Otago Regional Council

Our Reference: A915743

1 July 2016

Oceana Gold (New Zealand) Limited
PO Box 5442
Dunedin 9058

Dear Sir/Madam

Request for further information under section 92(1) of the Resource Management Act 1991 (the Act) – Consent Numbers RM16.138.01-19

Thank you for your application - Coronation North Project.

An initial assessment of your application has been made by Council's Resource Science Unit (RSU), Tonkin and Taylor, and NIWA. However to be able to make their full assessments we request the following information:

Information required from Tonkin and Taylor
Please provide comment on information requests *a* to *t* outlined in Table 1 of Appendix 1.

Information required from NIWA
Please provide comment on information requests *1* to *21* outlined in Table 5 of Appendix 2.

Further information requests *1* and *2*; could you also relate the predicted and current water quality to Council's Plan change 6A guidelines, in particular Schedule 15 and 16 of the Regional Plan: Water.

Information required from RSU

1. Council's preference, pursuant with Policy 6.5.5 (d) of the Regional Policy Statement for Otago, is to promote discharges to land where practical rather than to water bodies. Please provide comment on alternative methods of discharging.

2. Concerns have been raised that the proposed residual flow of 5 litres per second cannot be maintained below the Coal Creek Dam, given the size of catchment above the dam. Please provide flow summaries for the proposed Coal Creek Dam and indicate how you will maintain the proposed residual flow at all times.

3. Trout pose a highly significant threat to the Taieri flathead galaxias. The existence of a dam in the upper Mare Burn catchment provides an opportunity for trout to be legally or illegally liberated into the dam. This would result in trout colonising the downstream catchment and the subsequent loss of the local Taieri flathead galaxias. Do you intend to manage/remove the dam after it is no longer required? Could you also comment on how you will avoid the introduction of trout and other recreational fish species to the Mare Burn catchment.

4. No comment on how discharges will be diluted in particular sections of Maori Hen Creek and Trimbells Gully. Please confirm how adverse effects on these sections will be avoided, mitigated or remedied.

What are Your Options? – You may

(a) Provide the information requested within 15 working days [s92A(1)(a)] of this letter (25 July 2016) or

(b) Tell us in writing the date you will be providing the information, if you need longer than 15 working days [s92A(1)(b)]; or

(c) Tell us in writing that you refuse to provide the information [s92A(1)(c)].

What Happens Then?

Straightforward Option: If you decide to provide the information under option (a) or (b) above, your application will be placed on hold until the information arrives on the agreed date [s88C(2)(b)]. After that it will be taken off hold and processing of the application will continue.

Complex Option:

1. If you choose option (c) above and refuse to provide the information, or

2. If you agree to provide the information by an agreed date and don't do so or

3. You don't respond at all:

We strongly urge you to choose either option (a) or (b) above, to avoid the unnecessary cost of public notification and the potential declining of your application.

Otago Regional Council

If you have any further queries please contact me on (03) 474 0827 or 0800 474 082.

Yours sincerely

Charles Horrell
Consents Officer
Encl

Telarc. QUALITY ISO 9001

Otago Regional Council

Appendix 1: Information requests identified from Tonkin and Taylor

Tonkin+Taylor

Job No: 51640.0230
13 June 2016

Otago Regional Council
Private Bag 1954
Dunedin

Attention: Charles Horrell

Dear Charles

Proposed OceanaGold Coronation North Project
Section 92 requests for additional information

Tonkin & Taylor Ltd (T+T) has been engaged by the Otago Regional Council (ORC) to carry out a review of aspects of the Coronation North Project (CNP) application for resource consent. The scope is set out in our proposal dated 10 June 2013. Following our initial overview of the information provided to us for review we have identified various information gaps and/or uncertainties where we believe additional information is required for our review (refer Table 1, below). Can you please arrange for the Applicant to respond to these matters in accordance with Section 92 of the Resource Management Act (RMA). We have included a column to cater for the Applicant's responses, should this prove useful.

Table 1 Section 92 requests for more information

Item	Matter to be addressed by the Applicant	Response by the Applicant.
Appendix 5: Golder Associates; Coronation North Project Groundwater Assessment.		
a.	**Section 5.4 Groundwater recharge** Please provide further information that clarifies how the groundwater recharge rate has been derived and demonstrates that this number is appropriate for both pit inflow calculations and waste rock stack seepage calculations.	
b.	**Section 5.53 Groundwater area of influence calculations** Please further clarify how the "Reasonable Area of Influence" as described in 5.5.3 is calculated. Please provide further information on how the groundwater divide between the pit and adjacent gullies (as demonstrated in Figure 5) has been established in order to	

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P +64-3-363 2440 F +64-9-307 0265 E chc@tonkintaylor.co.nz

Item	Matter to be addressed by the Applicant	Response by the Applicant.
	determine the Reasonable Area of Influence. Please provide further justification and/or clarification of the following statements presented in Section 5.5.3, under items 1) and 4) *"This scenario differs from Scenario 1 in that is also takes into account the groundwater systems in gullies close to the pit, which are unlikely to remain relatively unchanged irrespective of the construction of the pit".*	
c.	**Effects on stream flow and surface water allocation** Please provide further information on the cumulative effects of ground drawdown as a result of mining and as a result of the interception of recharge from the waste rock stacks on surface water recharge and its consequent effects on stream flows, including those gullies draining to the Shag River Catchment. Please provide an assessment of the effects of any reduction in stream flow on allocable flows in both the Taieri and Shag River Catchments as set out in Section 6.4 and Schedule 2 of the Regional Plan: Water for Otago.	
d.	**Net seepage flows into pit lakes** Appendix F provides an assessment of net groundwater inflow into the pit lakes following mine closure and states that these inflow rates have been carried through into the surface water modelling. Please comment on whether evaporation from the pit lakes has been taken into account in the surface water modelling and whether evaporation from the pit lakes has also been taken into account in determining the likely timeframes for filling of the pit lakes.	
e.	**Section 5.6 Waste Rock Stack Seepage calculations** Section 5.6 concludes that recharge through the waste rock stack will be intercepted and discharge to one of four silt ponds. Please comment on the likely effect of this interception on calculations of groundwater inflows into the mine pits and its consequential effect on the rate of post-closure mine lake filling.	

Item	Matter to be addressed by the Applicant	Response by the Applicant.
Appendix 14: Engineering Geology Ltd.; Oceana Gold (New Zealand) Ltd., Macraes Gold Project Coronation North Project, Erosion and Sediment Control.		
f.	Section 5 page 3 refers to "*the principles embodied in the guidelines prepared by the Auckland Regional Council (Ref.2), and more recently the Environment Canterbury Guidelines (Ref.1), modified where appropriate based on operating experience.*" Please advise any instances where the design of the erosion and sediment control measures will depart from the Environment Canterbury Guidelines referred to in the application. The justification for such departures should also be provided (if not already included).	
g.	The ECan Guidelines refer to a design standard arising from a 20 % (1 in 5 year) ARI 10 hour event, whereas the application mentions the first 24 hours rainfall from a 72 hour duration 2 year ARI storm. Please state the design rainfall depth associated with both storms at the site and provide details of the hyetograph used to determine the rain fall depth associated with the first 24 hours of the 72 hour duration storm. Please clarify why you consider it appropriate to use a lesser rain fall depth than suggested by the ECan Guidelines in the event that the proposed design depth is less than recommended by the ECan Guidelines.	
h.	In order to understand the concept generally described in the application, and further to Figure 5 included in Appendix 14, please provide a concept plan(s) to illustrate the following: • Location and alignment of temporary clean water diversion drains together with details of catchment areas and drain capacities. Outline proposals for any required construction staging. • Location and alignment of permanent clean water diversion drains together with details of catchment areas and drain capacities. • Location of stormwater detention ponds and their catchments including details of catchment areas and live storage volumes.	

Item	Matter to be addressed by the Applicant	Response by the Applicant.
i.	Please advise details of proposed water quality monitoring within the catchments associated with the application including location, frequency and parameters being measured.	
j.	Please provide details of proposed criteria to assess monitoring results against (along with response protocols) including threshold criteria that would trigger a requirement for a comprehensive review of water quality to determine whether additional mitigation measures should be adopted to ensure appropriate discharges (latter in accordance with approach utilised by existing consents).	
Appendix 17: techNick; Mining Vibration Assessment, Coronation Project, Macraes New Zealand; April 2013 and 9 December 2015.		
k.	**4. Sensitive Areas** Please clarify where the respective distances to Longdale Station and Howard's residence are measured from. Our review of the document by Opus, Macraes Gold Project Coronation North Project; Landscape and Visual Assessment, Appendix 1 – Coronation Base Map, indicates that Longdale Station is located approximately 2.0km from the boundary of the Coronation North Pit, and Howard's residence is located approximately 1.8km from the boundary of the Coronation Pit Extension.	
l.	**5.1.d Vibration predictions for Coronation Project** Please clarify how the respective adopted site constant (K_g) and site exponent (B) of 1450 and -1.6 have been verified. If this has been done using monitoring data from similar works on site, please provide the relevant data presented in an appropriate plot. Alternatively, if the intention is to verify these factors using monitoring during the Coronation project, please provide details of the monitoring programme. We note that the adopted site constant is higher than the "average field conditions" value provided in AS 2187.2 – 2006, however this relates to a 50% probability of exceedance, rather than the 5% probability of exceedance adopted for this project.	

Item	Matter to be addressed by the Applicant	Response by the Applicant.
m.	**5.1.e Airblast** Please clarify the value used for the site constant (K_a) and how this value and the site exponent (a) of -1.2, have been verified. If this has been done using monitoring data from similar works on site, please provide the relevant data presented in an appropriate plot. Alternatively, if the intention is to verify these factors using monitoring during the Coronation project, please provide details of the monitoring programme.	
Appendix 18: Engineering Geology Ltd.; Macraes Gold Project, Coronation North Waste Rock Stack, Design Report, 29 April 2016.		
n.	The design report does not describe the geometric design rules for the RWS, such as lift limitations, batter angles, batter heights, berm widths and the camber on the crest of the stack. Please provide a summary of these design parameters.	
o.	Please provide the design assumptions/parameters for 'stripping and foundation preparation', the definition of 'coarse rock fill' and the definition of 'initial toe fills'.	
p.	Please provide some discussion around the potential for foliation shears, or similar, that might require reduction of the anisotropic schist shear strength model to c = 0, phi = 20 deg (or less) along the plane of foliation.	
q.	The waste rock shear strength function is a different approach to that adopted on previous WRSs. The result appears to be an increase in calculated stability from about FOS 1.2 to FOS 2. Please provide a summary of the basis for adopting this function, and/or a copy of ref. 3. Engineering Geology Ltd (2014) 'Macraes Gold Project, Coronation Waste Rock Stack, Design Report'.	
r.	Does this report cover the redesign of the Coronation WRS in order to avoid the south wall of the Coronation North Pit? Please provide some information regarding redesign of the Coronation WRS.	
Appendix 19: Pells Sullivan Meynick; Impact of the Coronation and Coronation North Waste Rock Stack on Open Pits; 12 April 2016.		
s.	Please provide a summary of the assessment that forms the basis for the recommended 100 m offset from pit crest to WRS toe. The very long term retreat of	

Item	Matter to be addressed by the Applicant	Response by the Applicant.
	the pit crest is often a controlling factor in such an assessment. This may be covered in a previous study carried out for the site?	
Appendix 20: Pells Sullivan Meynick Coronation North Pit – Slope Design Angles, 5 April 2016.		
t.	Does this report also cover the proposed expansion of the Coronation Pit? Please provide some information to confirm the pit wall design for the Coronation Pit.	

Please do not hesitate to contact us if you wish to discuss any aspect of these matters further. In the first instance please refer correspondence to Tim Morris, tmorris@tonkin.co.nz.

This report has been prepared for the exclusive use of our client, with respect to the particular brief given to us and it may not be relied upon in other contexts or for any other purpose, or by any person other than our client, without our prior written agreement.

Tonkin & Taylor Ltd
Environmental and Engineering Consultants

Tim Morris
Senior Civil Engineer

13-Jun-16
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Otago Regional Council

Appendix 2: Technical Assessment and information requests from NIWA

NIWA
Taihoro Nukurangi

Memo

From	**Dr Chris Hickey**
To	Charles Horrell, Otago Regional Council
CC	
Date	27 June 2016
Subject	Technical Assessment - Oceana Gold

The objective of this assessment was to review specified components of a resource consent application from Oceana Gold to Otago Regional Council (ORC) for an extension of Macraes mine (Oceana Gold Application RM16.138). The brief specified (P. Christophers email of 090616):

(i) Review of "Surface Water Modelling", "Arsenic and Iron Mobility" and "Water Quality Mitigation – Fresh Water Dam Scenario", "Erosion and Sediment Control", which can be found in objective links Oceana Gold - Consent Application Appendices 4a; Oceana Gold - Consent Application Appendices 4b and Oceana Gold – Consent Application Appendices 14 & 15.

(ii) Review relates to surface water quality and not aquatic ecological values.

All assessments are based on the information supplied in the supplied Appendix information. Additional information was obtained from Charles Horrell (ORC) in relation to existing consent conditions, fauna present at stream sites and information on the proposed water storage dam.

Background

Oceana Gold proposes to open a new pit mine and store mine tailings operation in the Coal Creek catchment. As part of this project a freshwater storage dam is proposed in the catchment to augment flows downstream of discharge areas. Stream flows in Mare Burn in the Maori Hen Creek area upstream of Coal Creek confluence dry out in summer periods. A monitoring site on Mare Burn (MB01) has existing compliance monitoring conditions which relate to existing leachate entering the stream in the upper catchment. A new monitoring site (MB02) is proposed for further downstream in Mare Burn at a site located downstream of the Coal Creek confluence, which will be downstream of the proposed freshwater storage dam. The catchment and proposed developments together with the MB01 and MB02 monitoring sites are shown in Figures 1 and 2, with the location of the proposed Coal Creek freshwater dam shown on Figure 3.

Monitoring data for Frasers Pit is provided for the period 1998-2000 (Appendix A, (Golder Associates 2016)). Proposed compliance criteria existing at MB01 and proposed for MB02 are provided in Table 1. The application states that: "*The primary usage of water from Mare Burn is considered to be for stock watering. No potable water supply takes are known to exist along Mare Burn.*" (section 6.3.2, (Golder Associates 2016)). The application provides predicted water quality compliance with the parameters and criteria provided in Table 1. No other parameters of potential concern are addressed in the appendix documents reviewed.

Table 1. Proposed receiving water compliance conditions (Golder Associates 2016)

Table 21: MB01 and MB02 compliance criteria.

Parameter [1]	Existing at MB01 and proposed for MB02	ANZECC 2000 (stock water)	NZDWS 2008 [2]
pH (unitless)	6.0 – 9.5	-	7.0 – 8.5
Sulfate	1,000	1,000	250
Cyanide$_{WAD}$	0.1	-	0.08
Arsenic	0.15	0.5	0.01
Copper [3]	0.009	0.5	2
Iron	1.0	N/A	0.2
Lead [3]	0.0025	0.1	0.01
Zinc [3]	0.12	20	-

Notes: 1) All units g/m^3 unless stated.
2) Some of these values are maximum acceptable values while others are guideline values for aesthetic determinands.
3) Copper, lead and zinc compliance criteria for MB01 are hardness related.

Assessment

In undertaking this review I used a check list of issues which I consider should be addressed in relation to management of water quality downstream of the various discharge sites in order to provide for adequate levels of ecological protection for the receiving waters. In applying this approach I have assumed that at some point downstream there will be ecological values which should be protected. I am not in a position to judge what level of protection should be provided at monitoring sites MB01 or MB02 or whether some level of assimilative capacity (e.g., cumulative downstream dilution) might need to be invoked as part of the consenting process. Should this be the case, then further downstream monitoring sites may need to be in place to ensure such compliance is met. General issues related to this check-list are summarised in my table of potential issues that ORC may wish to raise as part of their s92 questions relating to the application.

The ANZECC (2000) guidelines provide for a risk-based approach to environmental management. As such, they provide for a range of numeric values corresponding to different levels of protection for chemical contaminant concentrations in the aquatic environment. These range from 99% protection levels for pristine environments, through 95% protection for 'slightly disturbed' environments, to lower levels of protection (i.e., 90% or 80%) for environmental with reduced ecological values. As a default I have noted 95th percentile guidelines since those are the values normally used for waters with low level anthropogenic stressors. The ORC may wish to consider other protection levels for this receiving environment. However, for some contaminants risk-based guidelines are not available and only short-term (acute) or long-term (chronic) guidelines may be available for those contaminants. Their application would depend on the nature of the discharge (i.e., how time-variable).

I have specifically addressed the contaminants of potential concern (COPCs) in Table 2 for the various activities which are operating or are proposed to operate in the catchment. Notably, amongst those are major ecological stressors which are not addressed, including: total dissolved solids (TDS, potentially measured by electrical conductivity (EC)), suspended sediments / turbidity and various other metals which may be present (e.g., manganese, nickel, chromium). Increased receiving water concentrations of SS and turbidity have the potential to result in both aesthetic and/or ecological adverse effects and so should be addressed from both perspectives. Normally, with such a mining operation I would expect that specific management and mitigation measures would be in place to reduce SS concentrations and event loads (e.g., by chemical dosing, retention systems for first flush capture). An assessment of the potential impacts of SS

requires background receiving water concentrations over various flood events, together with information on the proposed management approach to be taken and predicted discharge concentrations. Presently, this information is not included in the reviewed appendix documents.

Table 2. Overview of contaminants of potential concern (COPCs) for Mare Burn downstream of proposed pit and waste rock discharges

Discharge	Contaminant / stressor of concern	Sources	Potential effects
Waste rock	Heavy metals (copper, zinc, nickel, chromium, silver)	Leaching	Toxicity
	Reduced metals (iron, manganese)	Reduced metals occur under anoxic conditions	Toxicity by smothering
	Metaloids (arsenic, antimony)		Toxicity
	Sulphate/conductivity		Toxicity
	pH	Sulphide oxidation; addition of flocculents (e.g., alum); pH control	
	Sediment / turbidity	Mining operations	Aesthetics / toxicity
Pit operations	As above		
	Chemicals for suspended sediment management	Various chemical potentially used for SS management	Toxicity
	Nutrients (nitrogen and phosphorus)		Aesthetics / periphyton growths
	Cyanide	Gold extraction processing	Toxicity
Reservoir	Low dissolved oxygen	Generated under stratified conditions in hypolimnion	Toxicity
	Hydrogen sulphide	as above	Toxicity
	Ammonia	as above	Toxicity
	Iron & Manganese	as above	Toxicity
	Nutrients	from run-off	Aesthetics / periphyton growths
Other	Residual flows	Abstractions of water	Habitat loss in streams
Roading	Sediment	Roading	Aesthetics / toxicity
	Dust control chemicals		Toxicity
Run-off	Hydrocarbon spillages	Transort activities on site	Toxic and aesthetic effects

Table 3. Comparison of existing compliance criteria at site MB01 with potential ecologically relevant criteria suitable for MB02

Parameter	Existing compliance criteria at MB01	Potential ecological protection criteria for MB02	Reference for proposed criteria	Notes
pH (unitless)	6.0-9.5	6.5-9.0	(ANZECC 2000)	1
Dissolved copper	0.009	0.0014	ANZECC (2000)	2
Dissolved zinc	0.12	0.008	ANZECC (2000)	2
Dissolved nickel		0.011	ANZECC (2000)	2
Dissolved lead	0.0025	0.0034	ANZECC (2000)	2
Dissolved silver		0.00005	ANZECC (2000)	
Arsenic	0.15	0.013, 0.024	ANZECC (2000)	3
Iron	1	1	US EPA (1976)	
Manganese		0.5		4
Cyanide	0.1	0.007	ANZECC (2000)	
Sulphate	1000	128	MFE-BC (2013)	5
Dissolved oxygen	~-	>7.0 (>5.0)	NPS-FM (MfE 2014)	6
Nitrate		<2.4 (<3.5)	NPS-FM	7
Ammonia		<0.24 (<0.40)	NPS-FM	8
Turbidity		30-50% change in clarity	(MfE 1994)	9
Suspended solids		30-50% change in clarity	MfE (1994)	9

Notes:
All units g/m^3 (i.e., mg/L) unless stated.
1. pH range from ANZECC. Aluminium becomes markedly more toxic at pH 6 so range should be limited. Ammonia toxicity increases at high pH.
2. Default metal guideline for a hardness of 30 g $CaCO_3$ m^3.
3. Guideline dependent on arsenic speciation (AsIII or AsV)
4. Manganese floc precipitates like iron floc. Estimated guideline value for initial evaluation.
5. Guideline is hardness-dependent. Value is for 'very soft' waters and may be higher in high hardness waters.
6. Values for 7 day mean minimum (1 day minimum) in summer period for 'B' attribute waters.
7. Values for median (95th percentile bracketed) for 'B' attribute waters.
8. Values for median (maximum bracketed) for 'B' attribute waters for total ammoniacal-N at pH 8. Note that pH adjustment for other pH values.
9. Turbidity and SS change relative to background water clarity as aesthetic measure. No values available for ecological protection.

For some classes of contaminants (e.g., nutrients – nitrogen and phosphorus) compounds there is no information provided. Some background stream concentrations and existing pond monitoring data should be provided, together with an assessment of the potential for any eutrophication effects.

A summary of potential water quality guidelines is provided in Table 3 together with source references. Comparison of these guideline values with those existing or proposed for the receiving water sites indicate marked differences between ecological protection thresholds and those proposed for stock water consumption. Most notably these differences exists for sulphate (presumably the major contributor to TDS), zinc, arsenic and cyanide.

TDS and sulphate

The median and 95th percentile EC values for New Zealand rivers based on the "100 rivers" study were 86 µS/cm and 225 µS/cm (Close & Davies-Colley 1990; Quinn & Hickey 1990; Smith & Maasdam 1994). No information is provided regarding the EC values in the Mare Burn but it would be expected to be in the lower end of this range.

There are no water quality guidelines for EC or TDS in the ANZECC (2000) guidelines, and no site-specific guideline has been developed for NZ freshwaters. Therefore no linkage has been established for NZ freshwater species with EC as an ecological stressor. However, the US EPA have derived a "field-based benchmark" for EC in central Appalachian streams areas where mountain top mining is occurring, and in

which EC changes are dominated by salts of calcium, magnesium, sulphate and bicarbonate (US EPA 2011). The criteria derived from that study are addressed below.

The US EPA (2011) study derived extirpation (i.e., species extinction) thresholds for 195 macroinvertebrate species from over 2000 samples collected from the Appalachian region. The resulting species sensitivity distribution (SSD) for these species was used to calculate statistically-derived protection thresholds for macroinvertebrate species resident in those streams. The EC in these Appalachian streams ranged from 150 to 12,000 µS/cm. The results showed that the percentage of species extirpated in Appalachian streams as the EC increases. The 95% percentile protection EC criterion for these streams was determined to be 295 µS/cm.

The Canadian province of British Columbia has recently compiled a review of mining-related increases in sulphate concentrations in freshwaters (British Columbia Ministry of Environment 2013). The toxicological approach taken for this guideline derivation is broadly consistent with the ANZECC derivation approach and establishes a range of sulphate guideline values (GVs) for ecological protection which are related to water hardness – with the GVs increasing as water hardness increases. The British Columbia GVs are summarized in Table 4. Assuming the Mare Burn waters are in the 'very soft' category the sulphate guideline would be 128 mg/L. This GV is 7.8x lower than the existing (MB01) and proposed (MB02) guidelines based on stock watering (Table 3). Water hardness information for Mare Burn would be required to refine the application of these GVs to the local receiving waters.

Table 4. British Columbia Ministry of Environment sulphate toxicity guidelines (British Columbia Ministry of Environment 2013)

Table 6. Sulphate water quality guidelines (mg/L) based on water hardness (mg/L) categories.

Water hardness* (mg/L)	Sulphate guideline (mg/L)
Very Soft (0-30)	128
Soft to moderately soft (31-75)	218
Moderately soft/hard to hard (76-180)	309
Very hard (181-250)	429
>250	Need to determine based on site water**

*Water hardness categories adapted from the CCME.

** Toxicity tests on the early stage rainbow trout were only conducted up to a water hardness of 250 mg/L. Natural background concentrations of water hardness in BC are generally much lower than 250 mg/L. It is recommended that additional toxicity testing on several species is required if natural background water hardness is greater than 250 mg/L. Organisms exposed to higher concentrations of water hardness in combination with sulphate may experience osmotic stress.

Sediments

The management approach for silt and sediments is outlined in an Erosion and Sediment Control Report (Engineering Geology 2016). This outlines the general approaches to be used in the catchments and states that the "*Existing erosion and sediment control practices have worked well and so similar practices are proposed for the Coronation North Project.*" (p10). The details of an erosion and sediment control plan (ESCP) are proposed to be developed once the consents are granted (p2).

This report provides no monitoring data to support the statement that the existing management procedures have worked well. No information is provided as to whether chemical dosing for sediment floccing is used in the current practice. Neither is there any background information on clarity in the receiving environment.

The report does identify that the highest risk for sediment loss is in the initial construction period (p9). On this basis it may be desirable to have continuous turbidity monitoring installed at site MB02 during the construction phase and some adaptive management practice linked to the turbidity monitoring data.

Receiving water dilution

The dilution available in upper Mare Burn and below the proposed Coal Creek freshwater dam is not provided. It would be useful to have flow hydrographs for: (i) downstream of Maori Hen Creek at site MB01; (ii) natural flows downstream of Coal Creek (site MB02); (ii) proposed augmented flows downstream of Coal Creek. This information would show seasonal variation in expected flows and should be supplemented with a time-series plot of the pit water dilutions at MB01 and MB02, together with predicted concentration plots relative to appropriate ecological protection guidelines (e.g., Table 3).

Coal Creek freshwater dam discharge

My understanding is that a 30 m high dam will be constructed on Coal Creek to supplement the downstream flows in Mare Burn. Based on a visual evaluation of the contours in this catchment I would expect that this dam is highly likely to stratify and potentially deoxygenate its hypolimnetic water. Should this occur there is potential for deoxygenation to occur resulting in: (i) adverse downstream effects relating to reduced dissolved oxygen; (ii) potentially toxicity from elevated hydrogen sulphide; (iii) potential toxicity from elevated ammonia; (iv) release of dissolved iron and manganese which will potentially settle as flocs downstream. Algal blooms may be possible in the dam should nutrient concentrations be sufficiently elevated – however, I would anticipate that nutrient concentrations should be low in this catchment.

A comprehensive assessment and prediction of the likely downstream water quality should be provided. This should include a consideration of DO conditions relative to the NPS-FW standards.

Overview

A summary of key issues which I consider should be addressed to provide further information for water quality evaluation is provided in Table 5.

Summary

I acknowledge that existing water quality conditions exist at monitoring site MB01, however, I consider that the suite of compliance parameters is insufficient relative to the expected COPCs. Therefore, I would recommend that a more comprehensive suite of parameters should be in place for the more downstream monitoring site (MB02) and that the compliance criteria for those sites should provide an adequate level of ecological protection for the receiving water in the downstream Mare Burn. The selection of appropriate thresholds for such guidelines will be dependent on the level of biodiversity and presence of rare and endangered species in the lower catchment. I have not reviewed any information in the biological assessments and cannot provide further guidance at this time on the appropriate guideline levels.

Figure 1.

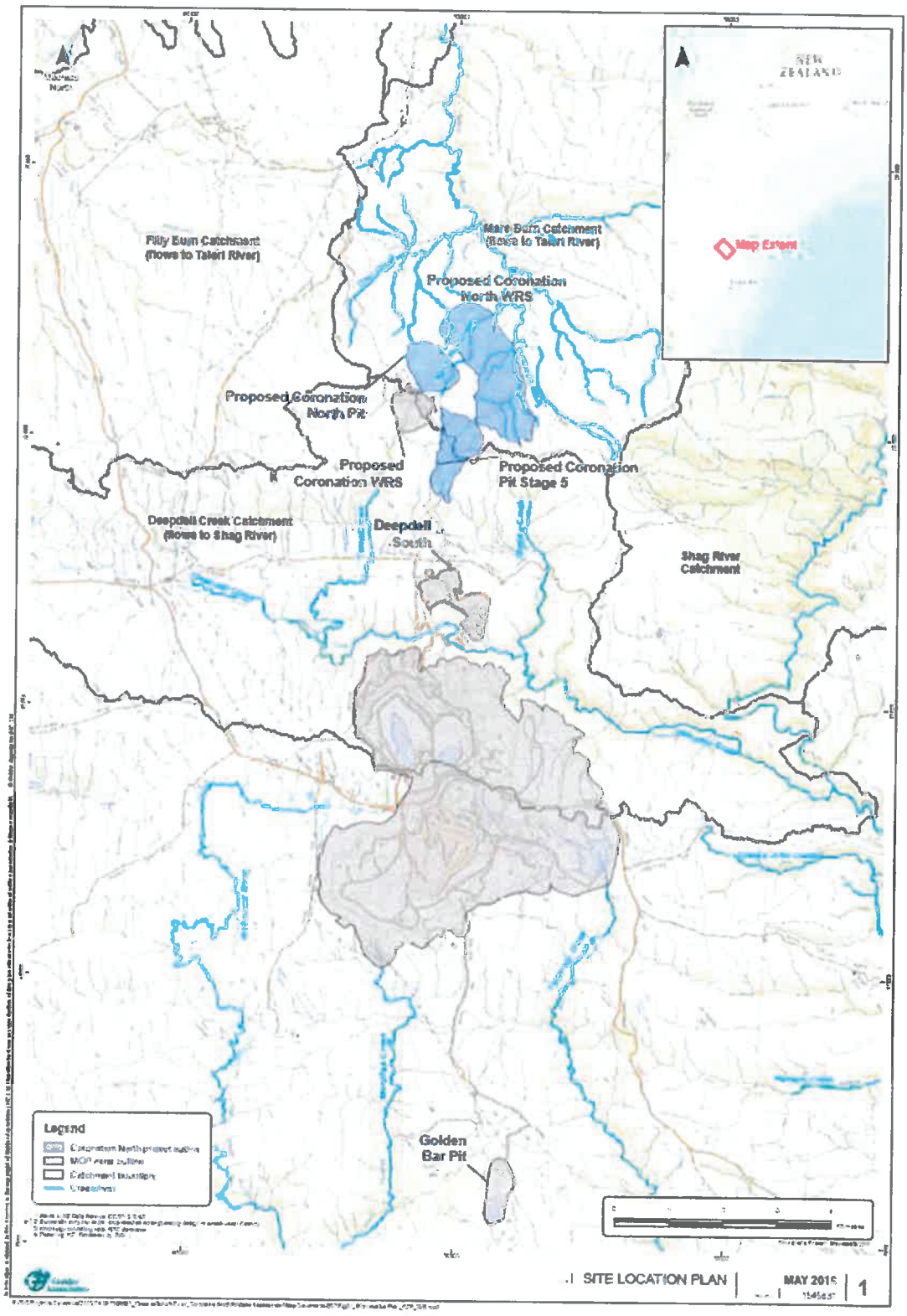

Filly Burn Catchment
(flows to Taieri River)
Mare Burn Catchment
(flows to Taieri River)
Proposed Coronation
North WRS
Proposed Coronation
North Pit
Proposed
Coronation WRS
Proposed Coronation
Pit Stage 5
Deepdell Creek Catchment
(flows to Shag River)
Deepdell
South
Shag River
Catchment
Golden
Bar Pit
Legend
SITE LOCATION PLAN
MAY 2016
1

Figure 2.

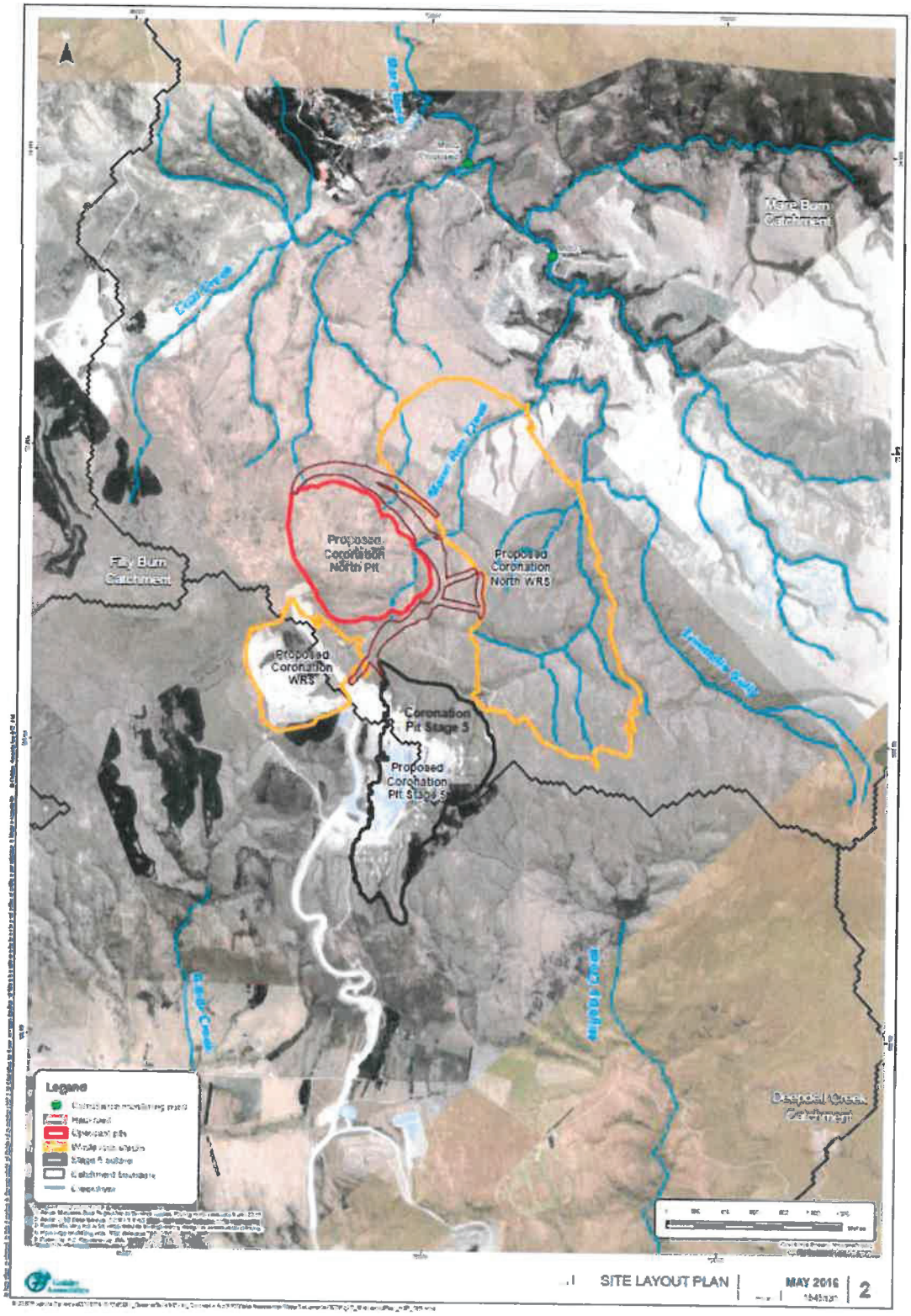
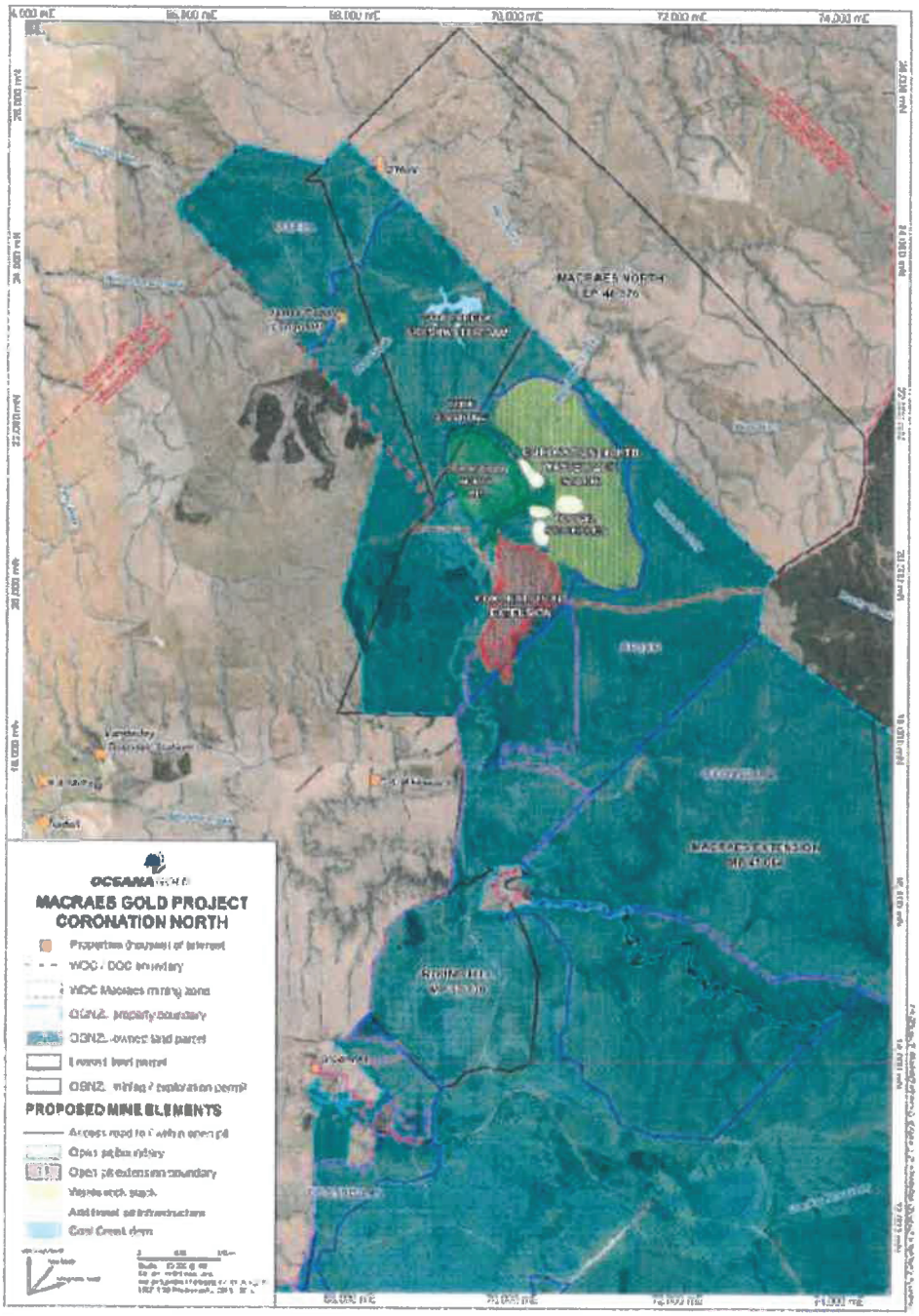

Kare Burn Catchment
Fly Burn Catchment
Proposed Coronation North Pit
Proposed Coronation North WRS
Proposed Coronation WRS
Coronation Pit Stage 3
Proposed Coronation Pit Stage 5
Deepdale Creek Catchment
Legend
SITE LAYOUT PLAN
MAY 2016
2

Figure 3.

Figure 4–1 Coronation North Project Base Map



References

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Table 5. Summary of issue for further information requests

Item	Issue	Information requested	Comment
1	Background water quality	Provide background monitoring information on Mare Burn clarity (i.e., turbidity, suspended sediments, black disk clarity) to provide base flow and flood conditions.	Background information on the receiving water clarity is required to establish compliance conditions.
2	Background water quality	Provide background monitoring information on Mare Burn nutrient (nitrogen and phosphorus) concentrations under base flow and flood conditions.	Background nutrient data is required to assess likelihood of periphyton blooms.
3	Background water quality	Provide background monitoring information on Mare Burn electrical conductivity and sulphate concentrations under base flow and flood conditions.	Background EC data is required to assess likelihood of toxicity criteria exceedance based on anticipated add to background compliance conditions.
4	Compliance	Provide an indication on the likelihood of compliance with potential ecological compliance conditions under base flow and flood-flow conditions. Will multiple compliance criteria be exceeded under specific circumstances and if so for what duration? Note that a cumulative exceedance plot is not sufficient for this analysis as it does not distinguish between large numbers of multiple exceedances and fewer long-duration (i.e., chronic) exceedances.	This is to establish the likelihood of multiple stressors resulting in cumulative adverse effects on downstream communities.
5	Freshwater dam	Provide an assessment of whether the proposed Coal Creek freshwater dam will stratify and the likely period of seasonal stratification.	Based on the proposed depth of the dam (30 m) it is anticipated that prolonged seasonal stratification will occur.
6	Freshwater dam	Provide an assessment of whether the proposed Coal Creek freshwater dam will deoxygenate and, if so, whether it will result in elevated iron, manganese, ammonia or sulphide concentrations.	Information on predicted COPCs should stratification occur.
7	Freshwater dam	If the proposed Coal Creek freshwater dam will deoxygenates, provide predictions of concentrations of contaminants downstream at MB02 in Mare Burn.	Prediction information of downstream concentrations for COPCs.
8	Freshwater dam	If the proposed Coal Creek freshwater dam will deoxygenates, provide predictions of dissolved oxygen at site MB02 ad a compliance assessment with NPS-FM standards for DO.	NPS-FM standards assessment.
9	Freshwater dam	If the proposed Coal Creek freshwater dam deoxygenates, will mitigation measures, such as aeration be used to destratify and ensure aeration above critical thresholds?	Mitigation and management responses.
10	Guidelines	Provide ecological protection guidelines suitable for application to compliance monitoring site MB02	A comprehensive suite of parameters and guidelines for ecological compliance is provided in Table 3 of this report.
11	Guidelines	Provide an updated assessment of compliance with the ecological guidelines at site MB02	This should repeat modelling work as provided in Appendix A (Golder Associates 2016) for an extended suite of parameters.
12	Guidelines	Provide information on predicted suspended sediment and turbidity levels in pit lake and at downstream compliance sites	No information is currently provided either for existing pit lakes (e.g., Fraser Pit) or for receiving water background concentrations.
13	Guidelines	Provide an updated assessment of compliance with the NPS_FW standards for nitrate and ammoniacal-N at site MB02. This assessment should include an add to background approach to establish predicted concentrations downstream of the monitoring site.	No information is currently provided for potential effects on receiving water standards for nitrate and ammonia toxicity.
14	Guidelines	Provide an assessment of the potential for elevated nutrient concentrations, wither from the pit lakes, waste rock storage or from the Coal Creek freshwater dam to result in increased downstream perihyton blooms.	No information provided on the likelihood or otherwise of nutrient stimulation of periphyton growths. Based on NPS-FM standards for attribute classes.
15	Guidelines	Provide a specific assessment of the likely compliance with the hardness-adjusted ecological protection guideline for sulphate at site MB02 both during operations and following mine closure. If significant exceedance of this sulphate guideline occurs then information on the distance downstream for a compliance point should be provided.	The proposed ecological compliance conditions for sulphate is markedly lower that the stock watering guideline currently used. Given the predicted concentrations the ecological guideline will be exceeded for long periods. Information on the downstream distance for compliance or treatment measures should be provided.
16	Guidelines	If pit discharge and waste rock discharges are likely to result in dissolved arsenic concentrations comparable with those in the Frasers Pit (Golder Associates 2016, Appendix A, Table A3) then speciation information for arsenic should be provided.	Elevated arsenic concentrations will require consideration of total and dissolved arsenic and speciation. Site-specific arsenic guidelines may require toxicity testing of locally relevant species should potential arsenic toxicity be identified as a significant issue.
17	Guidelines	Provide information on the water hardness in Mare Burn suitable for use in applying hardness-adjusted metal and sulphate toxicity guidelines.	Information required to establish site-specific compliance conditions for metal and sulphate.
18	Hydrology	Provide flow hydrographs for: (i) site MB01; (ii) MB02 (existing); and (iii) MB03 after freshwater dam inflows.	Information to assist in establishing the seasonal variability in flow and duration of intermittent flow at MB01. Provides basis for wastewater dilution calculations.
19	Hydrology	Provide predicted wastewater dilutions for the above monitoring sites.	Information on available dilutions indicated likely exceedance risk for contaminants exceeding acute or chronic guidelines.

20	Management	Provide information on proposed chemical dosing and general management for sediments (e.g., first flush management, treatment ponds).	This anticipates that suspended sediment concentrations and associated turbidity may be significantly elevated relevant in receiving waters. As such, some treatment systems will be required to meet anticipated receiving water compliance criteria - particularly during construction phase. Continuous turbidity monitoring at site MB02 and adaptive management relating to this data may be required.
21	Management	Provide further information on the seasonality of the "water deficit" for the stormwater management. Will this just be in summer or a whole year deficit?	Engineering Geology (2016) report a "water deficit" for the existing operation and that water is pumped from the Taieri River to provide additional process water.