Date: 11/03/2025

To: Shay McDonald
Senior Consents Planner
Otago Regional Council

Surface water review – Oceana MPIV

Dear Shay,

My assessment of the Oceana gold (New Zealand) Limited Macraes Phase 4 Project Resource Consent Application and Assessment of Environmental Effects is presented below.

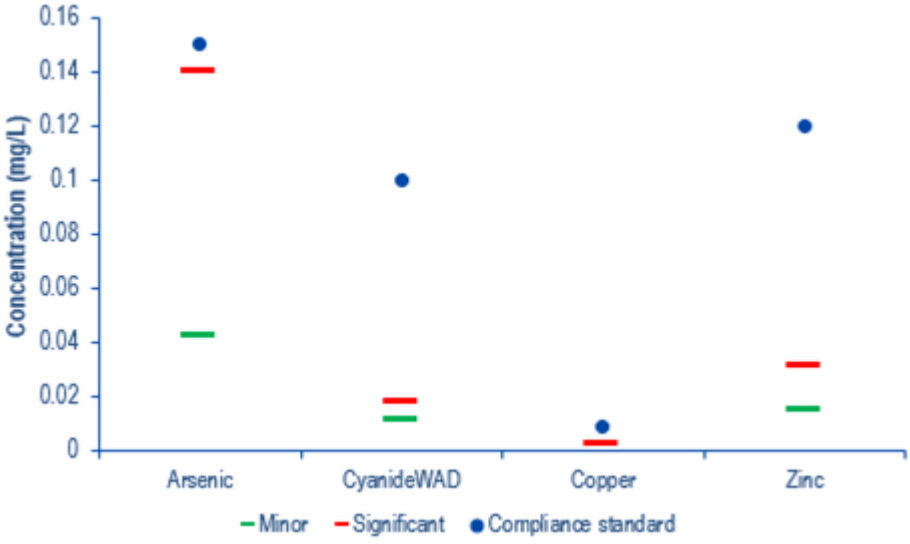
1 Background

Oceana Gold (New Zealand) Limited is seeking to new resource consents, and variations to existing resource consents to expand their mine at Macraes. ORC have asked me to assess the effects of the activity by providing answers to specific questions.

2 Assessment

Table 1 below provides my responses to those questions and is largely unchanged from my initial assessment. A Record of my notes made through review process is also provided in Table 2.

Table 1: Response to specific surface water science questions regarding Oceana MPIV.

General questions	
Q1	Is the technical information provided in support of the application robust, including being clear about uncertainties and any assumptions? Yes, or no. If not, what are the flaws?
	Yes, with the addition of the new information provided with the two S92 responses I consider the application to be a robust assessment of the effects of the proposed activities.
Q2	Are there any other matters that appear relevant to you that have not been included? Or is additional information needed? Please specify what additional info you require and why. Please explain.
	Whether assessing the activity against the consented baseline is appropriate is outside of my expertise. However, I would like to reiterate how inappropriate the current compliance standards are as they allow for significant adverse effects. To demonstrate this, I have quickly generated the graph below. The blue dots represent compliance standards, the green bars represent the thresholds for the onset of more than minor effects (ANZG 90% protection guideline) and the red bars represent the commonly used thresholds for the onset of significant adverse effects (ANZG 80% protection guideline). 

Q3	If granted, are there any specific conditions that you recommend should be included in the consent?
	Yes. I consider that conditions should require the source control/mitigations committed to in Section 6 of the AEE be conditioned, as should the erosion monitoring on the North Branch of the Waikouaiti River.
Surface Water	
Coronation – operation and closure effects	
Q4	Are there any critical deficiencies in the MWM report that would mean that it cannot be relied upon by GHD in their surface water reports? Has the MWM report incorporated the recommendations of the Strata Science peer-review?
	This is outside of the scope of my expertise, and I rely on E3 Environmental response to the same question when responding to questions below. I understand that despite some potential underestimation of low flow contaminant concentrations E3 Environmental are generally comfortable with the modelling provided with the application and the S92 responses
Q5	**Sitewide water balance model – are the revisions/updates, inputs, assumptions, and limitations clearly stated and justified? Is the model appropriate for use in this situation? Please explain.**
	The revisions/updates, inputs, assumptions, and limitations to the site wide balance model are clearly stated and justified. In my opinion the model is appropriate for use in this case. While not a specialist integrated groundwater-surface water quality/quantity modeller, I am aware that Oceana have used this approach in a number of other applications and the ORC reviews of that model have generally been favourable. The Applicant's own external reviewer also concludes that the modelling approach and the resulting conclusions are "*reasonable and defensible*". However, its performance relies on assumptions around geochemistry and hydrogeology that are outside of the scope of my expertise. I understand that despite some potential underestimation of low flow contaminant concentrations E3 Environmental are generally comfortable with the modelling provided with the application and the S92 responses.

Q5	**Based on the information provided in the application, do you agree that the adverse effects (nature, magnitude) on surface waters resulting from the proposed activities at the Coronation site are as described in the technical reports? Please explain.**
	Yes. Through Oceana's S92 responses (Annexure 4 and 2), GHD have provided significant additional information to support the model outputs in GHD (2024a) (including finer resolution reporting for all sites and raw copper data for MB01 and MB02). Based on that information I agree with GHD's conclusions that the proposed activity is unlikely to result in exceedances of the existing water quality criteria for impacted receiving environments. **Notes:** • *This assessment assumes the modelling approach used is fit for purpose which I understand E3 Environmental considers to be the case.* • *GHD only describe their outputs in terms of achieving compliance criteria and absolute change in water quality concentrations. They do not consider the ecological effects of a change in water quality, which is considered in Ryder (2024a). I consider the effects of the identified increase in nitrate concentration at MB01 below in the aquatic ecology section*
Q6	Are there any statements made within the AEE about surface water effects as a result of the activities at the Coronation Site that are not supported by the technical reports? Please explain.
	No. Water quality effects are presented in the same manner as Appendix 11.
Q7	**Are there any recommendations relating to surface water effects resulting from the activities at the Coronation Site, (that you consider to be of importance) made in the technical reports that are not included within the AEE? Please explain.**
	No. No recommendations are made in relation to this site in Appendix 20, while Appendix 11 simply notes that dilution water is not required and simply acts as a contingency against unexpected adverse effects (which is consistent with the AEE).
Q8	**Has sufficient justification for the assumption that "*…advective flow of oxygen through the WRS is limited/prevented via the saturation of the WRS toe (or similar)…*" been provided (relating to Trimbells WRS)? Please explain.**
	This is outside of the scope of my expertise and is covered by E3 Environmental

Q9	**Has the applicant clearly described a surface water monitoring programme relevant to the Coronation site? Is the proposed monitoring consistent with recommendations in the technical reports provided with the application? Do you consider that the monitoring is appropriate (frequency, locations, parameters)? Is it clear how any proposed monitoring will be used/incorporated into future management plans to manage adverse effects on surface water? Please explain.**
	No. No monitoring programme is provided. However, the existing monitoring programme is more than sufficient. Given that monitoring is required by other consents I am unsure if a monitoring programme is needed, although it would be useful prior to hearing.
Q10	**The MWM report describes a series of potential passive and active measures for the management and treatment of mine impacted waters. Has the Applicant been clear (in the AEE) about which source control methods they are adopting, or not adopting, the reasons for this, and the way in which these will be implemented e.g. immediately vs in adaptive management plans? Do you consider that the methods adopted will be sufficient to ensure that effects on surface water are no more than minor? Please explain.**

	Part 1 of this question is outside of the scope of my expertise falling somewhere between mine management and geochemistry.
	
	What is relevant to my assessment is that the modelling presented in Appendix 11 accurately factors in the source control methods that are certain to happen. Assuming the answer is yes (which E3 do not appear to agree with), then their efficiency in keeping effects on surface water to a no more than minor level can be determined from the modelling results. In my opinion, the effects on <u>water quality</u> in the Mareburn are **likely to be no more than minor** as:
	
	• If the existing compliance standards are treated as the baseline, none are expected to be exceeded at MB01 (the more impacted site).
	• If current state is treated as the baseline:
	  ○ Only sulphate, nitrate, arsenic, and zinc concentrations are expected to increase, at MB01 (the more impacted site) and increased concentrations of these parameters are not expected to result in a change in toxicity risk as:
	  ▪ Median nitrate concentrations are expected to to stay under the 99% species protection threshold while 95th percentile concentrations are expected to remain between the 90% and 80% species protection thresholds (Hickey, 2013);
	  ▪ Sulphate concentrations are not expected to exceed existing compliance standards, which I understand were set for ecological protection through whole of effluent toxicity testing; and
	  ▪ Median arsenic and zinc concentrations are still expected to meet the ANZG (2018) 95% species protection threshold.
	
	Note: *I consider the effects of the identified increase in nitrate concentration at MB01 below in the aquatic ecology section*

Q11	**Are the conclusions and recommendations as to surface water management reasonable? Are there any aspects on which you disagree? Please explain.**
	This is outside of the scope of my expertise. I simply note that the surface water management actions assumed in the modelling are necessary to ensure the effects are as described in the AEE.
Golden Bar – operation and closure effects	
Q11	**Sitewide water balance model – are the revisions/updates, inputs, assumptions, and limitations clearly stated and justified? Is the model appropriate for use in this situation? Please explain.**
	See response to Q5
Q12	**Based on the information provided in the application, do you agree that the adverse effects (nature, magnitude) on surface waters resulting from the proposed activities at the Golden Bar site are as described in the technical reports? Please explain.**
	Yes. Through Oceana's S92 responses (Annexure 4 and 2) GHD have provided significant additional information to support the model outputs in GHD (2024c). Based on that information I agree with GHD's conclusions that the proposed activity is unlikely to result in exceedances of the existing water quality criteria for impacted receiving environments. **Notes:** • *This assessment assumes the modelling approach used is fit for purpose which is assessed by E3 Environmental* • *GHD only describe their outputs in terms of achieving compliance criteria and absolute change in water quality concentrations. They do not consider the ecological effects of a change in water quality, which is considered in Ryder (2024a). I consider the effects of the identified increase in nitrate concentration at MB01 below in the aquatic ecology section*
Q13	Are there any statements made within the AEE about surface water effects as a result of the activities at the Golden Bar Site that are not supported by the technical reports? Please explain.
	No. Water quality data effects are presented in the same manner as described in Appendix 12.
Q14	**Are there any recommendations relating to surface water effects resulting from the activities at the Golden Bar Site, (that you consider to be of importance) made in the technical reports that are not included within the AEE? Please explain.**
	No. Section 5.4.3 of the AEE notes that compliance with the relevant sulphate and arsenic compliance standards will be achieved through the dewatering management approaches set out in GHD (2024b)

Q15	**Has sufficient justification for the assumption that "*…advective flow of oxygen through the WRS is limited/prevented via the saturation of the WRS toe (or similar)…*" been provided (relating to Trimbells WRS)? Please explain.**
	This is outside of the scope of my expertise, and is covered by E3 Environmental.
Q16	Has the applicant clearly described a surface water monitoring programme relevant to the Coronation site? Is the proposed monitoring consistent with recommendations in the technical reports provided with the application? Do you consider that the monitoring is appropriate (frequency, locations, parameters)? Is it clear how any proposed monitoring will be used/incorporated into future management plans to manage adverse effects on surface water? Please explain.
	No. See response to Q9
Q17	**Has the Applicant been clear (in the AEE) about which source control methods they are adopting, or not adopting, the reasons for this, and the way in which these will be implemented e.g. immediately vs in adaptive management plans? Do you consider that the methods adopted will be sufficient to ensure that effects on surface water are no more than minor? Please explain.**
	No. Section 6 and Table 6.1 appears to document the actions they will undertake to mitigate surface water effects but does not identify the mechanism through which these actions will be required (consent or management plan). Instead, the applicant notes they will provide consent conditions which will require management plans. Which actions will be required by condition, and which will be required by the associated action plans is unclear currently.
Q18	**The MWM report describes a series of potential passive and active measures for the management and treatment of mine impacted waters. Has the Applicant been clear (in the AEE) about which source control methods they are adopting, or not adopting, the reasons for this, and the way in which these will be implemented e.g. immediately vs in adaptive management plans? Do you consider that the methods adopted will be sufficient to ensure that effects on surface water are no more than minor? Please explain.**

Part 1 of this question is outside of the scope of my expertise falling somewhere between mine management and geochemistry.

What is relevant to my assessment is that the modelling presented in Appendix 12 accurately factors in the source control methods that are certain to happen. If the answer is yes (which E3 does not appear to agree with), then their efficiency in keeping effects on surface water to a no more than minor level can be determined from the modelling results.

In my opinion, the effects on water quality in the Golden Bar Creek and North Branch of the Waikouaiti Rivers are **likely to be no more than minor** as:

- If the existing compliance standards are treated as the baseline, none are expected to be exceeded at GB02 or NB03.
- If current state is treated as the baseline:
  - Only sulphate, nitrate, arsenic, and zinc concentrations are expected to increase for any period and increased concentrations of these parameters are not expected to result in a change in toxicity risk as:
    - Median nitrate concentrations are expected to to stay under the 99% species protection threshold while 95th percentile concentrations are expected to remain between the 90% and 80% species protection thresholds (Hickey, 2013);
    - Sulphate concentrations are not expected to exceed 1000 mg/L, which I understand has been confirmed as providing adequate ecological protection to local species through whole of effluent toxicity testing; and
    - Median arsenic and zinc concentrations are still not expected to exceed the ANZG (2018) 95% species protection thresholds in either water body.

However, I do note that cannot discount the possibility of more than minor effects in the Clydesdale Stream (GB01) during the closure period and in the long-term if the modelled effects of climate change do not eventuate. The predicted increase in copper during these phases is almost an order of magnitude greater than the ANZG 80% species protection guidelines. I do, however, note that presumably this is at least partially driven by already consented mining (this is something to explore further in hearing prep) and that this a very small and short stream.

While Sulphate concentrations are also expected to exceed toxicity driven existing compliance standards in the Clydesdale Stream, I note they they are already exceeded there. The increases in sulphate concentration at GB01 is also modest (20%) and presumably at least partially driven by already consented mining (this is something to explore further in hearing prep). Consequently, I agree with the implications in Ryder (2024b) that the increase in sulphate at this site is unlikely to increase toxicity risk.

Note: *I consider the effects of the identified increase in nitrate concentration at GB01 and GB02 below in the aquatic ecology section*

Q19	**Are the conclusions and recommendations as to surface water management reasonable? Are there any aspects on which you disagree? Please explain.**
	See response to Q11
App. 13 GHD 2024 Stage 3 Surface and Groundwater (FTSF, IM, and cumulative effects) – operation and closure effects	
Q20	**Sitewide water balance model – are the revisions/updates, inputs, assumptions, and limitations clearly stated and justified? Is the model appropriate for use in this situation? Please explain.**
	See response to Q5
Q21	**Based on the information provided in the application, do you agree that the adverse effects (nature, magnitude) on surface water from the proposed activities at the Frasers/Innes Mills/TTTSF area, and cumulative effects within each catchment and across the Macraes site, are as described in the technical reports? Please explain.**
	Yes. Through Oceana's S92 responses (Annexure 4 and 2), GHD have provided significant additional information to support the model outputs in GHD (2024c) (including finer resolution reporting for all sites). Based on that information I agree with GHD's conclusions that the proposed activity is unlikely to result in exceedances of the existing water quality criteria for impacted receiving environments. **Notes:** • *This assessment assumes the modelling approach used is fit for purpose which is assessed by E3 Environmental* • *GHD only describe their outputs in terms of achieving compliance criteria and absolute change in water quality concentrations. They do not consider the ecological effects of a change in water quality, which is considered in Ryder (2024a). I consider the effects of the identified increase in nitrate concentration at MB01 below in the aquatic ecology section*
Q22	**Are there any statements made within the AEE about surface water effects at the Frasers/Innes Mills/TTTSF area, or about the wider site, that are not supported by the technical reports? Please explain.**
	No. Water quality data effects are presented in the same manner as described in Appendix13.

Q23	**Are there any recommendations relating to surface water at Frasers/Innes Mills/TTTSF area, or about the wider site, (that you consider to be of importance) made in the technical reports that are not included within the AEE? Please explain.**
	No. All recommendations made in GHD(2024c) appear to be included in Table 6.1 of the AEE with the exception of "*The Back Road WRS (BRWRS) is not utilised during MPIV mine life*" However, I am not sure how important this is to the achievement of the water quality outcomes described in GHD(2024c)
Q24	**Has the applicant clearly described a surface water monitoring programme relevant to the Frasers/Innes Mills/TTTSF area, and the wider site (for cumulative effects)? Is the proposed monitoring consistent with recommendations in the technical reports provided with the application? Do you consider that the monitoring is appropriate (frequency, locations, parameters)? Is it clear how any proposed monitoring will be used/incorporated into future management plans to manage adverse effects on groundwater? Please explain.**
	No. See response to Q9
Q25	**Has the Applicant been clear (in the AEE) about which source control methods they are adopting, or not adopting, the reasons for this, and the way in which these will be implemented e.g. immediately vs in adaptive management plans? Do you consider that the methods adopted will be sufficient to ensure that effects on surface water are no more than minor? Please explain.**
	No. See response to Q17
Q26	**The MWM report describes a series of potential passive and active measures for the management and treatment of mine impacted waters. Has the Applicant been clear (in the AEE) about which source control methods they are adopting, or not adopting, the reasons for this, and the way in which these will be implemented e.g. immediately vs in adaptive management plans? Do you consider that the methods adopted will be sufficient to ensure that effects on surface water are no more than minor? Please explain.**

	Part 1 of this question is outside of the scope of my expertise falling somewhere between mine management and geochemistry.
	
	What is relevant to my assessment is that the modelling presented in Appendix 13 (and associated S92 responses) accurately factors in the source control methods that are certain to happen. If the answer is yes (which E3 does not appear to agree with), then their efficiency in keeping effects on surface water to a no more than minor level can be determined from the modelling results.
	
	In my opinion, the effects on water quality in the Deepdell Creek, Murphy's Creek, Shag River and North Branch of the Waikouaiti Rivers are **likely to be no more than minor** as:
	
	• If the existing compliance standards are treated as the baseline, none are expected to be exceeded.
	• If current state is treated as the baseline:
	  ○ Only copper, sulphate, nitrate, arsenic, and zinc concentrations are expected to increase for any period and increased concentrations of these parameters are not expected to result in a change in toxicity risk as:
	  ▪ Median nitrate concentrations are expected to to stay under the 99% species protection threshold while 95th percentile concentrations are expected to remain between the 90% and 80% species protection thresholds (Hickey, 2013).
	  ▪ Sulphate concentrations are not expected to exceed existing compliance standards when the assumed mitigations are employed and I understand these were set for ecological protection through whole of effluent toxicity testing (note, based on information provided with the second S92 response, even without mitigation the proposed activity is expected to reduce the effects of the activity in the North Branch of the Waikouaiti Rivers where the risk of sulphate compliance standard exceedance is greatest);
	  ▪ Median arsenic and zinc concentrations are still not expected to exceed the ANZG (2018) 95% species protection thresholds in either water body; and
	  ▪ Median copper concentrations are not expected to exceed the ANZG (2018) 95% species protection thresholds when the assumed mitigations are deployed (**NOTE MODELLING SUGGESTS THERE IS A RISK OF MORE THAN MINOR COPPER TOXICITY EFFECTS IN THE NBWRRF SITE WITHOUT THESE MITIGATIONS**)

Q27	**Are the conclusions and recommendations as to surface water management reasonable? Are there any aspects on which you disagree? Please explain.**
	See response to Q11

Aquatic Ecology	
Questions relate to all areas of the site	
Q28	**Are the impacted aquatic areas clearly, accurately, and unambiguously described/mapped to an acceptable level of detail, including adequate descriptions of existing instream ecological/natural values? Please explain.**
	Yes. Ryder (2024 a-c) clearly describes the impacted receiving environments, including their values. Maps and photographs are also provided where relevant.
Q29	**Have adverse effects on algae and macrophytes been assessed adequately for each impacted watercourse? Please explain.**
	Yes. Algal and macrophyte effects assessments for the impacted streams are provided in Ryder (2024a&b) with further information provided with the first S92 response (response to specific questions and update to Ryder (2024c). Dr Ryder has considered the current state of periphyton, macrophytes and nutrients in the impacted receiving environment and considered the risk of an increase in plant growth based on modelled future nutrient concentrations Through this review process I noted a lack of quantitative evidence to support the conclusions made regarding algal and macrophyte effects, and this has been remedied by the applicant through the second S92 response. ***Note:*** *for Deepdell Creek and Shag River are covered in the revised cumulative effects assessment provided with the first S92 response.*
Q30:	**Have adverse effects on benthic macroinvertebrates been assessed adequately for each impacted watercourse?? Please explain.**
	Yes (although I would describe some of these assessments (i.e., Ryder (2024b) as 'light') Assessment for impacted streams are covered in Ryder (2024a-c). Dr Ryder has considered the current state of macroinvertebrates and has considered the risk of degradation based on modelled water quality results and (presumably) his algal/macrophyte assessments
Q31	**Have adverse effects on fish been assessed adequately for each impacted watercourse?? Please explain.**
	Yes (although I would describe some of these assessments (i.e., Ryder (2024b&c) as 'light') Assessment for impacted streams are covered in Ryder (2024a-c). Dr Ryder has considered the current state of fish and has considered the risk of degradation based on modelled water quality results and (presumably) his algal/macrophyte and macroinvertebrate assessments
Q32	**Have the adverse aquatic ecological effects of the reclamation of sections of Clydesdale and Golden Bar Creeks been assessed adequately? Please explain.**
	Yes. Section 3.2.2. of Ryder (2024b) provides an assessment of effects that I consider to be appropriate based on the scale of the reclamation and offset, and the values of the waterbodies (one of which is not a river)

Q33:	**Has the effects management hierarchy (of the NPS-FM as required by the NES-F in relation to river reclamation) been applied correctly for the proposed reclamations? Please explain.**
	This is a planning matter and whether the requirement to avoid then minimise has been given sufficient weight is **outside my area of expertise**. However, I do note that reclamation cannot be mitigated. Therefore, the proposed offset is the most appropriate step if you consider avoidance and minimisation have been adequately considered. I also consider that as applied the effects management hierarchy has resulted in the activity generating effects that are no more than minor.
Q34	**Are there any statements made within the AEE about aquatic ecological effects at any impacted site that are not supported by the technical reports? Please explain.**
	No. The AEE uses the same terminology as in Ryder (2024a-c)
Q35	**Are there any recommendations relating to aquatic ecology at any impacted site (that you consider to be of importance) made in the technical reports that are not included within the AEE? Please explain.**
	Yes. Dr Ryders recommendation that: "*the Waikouaiti River North Branch channel at and immediately downstream of the discharge area be monitored in the initial stages of the Golden Pit dewatering, and should significant erosion be detected (e.g., erosion that results in bank collapse and sediment smothering the river bed outside of a zone of mixing zone (which, for the upper Waikouaiti River North Branch, a 50 m length is recommended), implement management options to control this to acceptable levels*"
Q36	**Are cumulative effects on aquatic ecology within each catchment adequately described and assessed? Do you see any deficiencies with this assessment? Do you agree with the assessment? Please explain.**
	Yes. The effects have been adequately described in Ryder (2024a-c). Upon review of the nutrient data provided with the second S92 response I now agree with Dr Ryder regarding the scale of adverse effects and am confident in his assessment of the potential for increased periphyton growth associated with the modelled increases in nitrate concentrations.

Table 2: Record of notes made through review process.

Activity	Notes	S92 draft questions	Final S92 questions	Summary of S92 response	Additional S92 questions
Discharge of tailings into Frasers Pit	• Modelled WQ effects • Results followed through to Ryder's assessment (includes relevant ecological information) • Mitigation modelled in IMOP / Deepdell etc. report. • Monitoring generally recommended to continue	• Appendix 13 notes compliance at DC07 and 08 relies on augmentation from camp creek dam at low flows. Is this available and has this been considered in Ryder? Same with passive treatment at Frasers and GB WRS, new sump at NBWRTR and conversion of Fraser, Clydesdale and Murphy SP into sumps so that only flows at high flows. + Controlled flows to NBWR • Appendix 13 5.8.1 Please provide an assessment of the validity of the water management assumptions (2,3,4,12) • 5.11 of Appendix 13 notes that "Selected contaminants" are presented. Does this mean more have been modelled and not provided? If so, please provide. Dont ask in appendix F. • High probability of copper causing significant adverse effects at MC02 and more than minor effects at NB03 during closure and long-term. What is the probability of this with the consented baseline? • Appendix F-6 notes that copper has been modelled with a hardness adjustment applied. Does this mean the modelled results are adjusted or unadjusted values? I take it to be unadjusted. Hardness adjustment is no longer conducted for copper. If some level of adjustment has been conducted, please provide raw copper concentrations. •	1. Appendix 13 notes ongoing compliance at DC07 and DC08 (Deepdell Creek) relies on: a. Augmentation from the Camp Creek Dam (or alternative source of water at low flows); b. A new sump to capture seepage from the Frasers West and South Waste Rock Stacks (WRSs); c. Conversion of the Frasers West, Clydesdale and Murphys silt ponds to sumps that return to Frasers pit and only discharge to surface water (North Branch of Waikouaiti River) in a controlled manner during high flows; and d. Passive treatment of seepage from Frasers West/South and Golden Bar WRSs. It is unclear whether these actions are planned. **Could the applicant please confirm which of these actions (or their alternatives) will occur?** 2. **Please update Appendix F of Appendix 13 to include summaries of current state** (as has been done in Table 5.8 and 5.9 of Appendix 11. If the information requested above reveals an increase in nitrate from current, please assess the potential impacts on periphyton growth in the receiving environments (noting that this is identified as an issue in Appendix 22). 3. The water quality data contained in Appendix F suggests there is a high probability of copper causing significant adverse effects at MC02 and more than minor effects at NB03 during closure and after closure. **To what extent does the current proposal contribute to long-term copper concentrations** (i.e., what are the modelled concentrations under a scenario where the proposed activities do not occur)? 4. Section 4.2.6 of Appendix 13 notes that "the proposed dewatering [of Frasers, Golden point and Innes Mills open pits] may reduce the total base flow of local creeks/streams by less than 8%". It then goes on to state "modelled reductions in seepage discharges to creeks are expected to have negligible impacts on creek and river flows through summer low flow periods". This is reinforced in Appendix 22 which states there will be "no material changes to the hydrological character of the receiving waters". However, little evidence is provided for this statement in relation to Deepdell Creek and the ecological effects are not considered further. **Please provide an assessment of**	1. S92 letter notes that all proposed actions expected to be implemented through adaptive management under the WQMP. However, Oceana acknowledge that additional consents may be required. **SHAY TO CONFIRM** whether these mitigations should be considered. 2. **NOT ANSWERED.** Update to WQ data provided in Annexure 04. Demonstrates substantial increases in nitrate. Periphyton effects considered further by Greg in Annexure 15. He considers increase in growth will not occur in Murphys Creek due to low DRP (limiting) and high nitrate (saturating). However, this is based on assessment for the Mare and only considers one receiving environment, for which no evidence in support of this (i.e., DRP data is missing, and NO3-N data shows concentrations below saturating). Ignores Deepdell, Shag River and North Branch, all of which who significant N increases. Follow up questions to look into: a. Are N concentrations saturating for all receiving b. Are DRP concentrations limiting for all receiving environments. c. Is his limitation argument even relevant given Keck and Lepori. **PLEASE PROVIDE RAW DATA FOR ALL SITES INCLUDING PERIPHYTON RESPONSE PROVIDED** in Annexure 04. 3. Attributes effects to model error generating concentration estimates in the WRS an order of magnitude higher. Reduces concentrations at MC02 to around ANZG 95% DG with mitigation. However, doesn't change NB03 concentrations (which are below ANZG 90% DGV). Values presented are non-adjusted. This is now addressed but only if mitigation can be considered. **SHAY TO CONFIRM**. Based on S92 response it appears copper is linked to sulphate, which is highly impacted by mitigation during mining. In which case adverse copper effects could be possible TBC. 4. Response provided in Annexure 04. Concludes that that effects on baseflow actually already realised. Modelled MALF not expected to change from current. (**RESOLVED - No adverse effects**).	1. Please confirm that the only mitigation assumed for the Deepdell Creek is flow augmentation from Camp Creek Dam? Figures 40 and similar in Appendix F refer to mitigation + flow augmentation. However, based on Section 5.11.2, the listed mitigations and the water balance model schematic the flow augmentation is the entirety of the mitigation. 2. Please provide all raw nutrient and periphyton data from sites on the Deepdell Creek and Murphys Creek 3. In relation to Appendix D of Annexure 4 of the S92 response please provide : a. Versions of Table 9-11 without the selected mitigations applied. b. An indication of the extent to which the current proposal contributes to increased 'closure' and 'long term' contaminant concentrations in the absence of mitigations (i.e., are predicted concentrations different from what would be expected with just the implementation of existing consents?). c. Comment on whether the proportional change between the modelled 'mining' concentrations and the 'closure' and 'long-term' concentrations can be applied to the measured current state to provide a better indication of concentrations during those phases for those contaminants where the modelled 'mining' concentrations do not adequately reflect measured current state data. For example, the 'long term' modelled maximum copper concentrations at NB03 are 2.0 times higher than the modelled maximum 'mining' concentration. Applying the proportional difference between those values to the measured current maximum of 0.005 mg/L results in a long-term maximum concentration of 0.01 mg/L, twice as high as what is predicted by the model. The reason for this is request is that under 5.2 of Annexure 4 of the S92 response it is stated that "*'current' data can be considered to have a comparable basis to the 'mining phase' data*". However, there are cases where the measured current concentration far exceeds the equivalent modelled 'mining' concentration presented in Appendix D (e.g. maximum copper concentrations), suggesting the modelled concentrations may be
Damming of water within Frasers Pit	• I haven't found an assessment of how this will impact flows in the North Branch. Probably not needed given it will be minor.				
Take and use of tailings return (supernatant) water from Frasers Pit (	• Believe this is factored in to modelling and follow up effects assessment. To confirm through S92				

Activity	Notes	S92 draft questions	Final S92 questions	Summary of S92 response	Additional S92 questions
		against naturalised flows, rather than with existing dewatering. • • If appropriate, please also comment on the use of camp creek dilution water to reduce hydrological effects rather than just water quality effects. • • Please update Appendix F of Appendix 13 to include summaries of current state (as has been done in Table 5.8 and 5.9 of Appendix 11. • • If the information requested above reveals an increase in nitrate or DRP from current (assumed not based on tables in Appendix 22), please assess the potential impacts on periphyton growth in the receiving environments (noting that this is identified as an issue in Appendix 22). • •	**potential impacts on (Deepdell) stream flows in terms of % reduction in naturalised MALF or, if more relevant, duration of drying**. Based on this assessment additional comment may be needed on whether flow augmentation is needed to mitigate hydrological effects as well as water quality effects.		underestimating the adverse effects of the proposal.
Discharge of waste rock to land within Coronation Pit Discharge of Coronation Pit water to Deepdell North Pit	• Modelled WQ effects • Results followed through to Ryder's assessment (includes relevant ecological information) • Mitigation modelled in IMOP / Deepdell etc. report. • Monitoring generally recommended to continue • Not considered in WB balance modelling • Assume it would not matter as it hasn't topped yet. • Flow effect allowed for by existing consents. • Confirm through S92	• Appendix 11 • Appendix 11 notes coal creek dilution dam has not been assumed as it is not needed to remain within existing compliance standards. However, that ignores the previously identified issues around those compliance standards allowing for significant adverse effects. • Please confirm the dissolved metal concentrations in Table 2 of Appendix 20 are correct. The maximums for copper appear high compared to the 95th percentiles in appendix 11. Please provide more qualitative evidence regarding hydrological effects on Mareburn, including comparisons of dewatering effects against relevant hydrological statistics such as MALF and time spent dry. This is not an attempt to refute Dr Ryders assessment. Rather to ensure that I have sufficient information to confirm it. Please confirm whether nitrate is expected to increase or decrease in the Mare burn, Appendix 11 and Appendix 20 contradict each other here. If an increase is expected could Dr Ryder, please re-visit his algae assessment in Section 4.3 of Appendix 20	5. Appendix 11 notes the Coal Creek dilution dam has not been assumed as it is not needed to remain within existing compliance standards. However, that ignores the previously identified issues around those compliance standards. **Please model this scenario or describe why it is not feasible to do so** (e.g., cost, time > 3 days, etc.). 6. **Please confirm whether the dissolved metal concentrations in Table 2 of Appendix 20 are correct**. The maximums for dissolved copper are much higher than the 95th percentiles in Appendix 11. 7. **Please provide more quantitative evidence regarding hydrological effects on Mareburn, including comparisons of dewatering effects against relevant hydrological statistics such as naturalised MALF** (as has been done in other reports appended to the application). This is not an attempt to refute Dr Ryders assessment. Rather to ensure that I have sufficient information to confirm it. 8. **Please confirm whether nitrate is expected to increase or decrease in the Mare burn**, Appendix 11 and Appendix 20 contradict each other on this point. If an increase is expected Dr Ryder may need to re-visit the algal assessment in Section 4.3 of Appendix 20.	5. Answered in Annexure 4 and S92 Letter. Basically, not done, state that they are not interested in reducing compliance limits. Thus, do not need to consider Coal Creek to offset adverse effects that happen beyond those limits. To **DISCUSS WITH SHAY**. 6. Annexure 15 confirms concentrations are correct. Shows concentrations can already be high in the Mareburn shows that the modelling is underestimating concentrations. I need to see that data to understand the risk better as those maximums are so high that it would suggest limited headroom. **PLEASE PROVIDE RAW DATA FOR ALL SITES** 7. Through assessment provided using best available data. (**RESOLVED - No adverse effects**) 8. Annexure 15 confirms nitrate increase. Considers increase will not increase periphyton due to limiting DRP and saturating NO3N concentrations (No DRP or periphyton data to support expert opinion). **PLEASE PROVIDE RAW DRP AND PERI DATA FOR ALL SITES**	6. Please provide all raw dissolved copper concentration data for sites on the Mareburn and Golden Bar Creek 8. Please provide all raw nutrient and periphyton data from sites on the Mareburn
Discharge of waste rock to land within Coronation North Pit Take and use of surface water from Coronation North Pit for the purpose of dewatering the Coronation North Pit and use for the purpose of dust suppression or in the mine water management system	• Modelled WQ effects • Results followed through to Ryder's assessment (includes relevant ecological information) • Mitigation modelled in IMOP / Deepdell etc. report.				
Take and use of groundwater from Coronation North Pit for the purpose of dewatering the Coronation North Pit and use for the purpose of dust suppression or in the mine water management system	• Impact on flow in the Mareburn modelled and discussed in Greg's report. • Mitigations probably not needed • Monitoring generally recommended to continue				
The diversion of surface water around the Golden Bar Pit, haul roads and stockpile area for the purpose of managing surface water runoff	• Has not been assessed explicitly. • Low priority but needs S92 (does water go back to natural catchment?)	• Please explain the order of magnitude difference in current copper concentrations at GB01 presented in Appendix 12 (Table 10) and Appendix 21 (Table 4). Results in appendix 12 are not consistent with Dr Ryders assessment that "dissolved metal concentrations are low and below water quality guidelines".			
Take and use surface water for the purpose of dewatering Golden Bar Pit and use for the purpose of dust suppression or in the mine water management system	• Hydrological assessment for Mc Cormicks and Murphys Creek but not for Golden Bar Creek. • Only an issue if dewatering not discharged there. Confirm through S92		9. **Please explain the order of magnitude difference in current copper concentrations at GB01 presented in Appendix 12** (Table 10) and Appendix 21 (Table 4). The results in Appendix 12 are not consistent with Dr Ryder's assessment	9. **RESPONSE PROVIDED** in Annexure 04 and Annexure 15. Attributes effects to model error generating concentration estimates in the WRS an order of magnitude higher.	
Take and use groundwater for the purpose of dewatering Golden Bar Pit and	• Mitigations probably not needed • Monitoring generally recommended to continue				

Activity	Notes	S92 draft questions	Final S92 questions	Summary of S92 response	Additional S92 questions
use for the purpose of dust suppression or in the mine water management system			that "*dissolved metal concentrations are low and below water quality guidelines*". 10. **Please confirm the management, rate and location of the dewatering discharge from Golden Bar Pit**. While Appendix 12 and Appendix 21 make recommendations on these matters I am unclear of what the actual planned approach is. 11. **For what reason has the 70 metres of gully within the footprint of the extended Golden Bar pit been classified as a river?**	10. **NOT ANSWERED**, I just want the rates and locations being sought by the applicant that will go in consent conditions. Not what could happen but is being applied for **SHAY TO CONFIRM IF THIS IS AN ISSUE** 11. **RESOLVED**. Annexure 8 and Annexure 15 indicate that the applicant no longer considers this a river. Which I agree with.	
Discharge water containing contaminants to Waikouaiti River North Branch for the purpose of disposing of water from dewatering of Golden Bar Pit	• Effects on surface water hydrology and quality modelled for Golden Bar and North Branch. • Ryders report also includes narrative assessment of: ○ Water quality ○ Ecology ○ Erosion For North Branch and Murphys Creek • Modelling report states it will go to Golden Bar Creek then to NB. No mention in Gregs Report on effects in Golden Bar. • Need to confirm exact location through S92				
Discharge water containing contaminants to Murphys Creek for the purpose of disposing of water from dewatering of Golden Bar Pit	• Ryders assesses ecological effects on Murphy's • Water quality and flow modelling not done. • Confirm location of discharge through S92 • Monitoring generally recommended to continue				
Disturb and excavate the bed of (an unnamed tributary of) Golden Bar Creek for the purpose of mining the Golden Bar Pit extension	• Limited but sufficient analysis in Ryders report. • Monitoring not needed • Offset proposed				
Discharge waste rock to land in Golden Bar Pit for the purpose of disposing of waste rock	• Modelled WQ effects • Results followed through to Ryder's assessment (includes relevant ecological information) • Mitigation modelled in IMOP / Deepdell etc. report. • Monitoring generally recommended to continue. • Impacts on Clydesdale Creek not assessed to consider whether this needs to be address through S92 later				
Take surface water for the purpose of creating the Golden Bar Pit Lake	• Long-term effects on flows in Golden Bar not assessed. • Not sure if this is an issue (TBD) • Monitoring generally recommended to continue				
Take groundwater for the purpose of creating the Golden Bar Pit Lake					
Discharge waste rock and contaminants from waste rock to land for the purpose of extending the Golden Bar Waste Rock Stack	• Modelled WQ effects • Results followed through to Ryder's assessment (includes relevant ecological information) • Mitigation modelled in IMOP / Deepdell etc. report. • Monitoring generally recommended to continue				
Disturb, deposit and reclaim part of an unnamed modified watercourse in the Clydesdale Creek Catchment for the purpose of extending the Golden Bar Waste Rock Stack	• Limited but sufficient analysis in Ryders report. • Monitoring not needed • Offset proposed				
Discharge silt and sediment to water for the purpose of extending the Golden Bar Waste Rock Stack	• Not assessed • Could request construction phase effects assessment for S92				
Permanently divert water around the Golden Bar Waste Rock Stack and into unnamed tributaries of Clydesdale Creek for the purpose of preventing surface water ingress and managing stormwater runoff	• Not assessed. • Low priority but needs S92 (does water go back to natural catchment)				
Discharge contaminants to water from the base and toe of the extended Golden Bar Waste Rock Stack for the purpose of waste rock disposal	• Modelled WQ effects • Results followed through to Ryder's assessment (includes relevant ecological information) • Mitigation modelled in IMOP / Deepdell etc. report. • Monitoring generally recommended to continue				
Discharge water from silt ponds to Clydesdale Creek for the purpose of operating silt ponds associated with the Golden Bar Waste Rock Stack	• Not assessed apart from associated seepage. • Based on low risk from earlier applications this can wait for S92.				

Activity	Notes	S92 draft questions	Final S92 questions	Summary of S92 response	Additional S92 questions
Discharge of waste rock to land within for the purpose of constructing a road	• Assume in wider modelling for Golden Bar • Check for S92				
Discharge silt and sediment to water in Northern Gully silt pond for the purpose of excavating waste rock from Northern Gully Waste Rock Stack	• Not assessed apart from associated seepage. • Based on low risk from earlier applications this can wait for S92.		12. **Please provide a (short) assessment of the potential for sediment discharges from the Northern Gully silt pond to generate adverse effects such as conspicuous changes in visual clarity or significant adverse effects on aquatic life.**	**NOT RESOLVED**. Assessment provided in Annexure 4 and Annexure 15 do not actually consider likely TSS concentrations in the discharge. Mitigations suggested if pond doesn't work but not confirmed by applicant and no triggers provided.	12. Please: a. Provide evidence that Northern Gully silt pond is appropriately sized as assumed in Annexure 4 to the S92 response. **b.** Describe the sediment related triggers that will be used to determine whether the further mitigation measures described in Annexure 4 to the S92 response are necessary. Describe what sediment monitoring will be undertaken to determine whether the mitigation triggers are exceeded.
Take and use surface water from Murphys Silt Pond, Frasers East Silt Pond, and Clydesdale Silt Pond for the purpose of capturing waste rock stack seepage and preventing its release to the environment	• Assessed as mitigation option				
Discharge water containing contaminants to land and to water in Golden Bar Pit for the purpose of managing waste rock stack seepage water	• Assessed as mitigation option				

Prepared by:

Dr Michael Greer
Principal Scientist, Director
Torlesse Environmental Ltd
M: +64 (27) 69 86 174
4 Ash Street, Christchurch 8011