrease in the residual flow.

Similarly, the high flows that contribute to the mobilisation of substrates and the prevention of bed armouring will not be affected by the change in flushing flow timing. Jowett (1997) noted that an average velocity of greater than 0.25 m/s is the minimum required for the movement of fine particles on the river bed. In the lower river this is predicted to occur at flows of approximately 1.25 m^3/s and higher (Table 7, Ryder and Hollows 2000), so the existing 1 m^3/s flushing flow during October to March will not be contributing to reducing bed armouring. Accumulation of fine sediment deposits on the bed is not expected to be a problem in the lower river due to its generally forested catchment, the deposition of fine sediments in the lake, upper river and head pond before they enter the lower river and the steep, fast flowing nature of the lower river.

C. Information requested:

"*An assessment of the risk of nuisance periphyton growth in terms of water quality data and ANZECC guidelines for nutrients and the periphyton attribute table in the National Policy Statement for Freshwater Management.*"

Response:

The National Policy Statement for Freshwater Management (amended 2017, hereafter the 'NPS-FM') provides a national framework that directs how councils are to go about setting objectives, policies and rules about fresh water in their regional plans. The NPS-FM includes nationally set minimum acceptable states for nine attributes, which are indicators of "ecosystem health" or "human health for recreation", these are called national bottom lines ('NBLs'). The NPS-FM defines four numeric attributes states for each attribute, 'A' through to 'D', and the NBLs fall between attribute states 'C' and 'D'.

The proposed Southland Water and Land Plan (April 2018, hereafter referred to as the 'Water Plan') classifies the Monowai River for the purposes of water quality as 'lake-fed'. For 'lake-fed' surface water bodies the Water Plan states in relation to periphyton:

"*Chlorophyll* a *shall not exceed 50 milligrams per square metre at any time or exceed a monthly mean of 15 milligrams per square metre for filamentous algae or diatoms and cyanobacteria*."

The Water Plan requirement for the Monowai River is therefore approximately equivalent to an NPS-FM periphyton attribute state 'A' (Table 1), although the NPS-FM does allow chlorophyll *a* to exceed 50 mg/m^2 in 8% of samples compared to the Water Plan which does not allow any exceedance.

Environment Southland do not monitor periphyton biomass in the Monowai River, and there is no other data available against which to assess periphyton biomass against the NPS-FM attribute table (noting that a minimum of 3 years of monthly monitoring data is required)[1].

The risk of nuisance periphyton growth can be assessed however in terms of water quality. In relation to this the NPS-FM requires that, to achieve a freshwater objective for periphyton within a freshwater management unit, regional councils must at least set appropriate instream concentrations and exceedance criteria for dissolved inorganic nitrogen (DIN) and dissolved reactive phosphorus (DRP). The Water Plan does not have any criteria for DIN and DRP for 'lake-fed' surface water bodies.

The Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC 2000) recommended trigger values for physical and chemical stressors for surface waterbodies. There is a long-term NIWA water quality monitoring data available for a site in the Upper Monowai River, which can be assessed against the ANZECC (2000) guidelines. Water quality in the upper and lower river is expected to be similar as there are no major changes in land use between the upper and lower river. NIWA monitor water quality at the 'Monowai River below gates' site (also known as 'DN10') as part of their National River Water Quality Network (NRWQN) programme (note that periphyton biomass is not included in NRWQN monitoring).

Nitrate-nitrite-nitrogen and DRP concentrations for the Monowai River are shown in Figures 1 and 2. In Figure 1 the dashed line at nitrate-nitrogen concentration 0.167 g/m^3 represents the ANZECC 2000 recommended trigger value for physical and chemical stressors for 'upland' streams. In Figure 2 the dashed line represents the ANZECC DRP trigger of 0.009 g/m^3. There is no trigger value given in the

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[1] Periphyton biomass was assessed in the river in August 2016 (Ryder Consulting 2017) and ranged from 6 to 23 mg per m^2, which is below the Water Plan limit of 50 mg per m^2.

ANZECC (2000) guidelines for 'lake-fed' streams. However, ANZECC (2000) note that values for lake-fed sites in upland rivers are lower. It is apparent from Figures 1 and 2 that nutrient concentrations in the Monowai River are very low and based on this that there is a low risk of nuisance periphyton growth.

Additionally, trend analysis for DRP and nitrate-nitrogen concentrations over the period 2004-2013 provides no indication that water quality in the Monowai River is improving or declining (i.e., indeterminate) (e.g., https://statisticsnz.shinyapps.io/river_water_quality_phosphorus/). Therefore, based on the existing water quality data the current low risk of nuisance periphyton growth is not expected to change in the future.

Didymo is already present in the river, however unlike other nuisance periphyton (e.g., long filamentous algae, cyanobacteria) its growth pattern does not always show a strong connection to high nutrient levels. Didymo cover in the lower river has varied from very high in 2007 to only isolated patches being present in 2009 (Ryder Consulting 2017), despite no indication of a change in nutrient concentrations over this period.

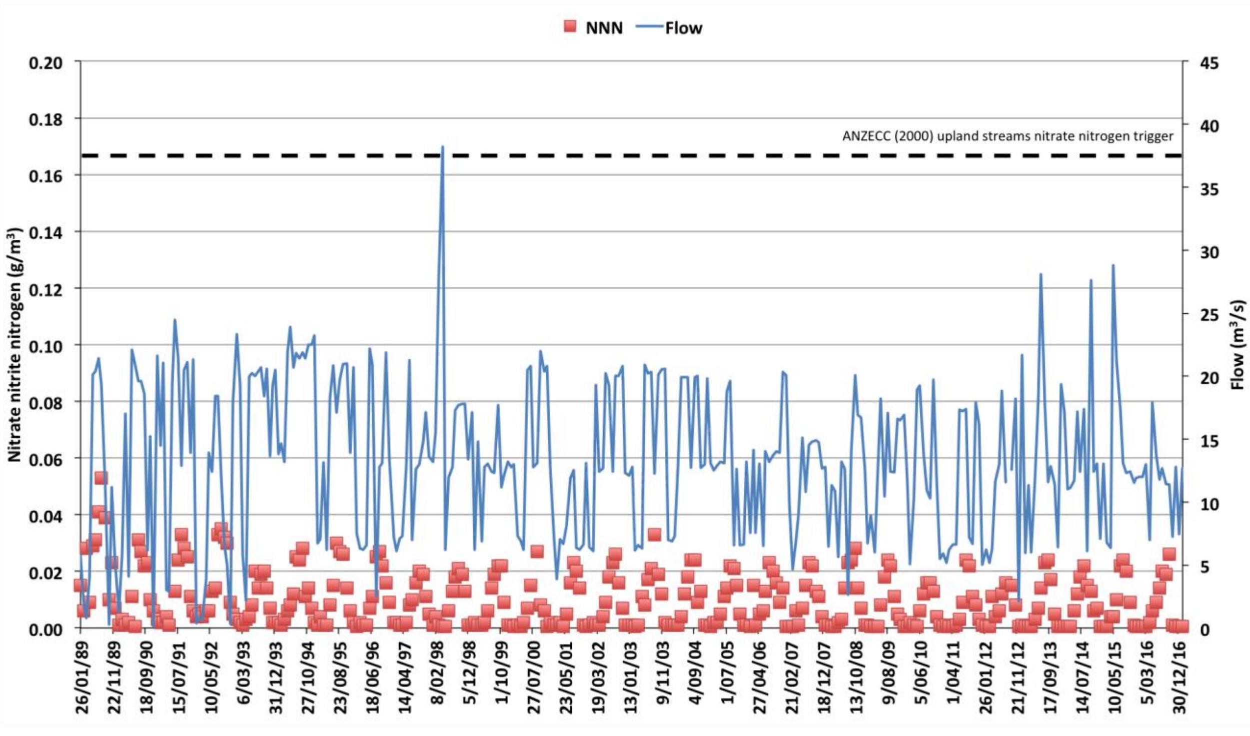

Figure 1. *Nitrate nitrite nitrogen concentration (g/m3) in relation to flow (m3/s) in the Upper Monowai River (NIWA NRWQN data). The dashed line represents the ANZECC nitrate nitrogen trigger of 0.167 g/m3.*

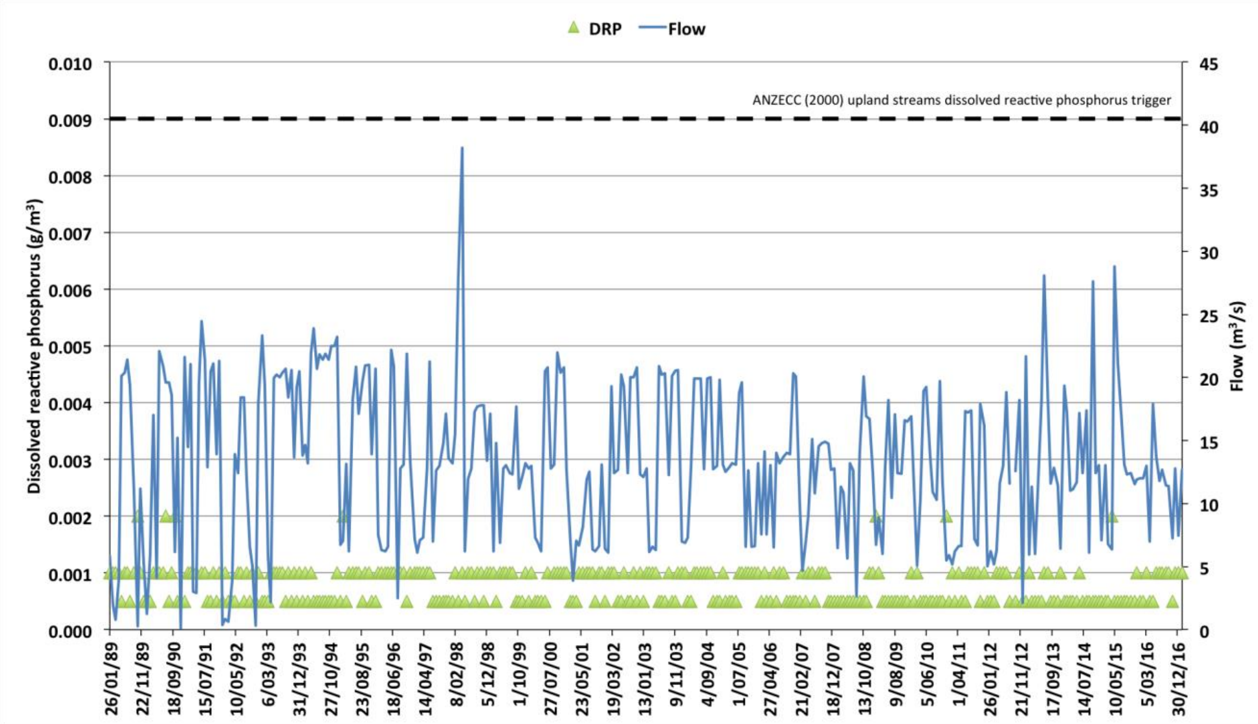

Figure 2. *Dissolved reactive phosphorus concentration (g/m3) in relation to flow (m3/s) in the Upper Monowai River (NIWA NRWQN data). The dashed line represents the ANZECC dissolved reactive phosphorus trigger of 0.009 g/m3.*

D. Information requested:

"*An assessment of the effects of the reduced flow and changes to the flushing regime on temperatures in the river, and diurnal variation in pH or dissolved oxygen, and how any adverse effects may be avoided or mitigated."*

Response:

Water temperatures in the lower river below the head pond weir (at the lower river flow sites) mostly meet the Water Plan standards (Figure 3). Marked increases in water temperature downstream in the lower river are not expected with reduced flow as the 2.4 km reach of lower river is a relatively short distance for increases in water temperatures to occur over. Additionally, the channel within this reach is shaded by vegetation and landscape features, which contribute to reducing the opportunity for water heating downstream.

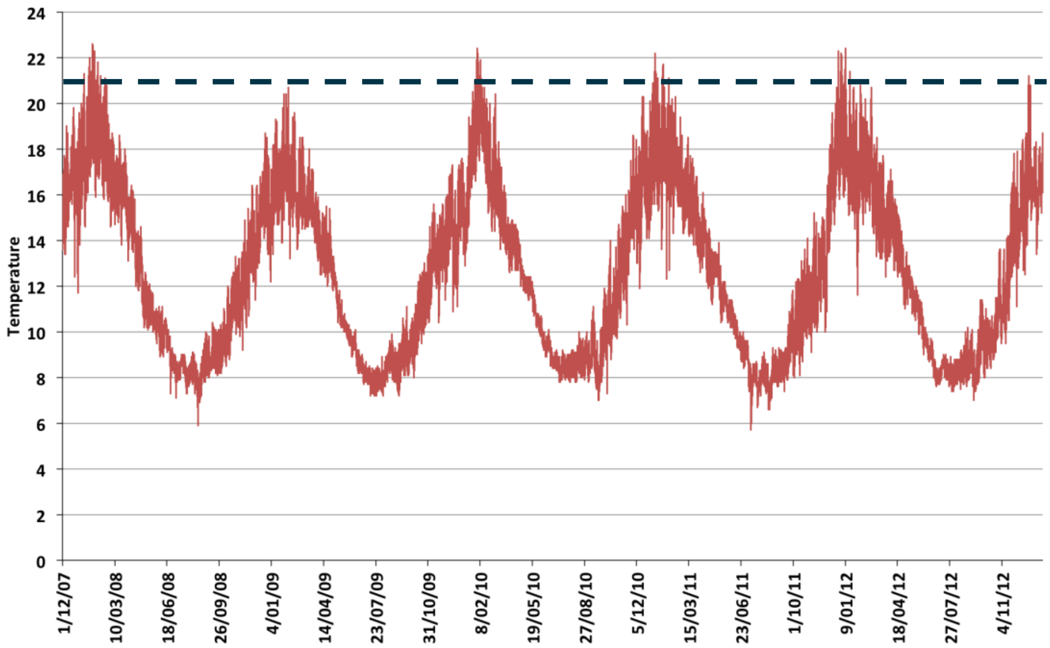

Figure 3. *Water temperature (°C) in the Lower Monowai River (NIWA data provided by Pioneer Energy). The dashed line represents the water temperature standard of less than 21 °C for 'lake-fed' rivers in the Water Plan.*

NIWA monitor water quality at the 'Monowai River below gates' site (also known as 'DN10') as part of their National River Water Quality Network (NRWQN) programme. pH (Figure 4) and dissolved oxygen (Figure 5) values typically meet the Water Plan requirements. NIWA measure water quality during the day only, and therefore there is no information available on diurnal variation in dissolved oxygen or pH. Large variations in water quality diurnally are however not expected in the lower river due to absence of aquatic plants (macrophytes) and generally low periphyton cover. The typically fast-flowing, wide and shallow character of much the lower river, also means that it is well oxygenated.

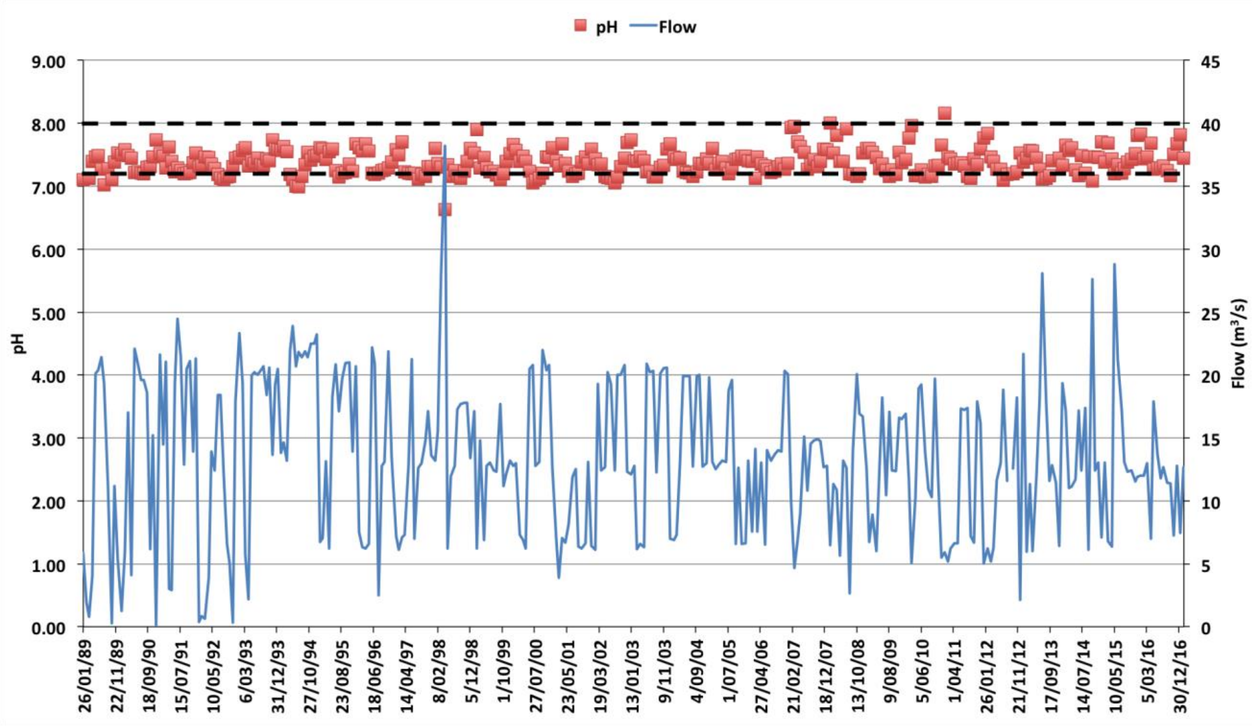

Figure 4. *pH in relation to flow (m3/s) in the Upper Monowai River (NIWA NRWQN data). The dashed lines represent the pH range of 7.2 to 9.0 for 'lake-fed' rivers in the Water Plan.*

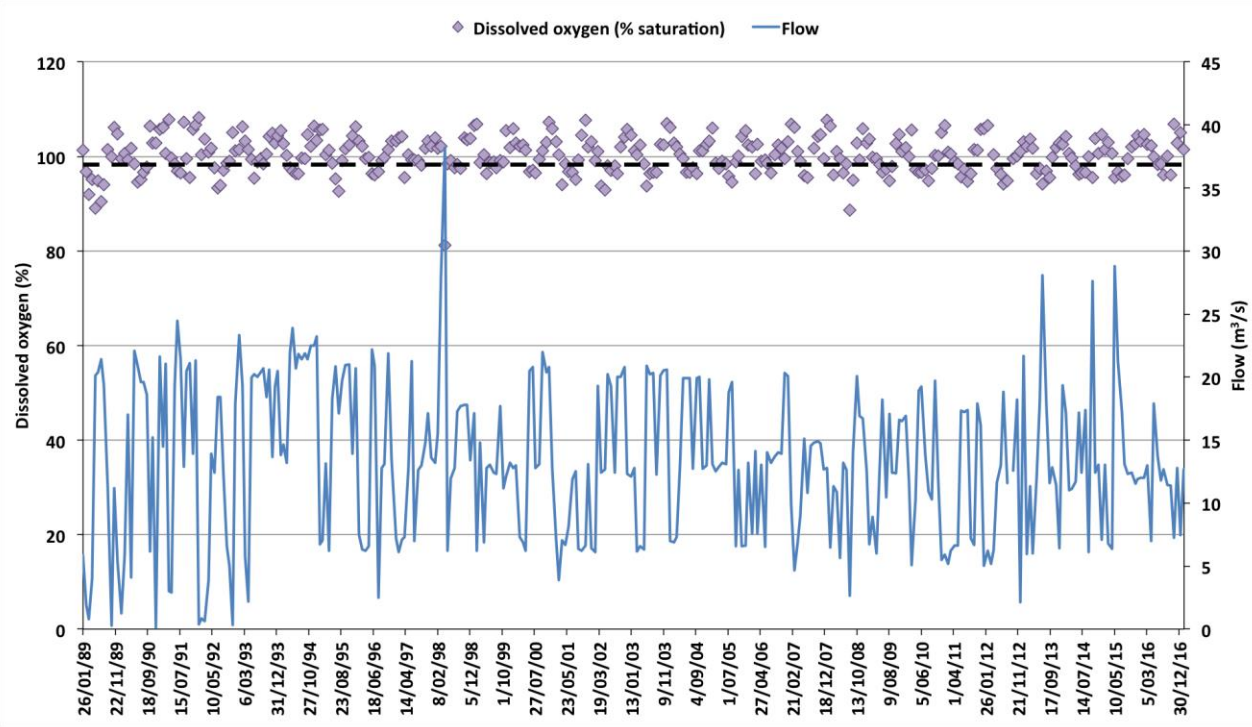

Figure 5*.* *Dissolved oxygen saturation (%) in relation to flow (m3/s) in the Upper Monowai River (NIWA NRWQN data). The dashed line represents the DO saturation of greater than 99% for 'lake-fed' rivers in the Water Plan.*

We trust that this fulfils the information needs for this application. If you have further queries in this regard, please contact Sue Ruston (consultant to Pioneer Energy Limited) on 021 872 889 or sue@enspire.co.nz.

Yours sincerely

TONY JACK

DEVELOPMENT ENGINEER