Annexure 1:

Macraes Water Quality Management Plan

Macraes

Water Quality Management Plan

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Department	**Environment and Social Performance**
Location/Site	Macraes

Approval table

	Position title	Name	Date
Authored by	Environmental Advisor	Renee Tomsett	June 2023
Reviewed by	Environmental Advisor	Jessie Callaghan	April 2024
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A	Elza Lotter/Debbie Clarke	Initial Issue	14 October 2014
B	Jarrod Lindsay	WQMP 2015	02 June 2015
C	Debbie Clarke/Lauren Arnold	Review and update to include Coronation North	31 March 2017
D	Lauren Arnold	Review	10 April 2018
E	Charlotte Boyt	Review and update of contact personnel, Discharge sites, Surface and ground water collection infrastructure.	17 Sept 2018
F	Charlotte Boyt	Update the WQ Plan to include Deepdell North Stage III consents. Review and update of contact personnel.	27 Nov 2020
G	Renee Tomsett	Full review and update to include MTI, SP11 and TTTSF	30 May 2023
H	Caitlin Harris and Renee Tomsett	Review and update to include Golden Bar, Battery Creek Silt Pond, Māori Tommy Gully Silt Pond, and Northern Gully Silt Pond Consents	April 2024

Contents

1 PURPOSE

1.1 Background

This Water Quality Management Plan (WQMP) has been prepared pursuant to OceanaGold (New Zealand) Limited's (OceanaGold) resource consents allowing the development of the Frasers Waste Rock Stacks, Mixed and Southern Pit 11 Tailings Storage facilities, Top Tipperary Tailings Storage Facility, Coronation Project, Coronation North Project, Deepdell North Stage III project, Frasers West Pit Project and the Golden Point Underground. These consents require that a WQMP be prepared and submitted to the Otago Regional Council prior to the exercise of the consents and thereafter be reviewed annually and updated if necessary. Consents RM20.424.01, RM20.424.02 and RM20.424.03 for Battery Creek, Maori Tommy Gully and Northern Gully Silt Ponds, as well as the 2002 Golden Bar consents, do not specifically require a WQMP to be submitted but are included here for consistency.

The specific consent conditions requiring a WQMP are:

- RM10.351.08 condition 9, RM10.351.10 condition 8 and RM10.351.11 condition 6 (Frasers West Waste Rock Stack);
- RM10.351.13 condition 8, RM10.351.16 V3 condition 11, RM10.351.17 V3 condition 11, RM10.351.20 condition 4 and RM10.351.23 condition 7 (Top Tipperary Tailings Storage Facility);
- RM12.378.02 condition 6, RM12.378.04 condition 6, RM12.378.05 condition 3, RM12.378.13 condition 7 and RM12.378.14 condition 8 (Coronation Project); and
- RM16.138.04 V1 condition 3 and RM16.138.05 condition 7 (Coronation North Project).
- RM20.024.14 condition 5 (Deepdell North Stage III Project).
- RM2006.304 V2 condition 7a, and RM2006.305 V5 condition 9a (Mixed Tailings Impoundment)
- RM2006.307 V1 condition 7a and RM2006.308 V4 condition 9a (Southern Pit 11)
- RM20.130.02 condition 8 (Golden Point Underground)
- RM20.167.03 conditions 6 & 7 (Frasers West Pit Project)

The WQMP outlines the monitoring requirements and methods, which will be applied to ensure that water quality associated with the Macraes Gold Project's operations meet the compliance parameters during mining operations and post-closure as set out in the Compliance and Monitoring Schedules attached to the resource consents.

The WQMP includes information on the following:

- Details of surface water and groundwater quality monitoring for the Frasers Waste Rock Stack, Top Tipperary Tailings Storage Facility, the Coronation Project, Coronation North Project, Deepdell North Stage III Project, Mixed Tailings Impoundment, Southern Pit 11

Impoundment, Golden Point Underground, Frasers West Pit Project, Golden Bar and other site silt ponds;

- The location, frequency and parameters measured;
- Identification of monitoring results that would trigger the requirement for a comprehensive review of water quality to determine whether additional mitigation measures should be adopted to ensure appropriate surface water and groundwater quality;
- A description of mitigation measures implemented or available during the mine operational period;
- A description of mitigation measures implemented or available post mine closure;
- A timeline detailing when it is anticipated that mitigation measures may be required and an indication of implementation timelines; and
- For the Coronation North Project, a description of how suspended sediment will be monitored using both the total suspended solids and Nephelometric Turbidity Unit parameters. Limits for both these parameters are now included in the WQMP as a requirement of RM16.138.04 V1 (discharge from Coronation Silt ponds), which has now been exercised.

The WQMP is intended to be a working document and as such information included is required to be reviewed annually. Details of the review will be forwarded to the Otago Regional Council (ORC) as part of the Project Overview and Annual Work and Rehabilitation Plan (AWRP). The ORC must be provided with any updates of the WQMP within 1 month of the update(s) occurring.

The following reports support this WQMP:

- URS New Zealand Ltd, May 2013: Coronation Project Water Management – Water Balance and Sulphate Modelling;
- Engineering Geology Ltd, April 2013: Coronation Project Erosion and Sediment Control;
- Macraes Phase III Project Water Quality Effects Mitigation Options, April 2011 (Golder Associates);
- Macraes Phase III Project Water Management Summary Report, April 2011 (Golder Associates);
- Coronation North Project Water Quality Mitigation – Fresh Water Dam Scenario, April 2016 (Golder Associates;
- Coronation North Project Surface Water Modelling, May 2016;
- Coronation North Project Groundwater Assessment, May 2016;

- Oceana Gold (NZ) Ltd, Erosion and Sediment Control Plan, February 2017;
- Deepdell North Stage III Consenting Project, Hydrology and Water Quality Assessment, June 2018 (AECOM);
- Frasers West Pit Effects on Receiving Water Quality, May 2020 (Wallbridge Gilbert Aztec);
- Golden Point Underground Mine Groundwater Assessment, April 2020 (Wallbridge Gilbert Aztec).

1.2 Objectives

The objectives of the WQMP are to:

- Describe current and proposed water quality management methods and procedures;
- Enable OceanaGold to operate in full compliance with resource consent requirements; and
- Describe the surface and groundwater quality monitoring regime and reporting of results.

2 BACKGROUND

2.1 Description of Activity

The Macraes Operation is located approximately 25km west of Palmerston in the Otago region. The site is approximately 1-2km east of Macraes village and is predominately surrounded by farmland. Vegetation in the area is largely a mixture of rough pasture and tussock. Elevation ranges from 380m within the Mare Burn gorge, 500m to 600m in the Frasers and Innes Mills pit areas and up to 820m in the west at Highlay Hill. The climate is semi-arid with a mean rainfall of 630mm per year and regular snowfalls during winter. The mine site occupies an area of land of approximately 1,500 hectares.

The key features of the existing mining operation relevant to the WQMP are;

- Open pits;
- Two underground mines;
- Waste rock stacks;
- An ore processing plant;
- Haul roads; and
- Tailings storage facilities.

2.1.1 Macraes Phase III

The main features of the MPIII Project (Figure 2.1) relating to the WQMP are:

- The Top Tipperary Tailings Storage Facility (TTTSF) constructed in the upper Tipperary catchment basin. The facility provides an additional 51Mt of total consented tailings storage capacity, and the construction of the embankment is ongoing;
- Frasers East and Frasers West Rock Stacks are linked by a rock stack called Frasers South Rock Stack and an extension added to the north of Frasers East Rock Stack called Frasers North Rock Stack;
- Macraes-Dunback Road has been realigned from near Hocking Road following the legal (but unformed) Macraes Back Road alignment north before turning west to run along the divide between the Deepdell and Tipperary catchments and re-joining the current alignment adjacent to Innes Mills Pit;
- Golden Bar Road has been realigned for the last 2.5km before re-joining Macraes-Dunback Road;
- New development of the Golden Point Underground Mine;
- Surface water on the expanded mining infrastructure will be managed with diversions and new silt control dams as necessary; and
- Expansion of Frasers and Innes Mills Pits.

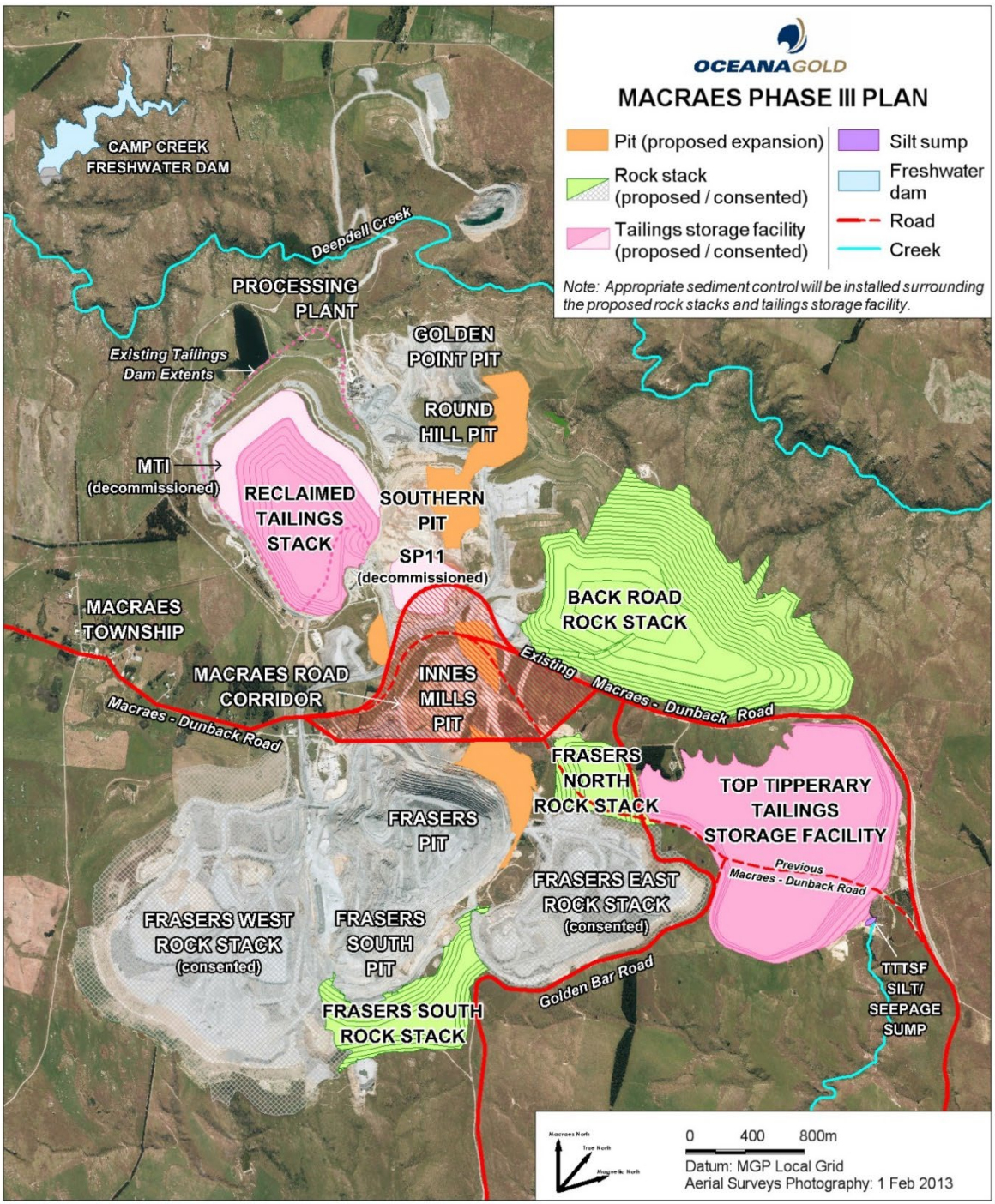

Figure 2.1: Consented Macraes Phase III features

2.1.2 Coronation Project Features

The key features of the Coronation Project that are relevant to the WQMP are:

- The Project is located on the ridgeline to the north of Horse Flat Road along the Shag River and Taieri River catchment divide and is situated between Sister Peaks and Highlay Hill;
- Waterways include the upper reaches of Camp Creek (Shag catchment), Maori Hen Creek and Trimbells Gully Creek (feeding the Mare Burn, part of the Taieri catchment);
- Coronation open pit. Upon closure Coronation Pit Lake will be formed;
- Coronation Waste Rock Stack. The WRS will be shaped to blend into the surrounding landscape and progressively rehabilitated;
- Ore from the Coronation Pit is hauled to the Macraes Processing Plant via a haul road from the pit to Horse Flat Road and then via the haul road extension along Golden Point Road alignment;
- Surface water runoff around the pit, waste rock stack and haul road will be managed with diversion drains and silt control ponds located in gullies downstream of disturbed areas.
- Sediment control is installed prior to any disturbance within each catchment area. Upon closure silt control ponds will be decommissioned and may become stock water ponds;
- Surface water and groundwater collected in the pit during rain events will be pumped out to a water sump adjacent to the pit. Water from this sump will be used for dust control and surplus water will be discharged via the closest silt pond; and
- Mining of the Coronation Pit was completed in 2021. There are currently no ongoing mining activities in the Coronation Project area.
- Mining of the Deepdell Pit was completed in 2023. There is currently no mining activity in the Deepdell area.

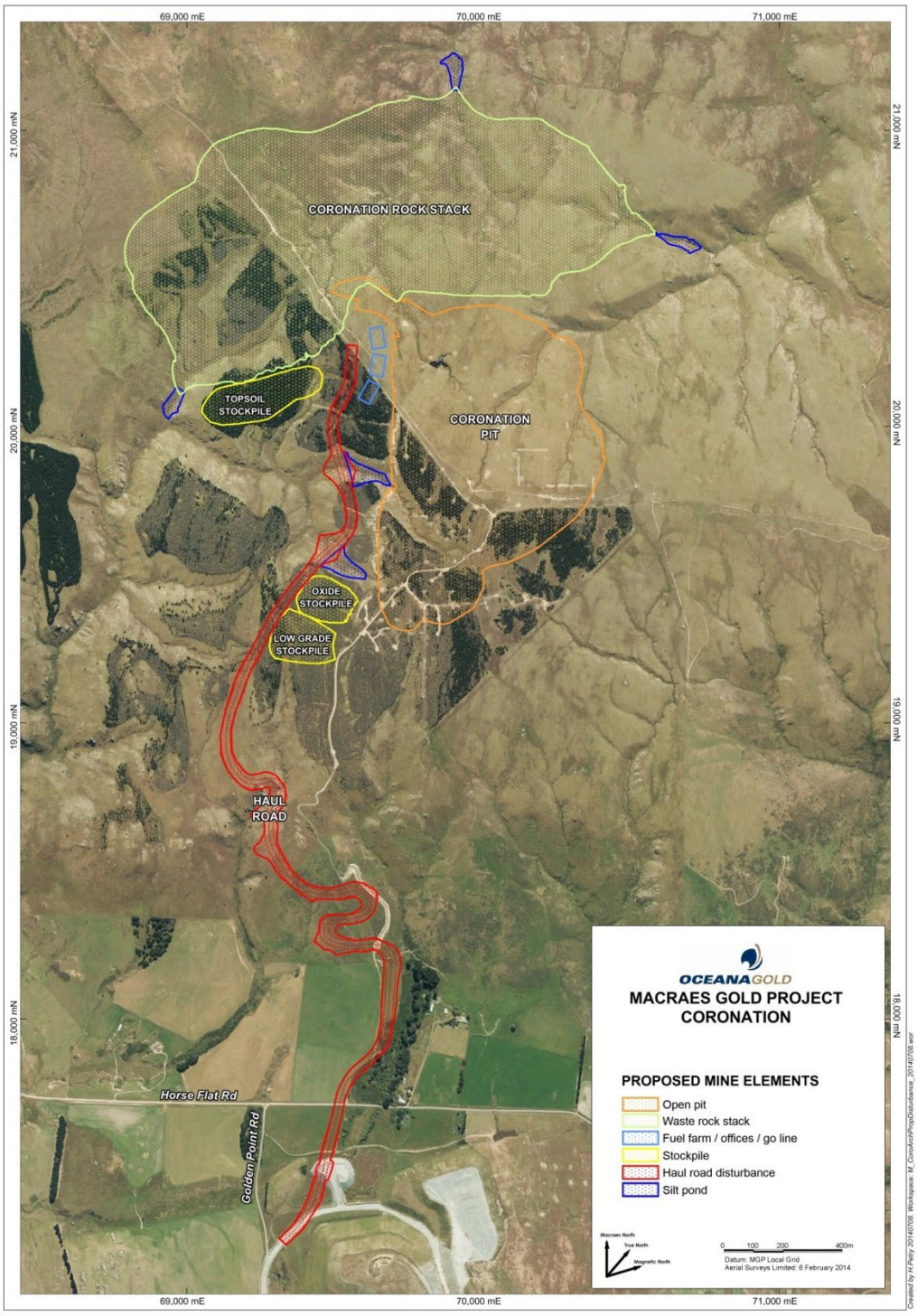

Figure 2.2: Consented Coronation Mine Elements

2.1.3 Coronation North Project Elements

The main features of the Coronation North Project relevant to the WQMP are:

- The project is situated in the Taieri River catchment between Sister Peaks and Highlay Hill. Waterways within the project area are Coal Creek, Maori Hen Creek, Trimbells Gully and the Mare Burn;
- Extension of Coronation Pit from a total area of about 62 hectares to about 85 hectares;
- A new Coronation North Pit with a maximum area of about 63 hectares. Upon closure Coronation North Pit lake will be formed;
- A new Coronation North Waste Rock Stack;
- An extension of Coronation Haul Road 2km to the north;
- A proposed freshwater dam within Coal Creek catchment. This dam will provide a constant water supply downstream to supplement naturally occurring low flows in Coal Creek and Mare Burn for water quality purposes; and
- All seepage from Coronation North Waste Rock Stack and any overflow from the Coronation Pit lake will report to the Mare Burn catchment, a tributary of the Taieri River.

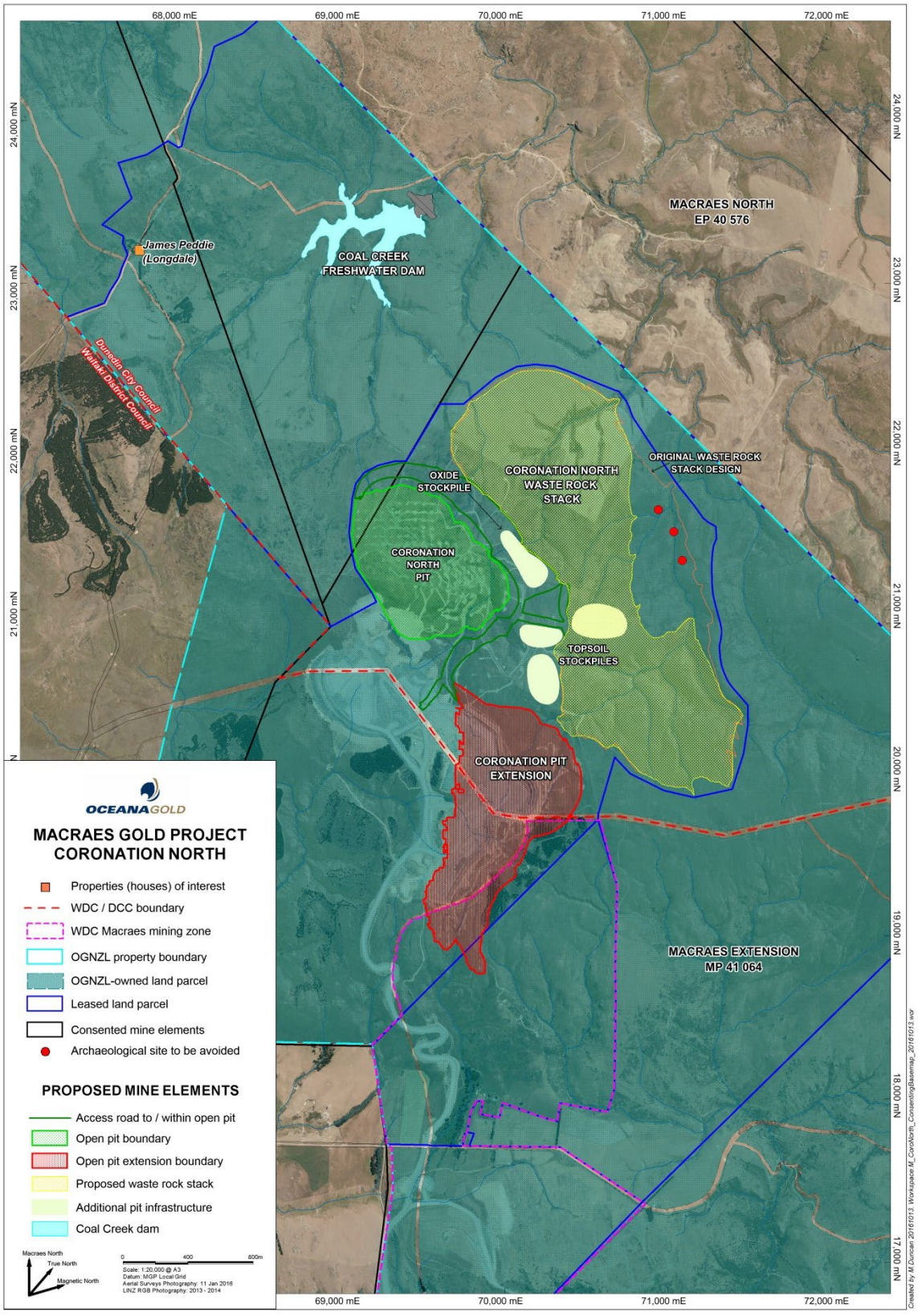

Figure 2.3. Consented Coronation North Mine Elements

2.1.4 Deepdell North Stage III Elements

The main features of the Deepdell North Stage III relevant to the WQMP are:

- The project is situated in the Deepdell North Stage III Project, Macraes approximately 700 metres east of the intersection of Horse Flat Road and Golden Point Road;
- Deepdell North Stage III backfill of the exiting Deepdell South Pit (13.2ha)
- A new Deepdell North Stage III Waste Rock Stack;
- An extension of Haul roads 30m wide all the roads within pit footprint only.

2.1.5 Mixed Tailings Impoundment (MTI)

- Mixed tailings impoundment embankment was raised to RL548m in April 2013
- Surface partially rehabilitated
- No tailings currently being deposited to this site

2.1.6 Southern Pit 11

- Tailings storage facility, embankment to construction to 544RL completed in May 2011
- No further embankment construction since
- Partially rehabilitated
- Dry mining of tailings scheduled to commence February 2024 as part of eventual removal of Southern Pit 11
- No tailings currently being deposited to this site

2.1.7 Frasers West Pit Project

The main features of the Frasers West Pit Project relevant to the WQMP are:

- The pit project and associated waste rock stacks are located within the surface water catchment of the existing Frasers Pit
- New access roads will be constructed within the current disturbed footprint
- Pit will eventually be backfilled

2.1.8 Golden Point Underground (GPUG)

The main features of the Golden Point Underground relevant to the WQMP are:

- The portal was cut in December 2021
- LOM currently runs until January 2028
- Further drilling ongoing
- Construction of Golden Point Underground Waste Rock Stacks

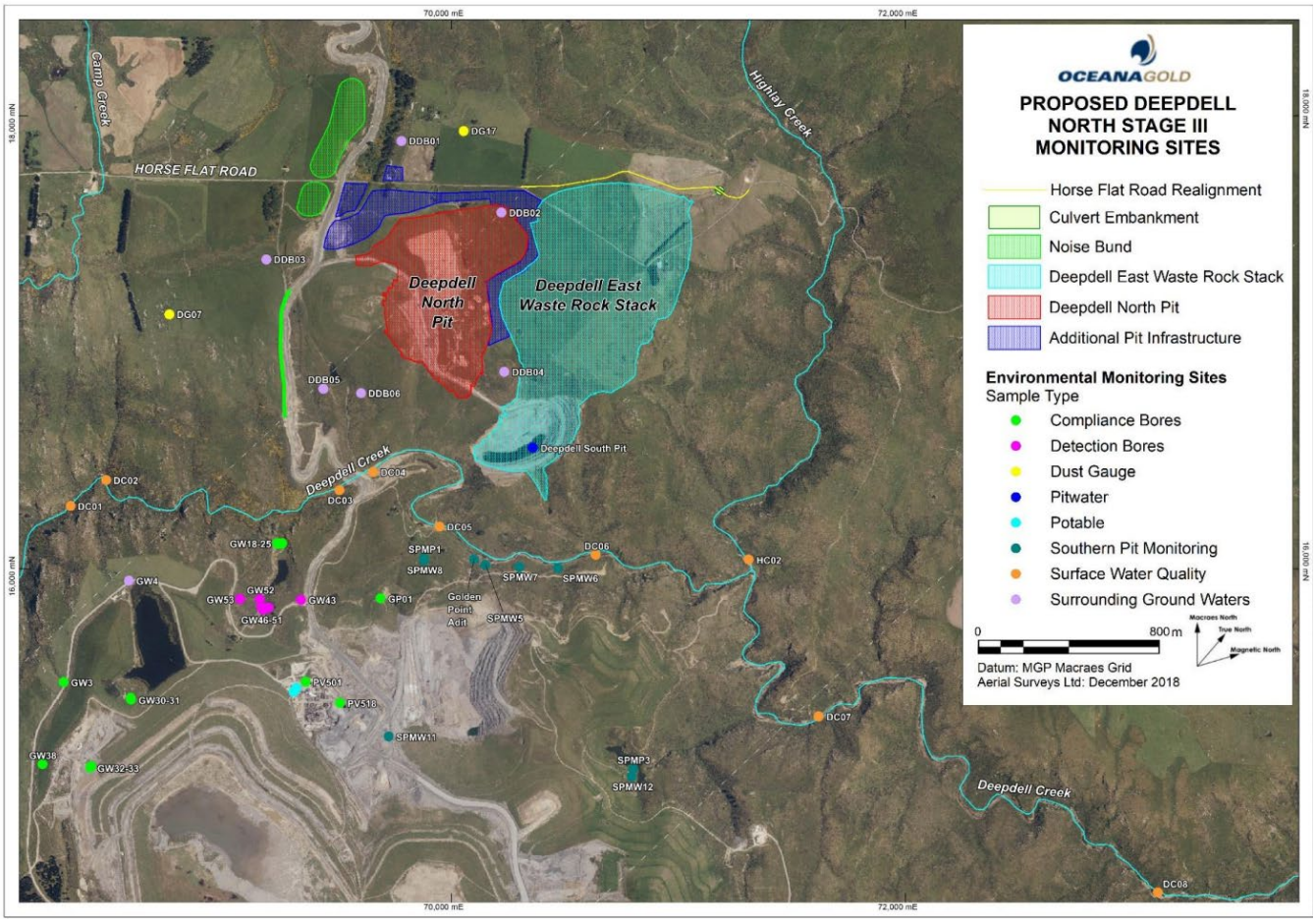

Figure 2.4. Consented Deepdell North Stage III Mine Elements

3 SURFACE WATER MONITORING

3.1 Top Tipperary Tailings Storage Facility Surface Water Monitoring

OceanaGold currently holds Discharge Permits RM10.351.16 V3 and RM10.351.17 V3 covering discharge of mine tailings and contaminants from mine tailings to land and water, respectively, for the purpose of disposing of mine process tailings in the Top Tipperary Tailings Storage Facility (part of the Macraes Phase III Expansion Project).

Water quality details relating to the management of sediment (pursuant to Discharge Permit Consents numbered RM10.351.13, RM10.351.20 and RM10.351.23) are contained in the Oceana Gold (NZ) Ltd, Erosion and Sediment Control Plan (ESCP).

Under the Compliance and Monitoring Schedule attached to Discharge Permits RM10.351.16 V3 and RM10.351.17 V3, the following surface water monitoring is required:

Monthly representative water samples from the following surface water sites:

- Shag River Compliance Point 2 (“Shag River at McCormicks”);
- Tipperary Creek (“TC01”); and
- Cranky Jims Creek (“CJ01”).

The location of each site is shown on Figure 3.1. All surface water sites shall be sampled on the same day. Samples shall be analysed at monthly intervals for the parameters listed in Table 1.

Table 3.1: Top Tipperary Tailings Storage Facility Surface Water Monitoring Parameters

Constituent	Monthly
Major cations:	
calcium	✓
magnesium	✓
potassium	✓
sodium	✓
Major anions:	
bicarbonate	✓
carbonate	✓
chloride	✓
sulphate	✓
pH	✓
Conductivity	✓
Arsenic	✓
Copper	✓
Iron	✓
Lead	✓
Zn	✓
Cyanide(WAD)	✓

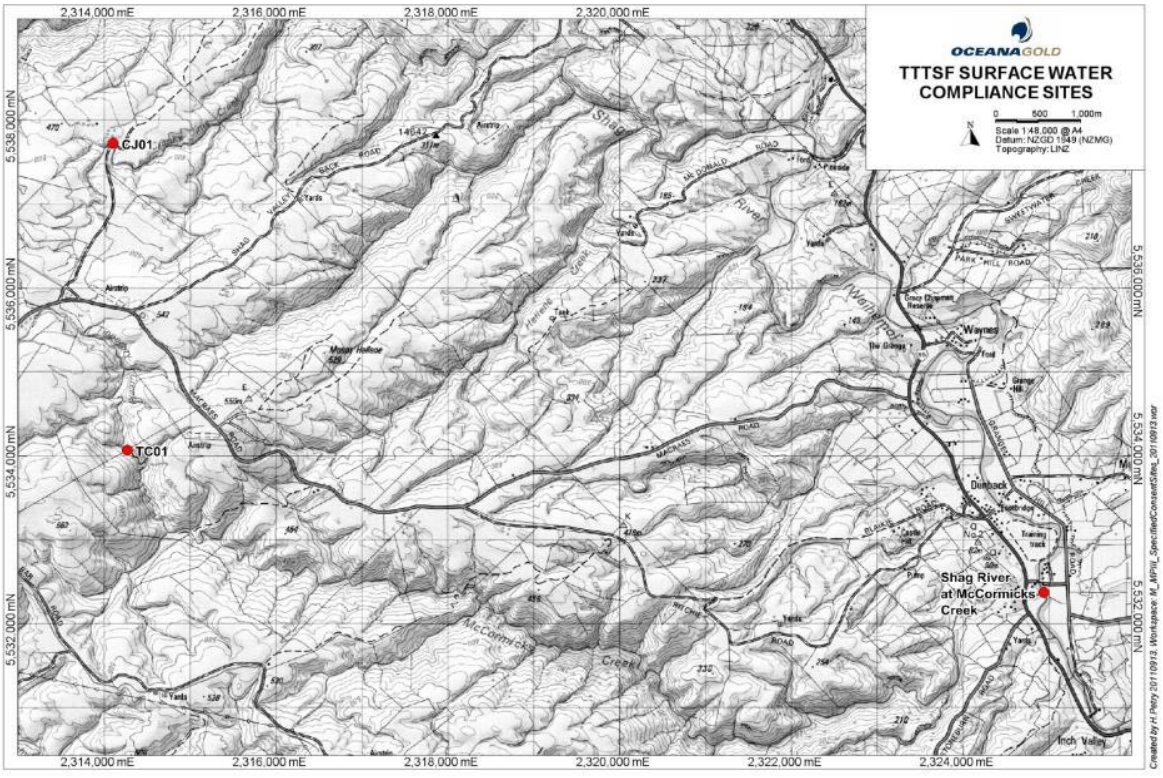

Figure 3.1: TTTSF Surface Water Quality Monitoring Sites

3.2 Frasers Waste Rock Stack Monitoring

OceanaGold currently holds the following consents in relation to the WQMP and Frasers Waste Rock Stack:

- Water Permit 96808 V3. To dam a tributary of the North Branch Waikouaiti River for the purpose of sediment control associated with surface water runoff from land disturbed by mining operations, post mining rehabilitation, and waste rock stacks in the vicinity of Macraes Flat;
- Water Permit 2004.359 V1. To dam Murphys Creek for the purpose of sediment control that is associated with surface water runoff from waste rock stacks and land disturbed by mining operations and post mine rehabilitation activities;
- Discharge Permit RM10.351.09 V1. To discharge waste rock and contaminants from waste rock to and for the purpose of extending the Frasers Waste Rock Stack (part of the Macraes Phase III Expansion Project);
- Discharge Permit RM10.351.10 V1. To discharge contaminants to water from the base and toe of the Frasers Waste Rock Stack for the purpose of waste rock disposal; and
- Discharge Permit RM10.351.11. To discharge water from silt ponds to tributaries of the North Branch of the Waikouaiti River and Murphys Creek for the purpose of operating silt ponds associated with the Frasers Waste Rock Stack.

Water quality details relating to the management of sediment (pursuant to Discharge Permit Consents numbered RM10.351.08, RM10.351.11 and RM10.351.12 are contained in the Oceana Gold (NZ) Ltd, Erosion and Sediment Control Plan (ESCP).

Under the Compliance and Monitoring Schedule attached to Discharge Permits RM10.351.10 V1 and RM10.351.11, the following surface water monitoring is required:

Monthly representative water samples from the following surface water sites:

- Frasers East Sump;
- North Branch Waikouaiti River Compliance Point 1 (“NBWRRF”);
- North Branch Waikouaiti River Compliance Point 2 (“NB03”); and
- Murphys Creek (“MC01”).

The location of each site is shown on Figure 3.2. All surface water sites shall be sampled on the same day. Samples shall be analysed at monthly intervals for the parameters listed in Table 2.

Table 3.2: Frasers Waste Rock Stack Surface Water Monitoring Parameters

Constituent	Monthly
Major cations:	
calcium	✓
magnesium	✓
potassium	✓
sodium	✓
Major anions:	
bicarbonate	✓
carbonate	✓
chloride	✓
sulphate	✓
pH	✓
Conductivity	✓
Arsenic	✓
Copper	✓
Iron	✓
Lead	✓
Zn	✓
Cyanide$_{(WAD)}$	✓

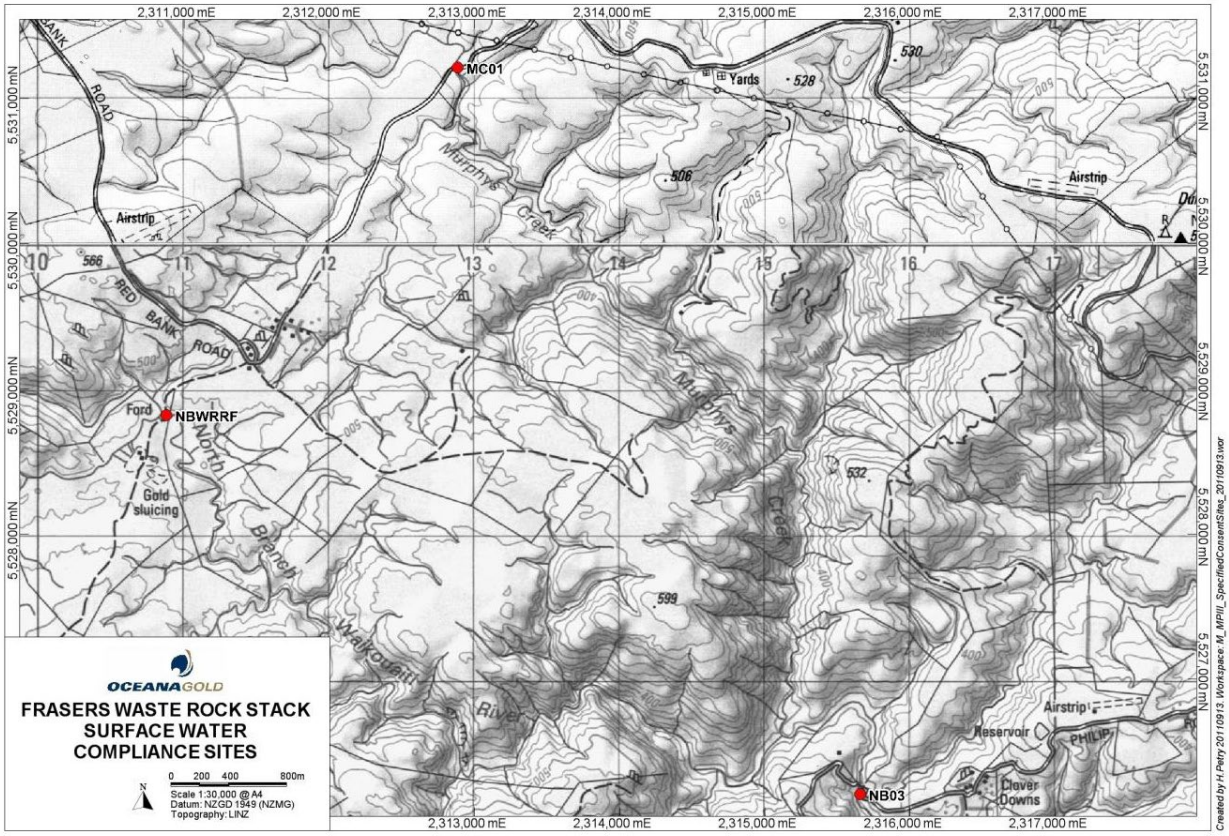

Figure 3.2: Surface Water Quality Compliance Monitoring Sites for Frasers Waste Rock Stack

3.3 Coronation Surface Monitoring

OceanaGold currently holds Discharge Consents RM12.378.02, RM12.378.04, RM12.378.05, and RM12.378.13 covering discharge of water and contaminants from silt ponds, pit dewatering and pit lake operation to unnamed tributaries of Maori Hen Creek, Trimbells Gully, Mare Burn and Camp Creek.

Management of sediment is detailed in the Oceana Gold (NZ) Ltd, Erosion and Sediment Control Plan (ESCP).

Under the Compliance and Monitoring Schedule attached to Discharge Permits RM12.378.04 and RM12.378.05, the following surface water monitoring is required:

Monthly representative water samples from the following surface water sites:

- Mare Burn Compliance Point (MB01);
- Deepdell Creek Compliance Point ("DC08"); and
- Shag River Compliance Point 1 ("Shag @ Loop")

The location of each site is shown on Figure 3.3. All surface water sites shall be sampled on the same day. Samples shall be analysed at monthly intervals for the parameters listed in Table 3.

Table 1.3: Coronation Surface Water Monitoring Parameters

Constituent	Monthly
Major cations:	
Calcium	✓
Magnesium	✓
Potassium	✓
Sodium	✓
Major anions:	
Bicarbonate	✓
Carbonate	✓
Chloride	✓
Sulphate	✓
pH	✓
Conductivity	✓
Arsenic	✓
Copper	✓
Iron	✓
Lead	✓
Zn	✓
Cyanide (WAD)	✓

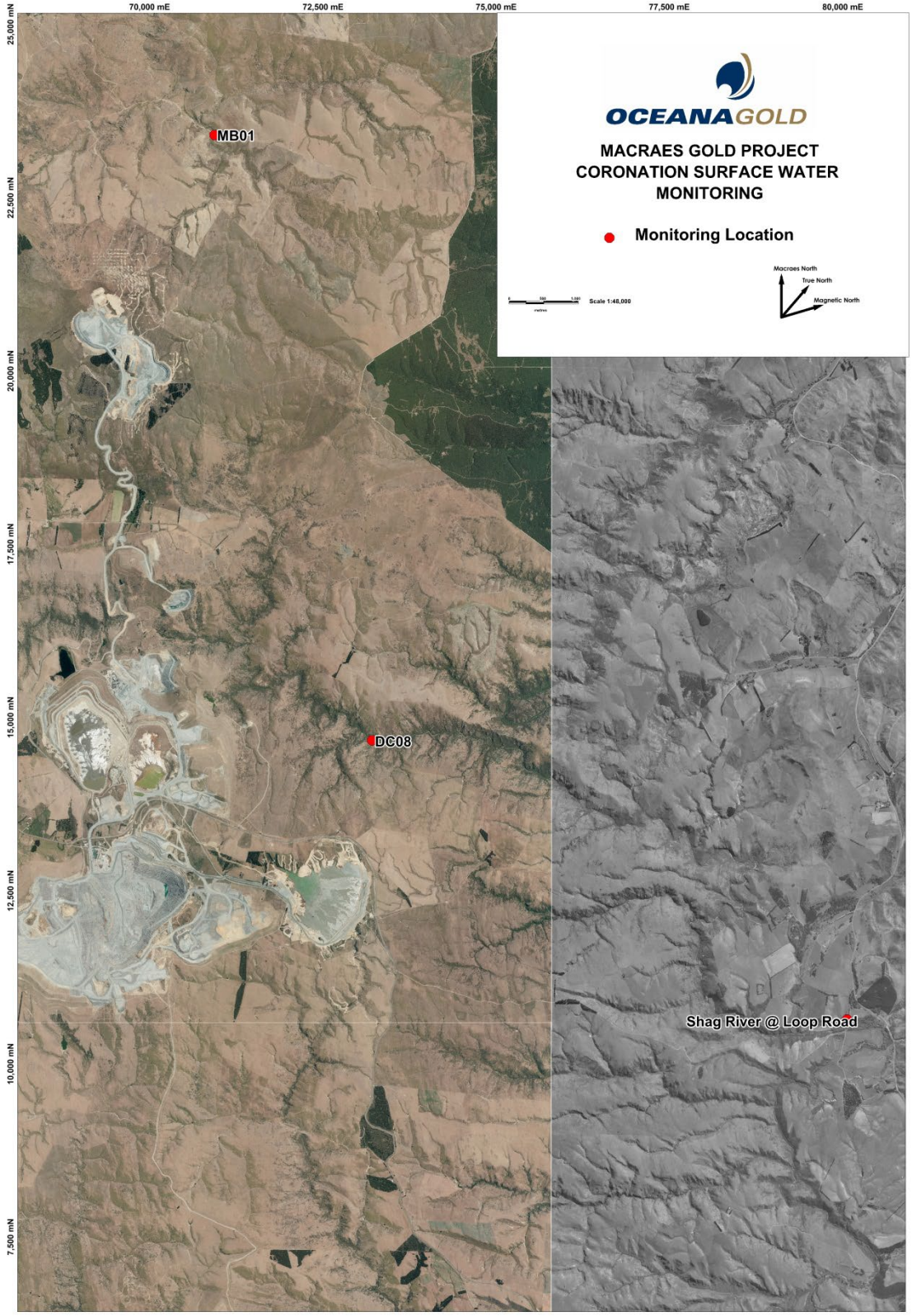

Figure 3.3: Surface Water Quality Compliance Monitoring Sites for Coronation

3.4 Coronation North Surface Water Monitoring

OceanaGold currently holds Discharge Permit RM16.138.04, RM16.138.05 and RM16.138.06 covering discharge of water and contaminants from silt ponds, pit lake operation and waste rock and Discharge RM16.138.08 covering the discharge of water from the Coal Creek Freshwater Dam to Coal Creek.

Management of sediment (pursuant to Discharge Permits RM16.138.03 and RM16.138.07) is detailed in the Oceana Gold (NZ) Ltd, Erosion and Sediment Control Plan (ESCP).

Under the Compliance and Monitoring Schedule attached to RM16.138.04, RM16.138.05 and RM16.138.09, the following surface water monitoring is required:

Monthly representative water samples from the following surface water sites:

- Mare Burn Compliance Point MB01
- Mare Burn Compliance Point MB02
- Coal Creek Monitoring Point CCMP01

The location of each site is shown on Figure 3.4. All surface water sites shall be sampled on the same day. Samples shall be analysed at monthly intervals for the parameters listed in Table 4.

Table 3.4: Coronation North Surface Water Monitoring Parameters

Constituent	Monthly
Major cations:	
Calcium	✓
Magnesium	✓
Potassium	✓
Sodium	✓
Major anions:	
Bicarbonate	✓
Carbonate	✓
Chloride	✓
Sulphate	✓
pH	✓
Conductivity	✓
Arsenic	✓
Copper	✓
Iron	✓
Lead	✓
Zn	✓
$Cyanide_{(WAD)}$	✓
Turbidity	✓
Suspended solids	✓

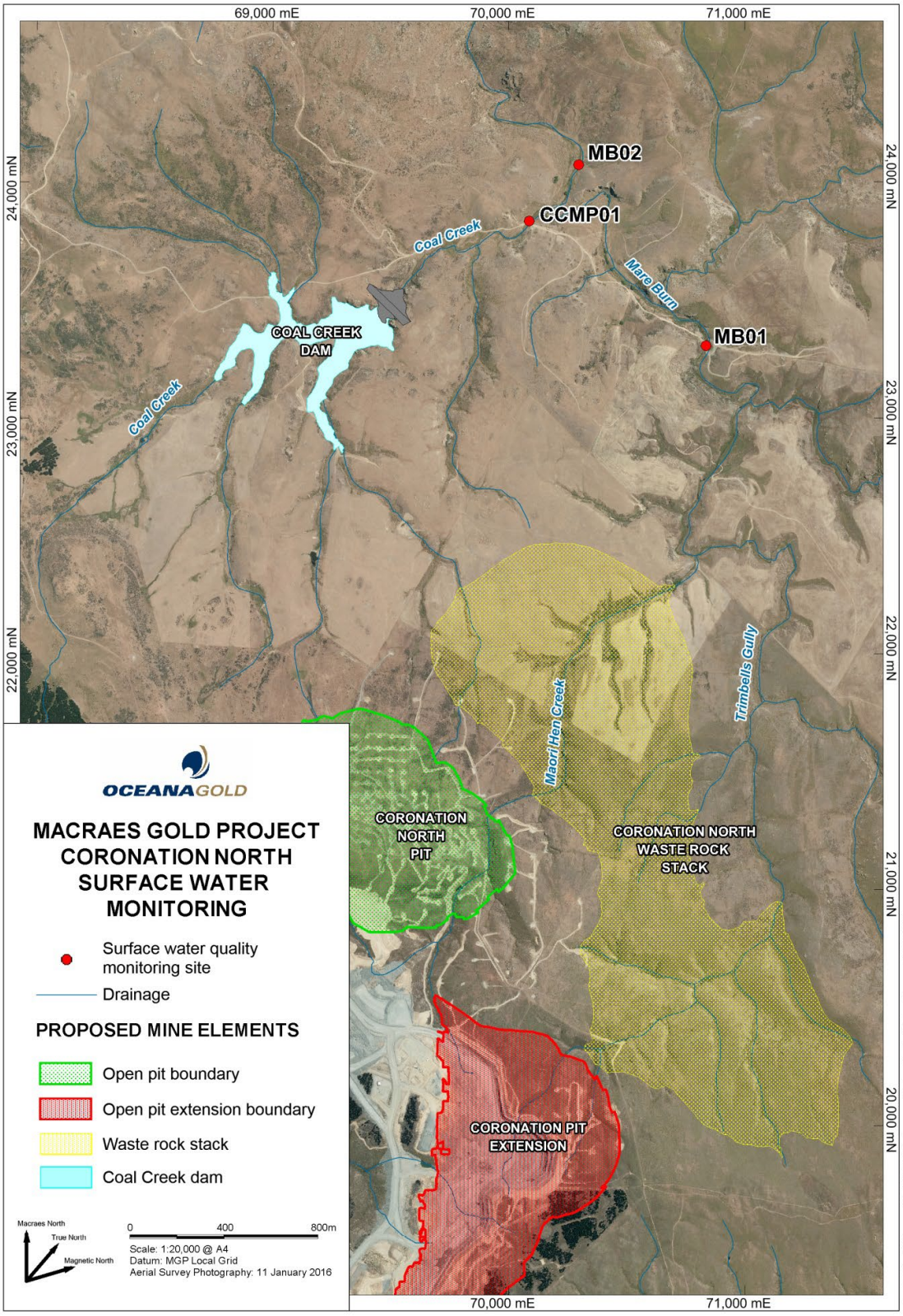

Figure 3.4: Surface Water Monitoring Site Locations for Coronation North

3.5 Deepdell North Stage III Surface Water Monitoring

OceanaGold currently holds Discharge Permit RM20.024.14 covering discharge of water and contaminants from silt ponds, pit lake operation and waste rock.

Management of sediment (pursuant to Discharge Permits RM20.024.14) is detailed in the Oceana Gold (NZ) Ltd, Erosion and Sediment Control Plan (ESCP).

Under the Compliance and Monitoring Schedule attached to RM20.024.14, the following surface water monitoring is required:

Monthly representative water samples from the following surface water sites:

- Deepdell Creek at DC08
- Deepdell Creek at DC01 (Upstream of mine activities)
- Shag River compliance point 1 (Shag River at Loop Road)
- Highlay Creek at HC02 (Immediately upstream of the confluence with Deepdell Creek)

The location of each site is shown on Figure 3.5. All surface water sites shall be sampled on the same day. Samples shall be analysed at monthly intervals for the parameters listed in Table 5.

Table 3.5: Deepdell North Stage III Surface Water Monitoring Parameters

Constituent	Monthly	Quarterly
Major cations:	✓	
Calcium	✓	
Magnesium	✓	
Potassium	✓	
Sodium	✓	
Major anions:	✓	
Bicarbonate	✓	
Carbonate	✓	
Chloride	✓	
Sulphate	✓	
pH	✓	
Conductivity	✓	
Arsenic	✓	
Copper	✓	
Iron	✓	
Lead	✓	
$Cyanide_{(WAD)}$	✓	
Total Inorganic Nitrogen	✓	
Nitrate	✓	
Nitrite	✓	
Ammonia	✓	
Phosphorous	✓	
Dissolved reactive phosphorous	✓	
Dissolved Inorganic Nitrogen	✓	

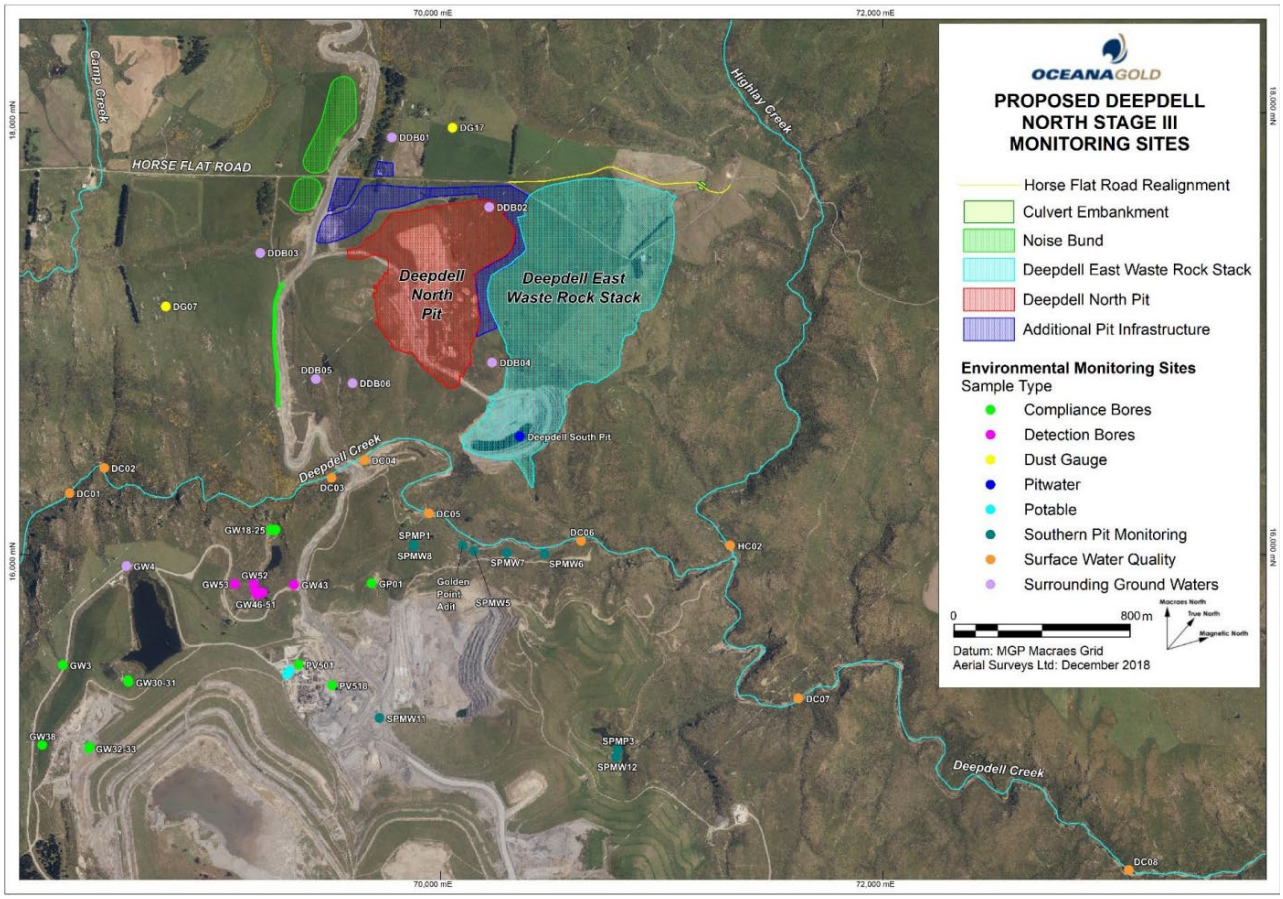

Figure 3.5: Surface Water Monitoring Site Locations for Deepdell North Stage III.

3.6 Mixed Tailings Impoundment Surface Water Monitoring

OceanaGold currently holds Discharge Permit RM2006.305 V4 to discharge mine tailings and contaminants to land and water from the mixed tailings impoundment.

Under the Compliance and Monitoring Schedule attached to RM2006.305 V4, the following surface water monitoring is required:

Monthly representative water samples from the following surface water sites:

- Shag River Compliance Point 1 (Shag River at Loop Road)
- Deepdell Creek Compliance Point (DC08)
- North Branch Waikouaiti River Compliance Point 1(NBWRRF)
- North Branch Wakouaiti River Compliance Point 2 (NB03)

All surface water sites shall be sampled on the same day. Samples shall be analysed at monthly intervals for the parameters listed in Table 6. Locations of these sites are shown in Figure 3.5 below.

Table 3.6 : Mixed Tailings Impoundment and Southern Pit 11 Surface Water Monitoring

Constituent	Monthly
Major cations:	
Calcium	✓
Magnesium	✓
Potassium	✓
Sodium	✓
Major anions:	
Bicarbonate	✓
Carbonate	✓
Chloride	✓
Sulphate	✓
pH	✓
Conductivity	✓
Arsenic	✓
Copper	✓
Iron	✓
Lead	✓
Zinc	✓
$Cyanide_{(WAD)}$	✓

3.7 Southern Pit 11 Surface Water Monitoring

OceanaGold currently hold Discharge Permit RM2006.308 V3 to discharge mine tailings and contaminants to land and water, at the Southern Pit 11 Tailings Impoundment, sometimes known as Southern Pit 11a.

Under the Compliance and Monitoring Schedule attached to RM2006.308 V3, RM2006.307 and RM2006.306, the following surface water monitoring is required:

Monthly representative water samples from the following surface water sites:

- Shag River Compliance Point 1 (Shag River at Loop Road)
- Deepdell Creek Compliance Point (DC08)

All surface water sites shall be sampled on the same day. Samples shall be analysed at monthly intervals for the parameters listed in Table 6 (above). Locations of these sites are shown in Figure 3.5 above.

3.8 Golden Point Underground Surface Water Monitoring

OceanaGold currently hold Discharge Permit RM20.130.02 to discharge water and associated contaminants to land where it may enter groundwater for the purpose of construction, operating, dewatering and decommissioning an underground mine.

Under the Compliance and Monitoring Schedule attached to RM20.130.02, RM20.130.04, RM20.130.05 and RM20.130.06, the following surface water monitoring is required:

Monthly representative water samples shall be collected from the following sites:

- Shag River Compliance Point 1 (Shag River at Loop Road)
- Deepdell Creek at DC01 (upstream of mine activities)
- Deepdell Creek Compliance Point (DC08)

All surface water sites shall be sampled on the same day. Samples shall be analysed at monthly intervals for the parameters listed in Table 7 below. The locations of these sites are shown in Figure 3.5 above.

Table 3.8: Golden Point Underground Surface Water Monitoring Parameters

Constituent	Monthly
Major cations:	
Calcium	✓
Magnesium	✓
Potassium	✓
Sodium	✓
Major anions:	
Bicarbonate	✓
Carbonate	✓
Chloride	✓
Sulphate	✓
pH	✓
Conductivity	✓
Arsenic	✓
Copper	✓
Iron	✓
Lead	✓
Zinc	✓
$Cyanide_{(WAD)}$	✓
Total inorganic Nitrogen	✓
Nitrate	✓
Nitrite	✓
Ammonia	✓
Phosphorous	✓
Dissolved reactive phosphorus	✓
Dissolved Inorganic Nitrogen	✓

3.9 Frasers West Pit Project Surface Water Monitoring

OceanaGold currently hold resource consent RM20.167.03 to discharge contaminants from the toe of a bund and waste rock stacks to land where they may enter water for the purpose of undertaking mining activities.

Under the compliance and monitoring schedule attached to RM20.167.01, RM20.167.02, RM20.167.03, RM20.167.04, the following surface water monitoring is required:

- Frasers Pit Sump;
- North Branch Waikouaiti River Compliance Point 1 (NBWRRF);
- North Branch Waikouaiti River Compliance Point 2 (NB03); and
- Murphys Creek (MC01)

Samples will be collected and analysed monthly for the criteria shown in Table 8 below. All surface water sampling must occur on the same day. The locations of these sites are shown in Figure 3.9 below.

Table 3.9: Frasers West Project Surface Water Monitoring Schedule

Constituent	Monthly
Major cations:	
Calcium	✓
Magnesium	✓
Potassium	✓
Sodium	✓
Major anions:	
Bicarbonate	✓
Carbonate	✓
Chloride	✓
Sulphate	✓
pH	✓
Conductivity	✓
Arsenic	✓
Copper	✓
Iron	✓
Lead	✓
Zn	✓
$Cyanide_{(WAD)}$	✓
Total inorganic Nitrogen	✓
Nitrate	✓
Nitrite	✓
Ammonia	✓
Phosphorus	✓

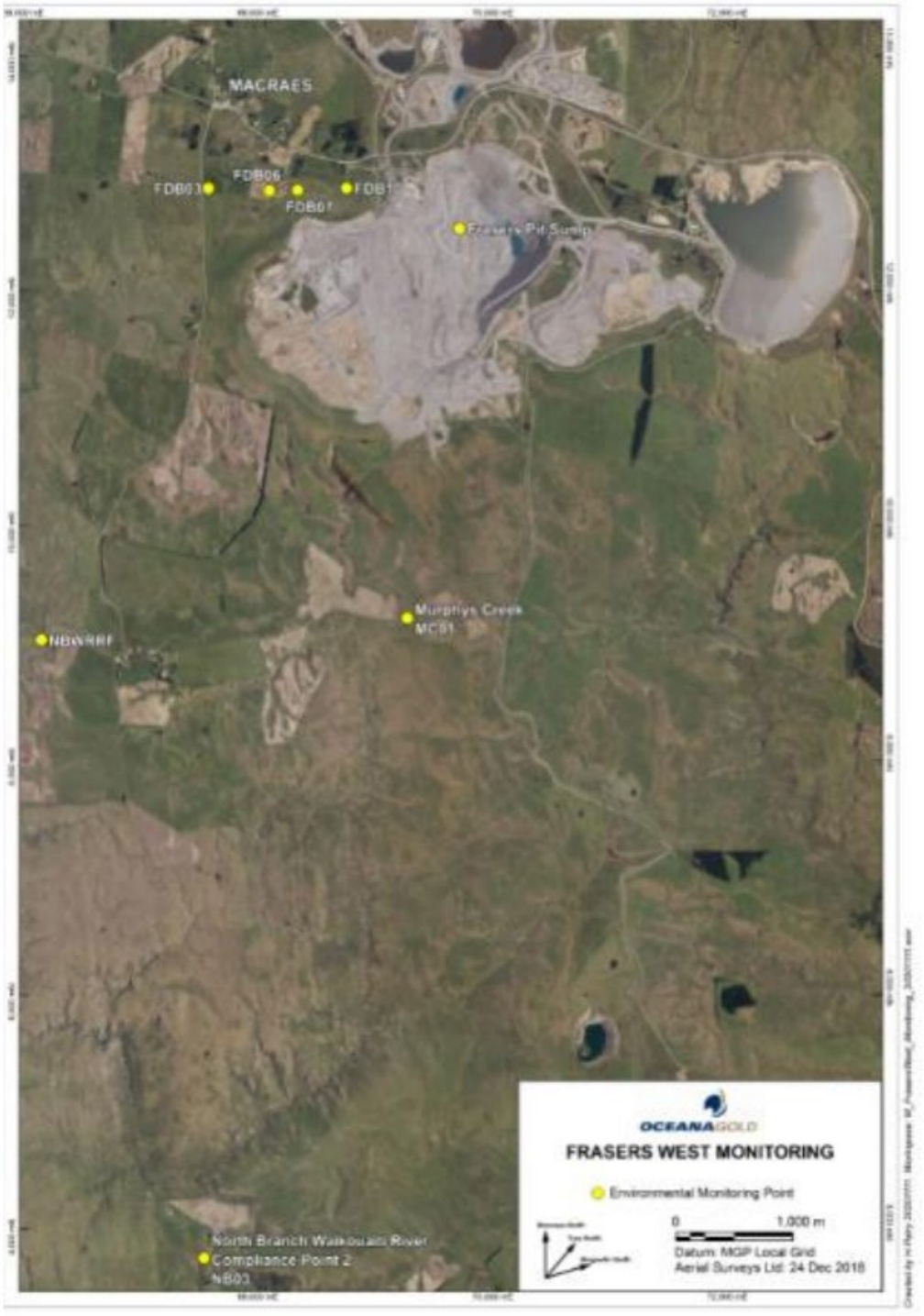

Figure 3.9: Frasers West Pit Project Water Monitoring Sites

3.10 Golden Bar Surface Water Monitoring

OceanaGold currently hold resource consents 2002.490, 2002.491, 2002.760, 2002.759, 2002.763. Under the compliance and monitoring schedule attached to 2002.491, 2002.759, 2002.763 the following surface water monitoring is required at sites listed below: Samples will be collected and analysed at the frequencies specified and for the criteria shown in Table 9.

- MC01- Murphys Tailings Ford
- MC02- Murphys Creek downstream of the junction with Clydesdale Creek
- NB01-Golden Bar Creek upstream of junction with NBWR
- NB02- NBWR upstream of junction with Golden Bar Creek
- NB03- NBWR down stream of junction Golden Bar Creek
- GB01-Immediately downstream of Clydesdale Silt Pond
- GB02-Golden Bar Creek adjacent to pit

Table 3.10: Golden Bar Surface Water Monitoring Schedule

Constituent	Quarterly	Annually
Major cations:	✓	
Calcium	✓	
Magnesium	✓	
Potassium	✓	
Sodium	✓	
Major anions:	✓	
Bicarbonate	✓	
Carbonate	✓	
Chloride	✓	
Sulphate	✓	
pH	✓	
Conductivity	✓	
Arsenic	✓	
Copper		✓
Iron	✓	
Lead		✓
Total inorganic Nitrogen		✓

3.11 Battery Creek Silt Pond Surface Water Monitoring

Under the Compliance and Monitoring Schedule attached to Discharge Permit RM20.424.01 monitoring of water from the following sites is required at quarterly and annually intervals. Samples will be collected and analysed at the frequencies specified and for the criteria shown in Table 10.

Surface water quality monitoring samples must be taken from:

- DC01
- DC02
- DC03
- DC04
- DC05
- DC06
- DC07
- DC08
- SPMP 1

Samples must be timed to coincide with low flows as far as practicable and undertaken four times a year at each site. Samples will be collected and analysed at the frequencies specified and for the criteria shown in Table 11.

Table 3.11: Surface Water Monitoring Schedule

Parameter	Quarterly	Annually
pH	✓	
Conductivity	✓	
Dissolved Arsenic	✓	
Dissolved Iron	✓	
Dissolved Copper	✓	
Dissolved Lead	✓	
Total Inorganic Nitrogen	✓	
Cyanide WAD	✓	

3.12 Northern Gully Silt Pond

Under the Compliance and Monitoring Schedule attached to Discharge Permit RM20.424.03 monitoring of the following surface water sites is required:

- DC01
- DC02
- DC03
- DC04
- DC05
- DC06
- DC07
- DC08
- SPMP 1

Samples must be timed to coincide with low flows as far as practicable and undertaken four times a year at each site. Samples will be collected and analysed at the frequencies specified and for the criteria shown in Table 15.

Table 3.12: Surface Water Monitoring Schedule

Parameter	Quarterly
pH	✓
Conductivity	✓
Dissolved Arsenic	✓
Dissolved Iron	✓
Dissolved Copper	✓
Dissolved Lead	✓
Total Inorganic Nitrogen	✓
Cyanide WAD	✓

3.13 Māori Tommy Gully Silt Pond Surface Water Monitoring

Under the Compliance and Monitoring Schedule attached to Discharge Permit RM20.424.02 monitoring of water from following sites is required:

- DC01
- DC02

- DC03
- DC04
- DC05
- DC06
- DC07
- DC08
- SPMP 1

Samples must be timed to coincide with low flows as far as practicable and undertaken four times a year at each site. Samples will be collected and analysed at the frequencies specified and for the criteria shown in Table 17.

Table 3.13: Surface Water Monitoring Schedule

Parameter	Quarterly
pH	✓
Conductivity	✓
Dissolved Arsenic	✓
Dissolved Iron	✓
Dissolved Copper	✓
Dissolved Lead	✓
Total Inorganic Nitrogen	✓
Cyanide WAD	✓

4 GROUNDWATER MONITORING

4.1 Top Tipperary Groundwater Monitoring

Under the Compliance and Monitoring Schedule attached to Discharge Permit RM10.351.16 V3, RM10.378.17 and RM10.378.20 groundwater monitoring is required of compliance bores, detection bores and the phreatic surface.

4.1.1 TTTSF Compliance Bores

Monthly representative samples of groundwater are required from no fewer than four compliance monitoring bores (TT01 to TT04 as shown on Figure 4.1) with additional parameters required at

quarterly intervals. Table 19 shows the parameters that are required to be analysed for at monthly and quarterly intervals.

Table 4.1.1: TTTSF Compliance Bores Monitoring Parameters

Constituent	Monthly	Quarterly
Major cations:	✓	
Calcium	✓	
Magnesium	✓	
Potassium	✓	
Sodium	✓	
Major anions:	✓	
Bicarbonate	✓	
Carbonate	✓	
Chloride	✓	
Sulphate	✓	
pH	✓	
Conductivity	✓	
Arsenic	✓	
Copper		✓
Iron		✓
Lead		✓
$Cyanide_{(WAD)}$		✓
Total Inorganic Nitrogen		✓

4.1.2 TTTSF Detection Bores

Monthly representative samples of groundwater are required from no fewer than eleven monitoring bores (TT05 to TT15 as shown on Figure 4.1) with additional parameters to be analysed at quarterly intervals. Table 20 states the parameters that are required to be analysed for at monthly and quarterly intervals.

Table 4.1.2: TTTSF Detection Bores Parameters

Constituent	Monthly	Quarterly
Major cations:	✓	
Calcium	✓	
Magnesium	✓	
Potassium	✓	
Sodium	✓	
Major anions:	✓	
bicarbonate	✓	
carbonate	✓	
chloride	✓	
sulphate	✓	
pH	✓	
Conductivity	✓	
Arsenic	✓	
Copper		✓
Iron		✓
Lead		✓
$Cyanide_{(WAD)}$		✓
Total Inorganic Nitrogen		✓

4.1.3 Phreatic Surface

The groundwater level in the compliance bores, detection bores and any other bores surrounding the TTTSF will be recorded at monthly intervals. The water level shall be recorded prior to sampling.

Figure 4.1: Top Tipperary Tailings Storage Facility Compliance and Detection Groundwater Monitoring Sites

4.2 Frasers Waste Rock Stack Groundwater Monitoring

Under the Compliance and Monitoring Schedule attached to Discharge Permit RM10.351.10 V1 and RM10.351.11, groundwater monitoring is required of surrounding groundwater bores and the phreatic surface for Frasers Waste Rock Stack. Bore FE01, North of the Frasers East WRS, is no longer sampled as this bore was destroyed as planned and is not required to be replaced.

4.2.1 Surrounding Groundwater Bores

Representative samples of groundwater from the surrounding groundwater bores shall be obtained. Surrounding groundwater bores shall be those located at:

- North and west of the rock stack known as Frasers West Waste Rock Stack,, and south of the North Branch of the Waikouaiti River (FDB03, 04, 05, 06, 07, 08 and 10);

- West of the waste rock stack known as Frasers West Waste Rock Stack (FDB02 and FDB11);
- South of the rock stack known as Frasers West Waste Rock Stack (FDB13);
- East of the rock stack known as Frasers East Waste Rock Stack (FE02); and
- South of the rock stack known as Frasers East Waste Rock Stack (FE03).

The location of these bores are shown on Figure 4.2 below. Table 21 shows the parameters that are required to be analysed for at quarterly and annual intervals.

Table 4.2.1: TTTSF Surrounding Groundwater Bores Monitoring Parameters

Constituent	Quarterly	Annually
Major cations:		
calcium	✓	
magnesium	✓	
potassium	✓	
sodium	✓	
Major anions:		
bicarbonate	✓	
carbonate	✓	
chloride	✓	
sulphate	✓	
pH	✓	
Conductivity	✓	
Copper		✓
Iron		✓
Lead		✓
Total Inorganic Nitrogen		✓
Arsenic		✓

Figure 4.2: Frasers Waste Rock Stack Surrounding Groundwater Monitoring Sites

4.2.2 Phreatic Surface

Monitoring of the groundwater level in the surrounding groundwater bores shall occur at quarterly intervals. The water level shall be recorded prior to sampling.

4.3 Coronation Project Groundwater Monitoring

Under the Compliance and Monitoring Schedule attached to Discharge Permits 12.378.04 and 12.378.05, groundwater monitoring of surrounding groundwater bores is required.

4.3.1 Surrounding Groundwater Bores

Representative samples of groundwater shall be obtained from no fewer than four monitoring bores (CP01 to CP04). However, bores CP01 and CP02 have been destroyed by mining activities. A new site has been identified to install a replacement monitoring bore and the installation of this is still being confirmed.

The location of these bores is shown on Figure 4.3. Table 4.3.1 states the parameters that are required to be analysed for at quarterly and annual intervals.

Table 4.3.1: Coronation Surrounding Groundwater Bores Monitoring Parameters

Constituent	Quarterly	Annually
Major cations:		
calcium	✓	
magnesium	✓	
potassium	✓	
sodium	✓	
Major anions:		
bicarbonate	✓	
carbonate	✓	
chloride	✓	
sulphate	✓	
pH	✓	
Conductivity	✓	
Copper		✓
Iron		✓
Lead		✓
Total Inorganic		✓
Nitrogen		✓
Arsenic		✓

Figure 4.3: Coronation Groundwater Waste Rock Stack Surrounding Groundwater Monitoring Sites

4.4 Deepdell North Stage III Project Groundwater Monitoring

Under the Compliance and Monitoring Schedule attached to Discharge Permit RM20.024.09, groundwater monitoring of surrounding groundwater bores is required:

4.4.1 Surrounding Groundwater Bores

Representative samples of groundwater shall be obtained from groundwater monitoring bores DDB01, DDB03 – DDB06. Water levels will be measured and recorded monthly prior to sampling.

The location of these bores is shown on Figure 4.4. Table 4..4.1 states the parameters that are required to be analysed for at quarterly and annual intervals.

Table 4.4.1: Deepdell North Stage III Surrounding Groundwater Bores Monitoring Parameters

Constituent	Quarterly	Annually
Major cations:		
calcium	✓	
magnesium	✓	
potassium	✓	
sodium	✓	
Major anions:		
bicarbonate	✓	
carbonate	✓	
chloride	✓	
sulphate	✓	
pH	✓	
Conductivity	✓	
Copper		✓
Iron		✓
Lead		✓
Total Inorganic		✓
Nitrogen		✓
Arsenic		✓

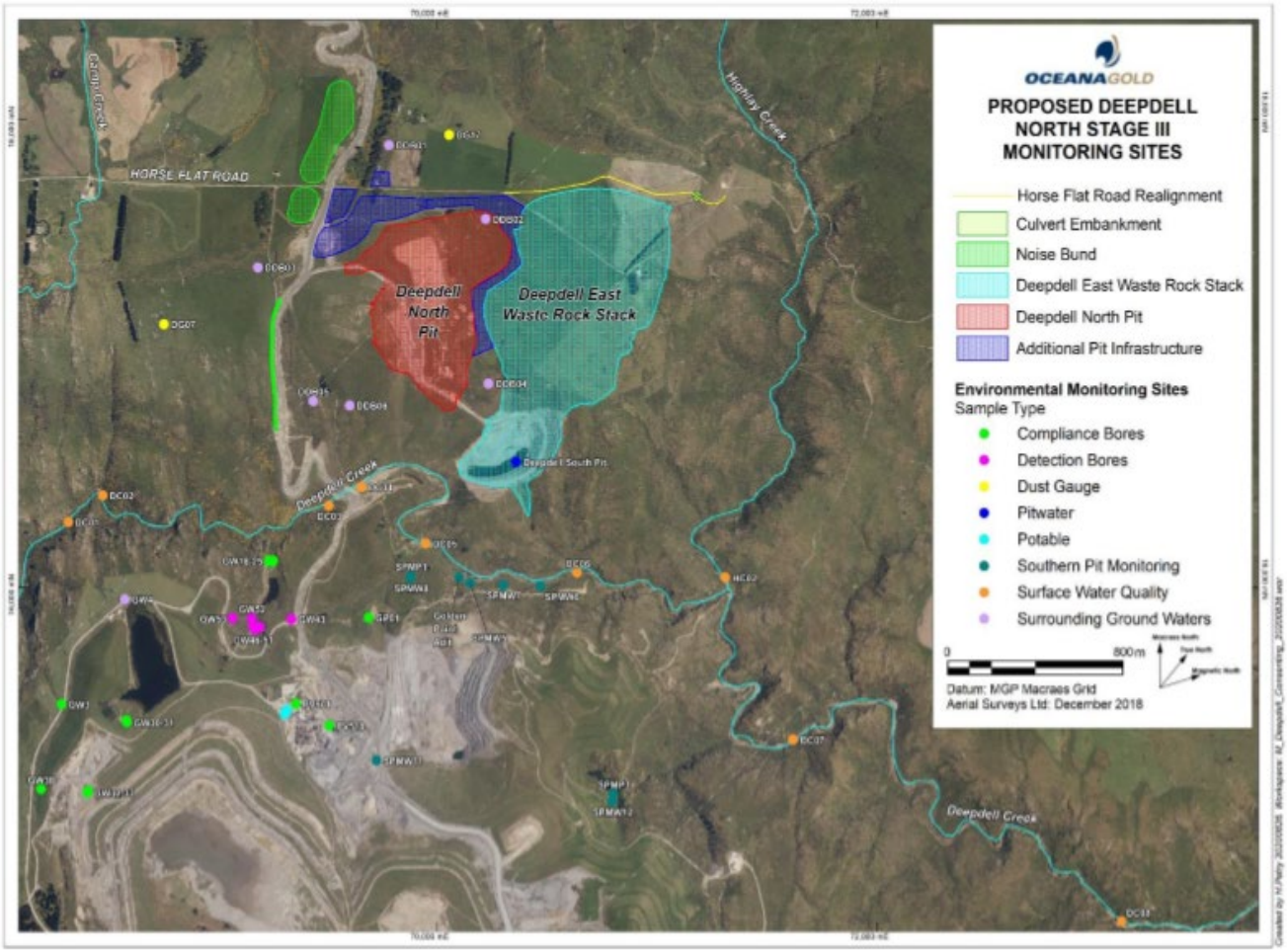

Figure 4.4: Deepdell North Stage III Waste Rock Stack Surrounding Groundwater Monitoring Sites

4.5 Coronation North Project Groundwater Monitoring

Under the Compliance and Monitoring Schedule attached to Discharge Permits 16.138.04, 16.138.05 and 16.138.09, groundwater monitoring of waste rock stack seepage is required.

4.5.1 Waste Rock Stack Seepage

Representative samples of groundwater shall be obtained from the toe of Coronation North Waste Rock Stack at the following points:

- Trimbells Gully
- Maori Hen Gully
- Coal Creek 1
- Coal Creek 2

The location of these sites is shown on Figure 4.5 below. Table 4.5.1 lists the parameters that are required to be analysed for at quarterly and annual intervals.

Construction of the waste rock stack will be progressive so commencement of monitoring of groundwater seepage will be dependent on waste rock being deposited in the catchment of each seepage collection point and there being sufficient seepage water discharged to allow a sample to be collected.

Table 4.5.1: Coronation North Waste Rock Seepage Monitoring Parameters

Constituent	Quarterly	Annually
Major cations:		
calcium	✓	
magnesium	✓	
potassium	✓	
sodium	✓	
Major anions:		
bicarbonate	✓	
carbonate	✓	
chloride	✓	
sulphate	✓	
pH	✓	
Conductivity	✓	
Copper		✓
Iron		✓
Lead		✓
Total Inorganic Nitrogen		✓
Arsenic		✓

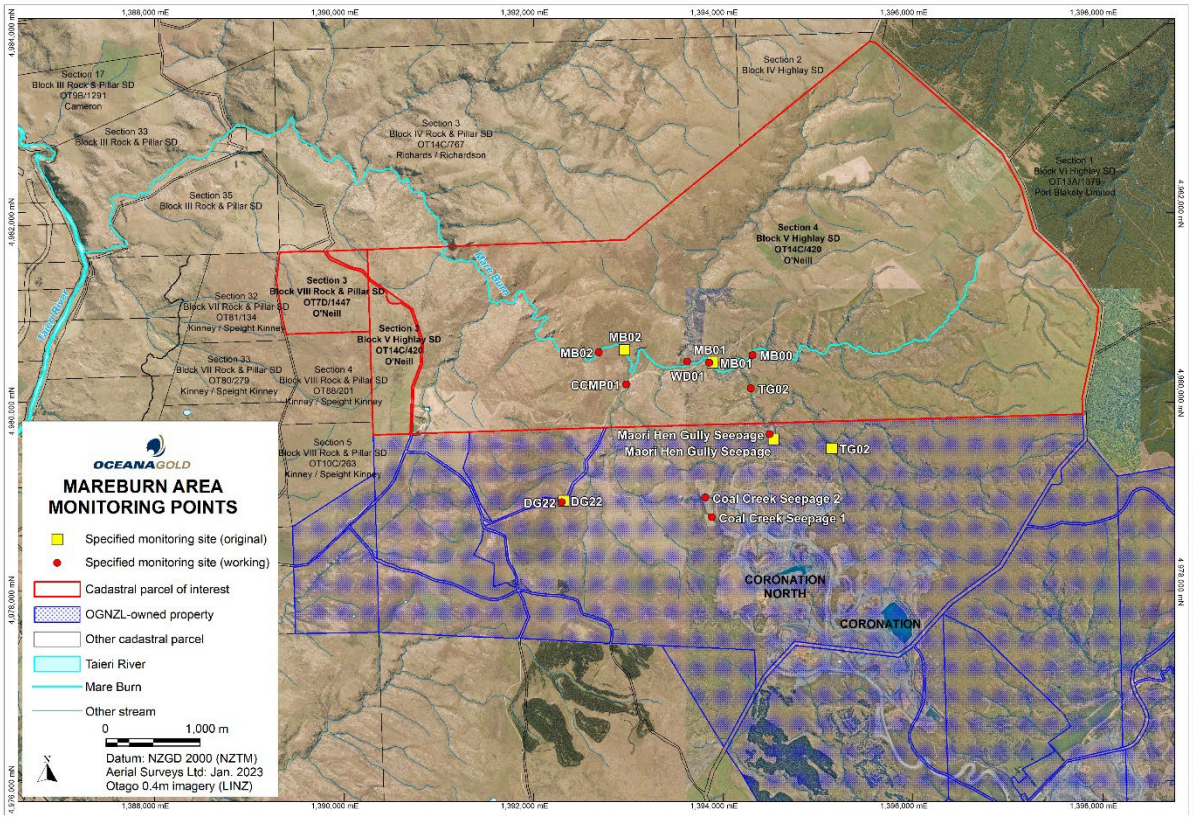

Figure 4.5: Coronation North Project Monitoring Sites

4.6 Deepdell North Stage III Project Groundwater Monitoring

Under the Compliance and Monitoring Schedule attached to Discharge Permits RM20.024.14, groundwater monitoring of waste rock stack seepage is required:

4.6.1 Waste Rock Stack Seepage

Representative samples of groundwater shall be obtained from the toe of Deepdell North Stage III Waste Rock Stack at the following points:

- Deepdell South Silt Pond
- Deepdell North Silt Pond
- Deepdell West Silt Pond

The location of these sites is shown on Figure 4.6. Highlay Silt Ponds 1 and 2 will also require monitoring, however these have not yet been constructed. Table 4.6.1 lists the parameters that are required to be analysed for at quarterly and annual intervals.

Construction of the waste rock stack will be progressive so commencement of monitoring of groundwater seepage will be dependent on waste rock being deposited in the catchment of each seepage collection point and there being sufficient seepage water discharged to allow a sample to be collected.

Table 4.6.1: Deepdell North Stage III Waste Rock Seepage Monitoring Parameters

Constituent	Quarterly	Annually
Major cations:		
calcium	✓	
magnesium	✓	
potassium	✓	
sodium	✓	
Major anions:		
bicarbonate	✓	
carbonate	✓	
chloride	✓	
sulphate	✓	
pH	✓	
Conductivity	✓	
Copper		✓
Iron		✓
Lead		✓
Total Inorganic Nitrogen		✓
Arsenic		✓

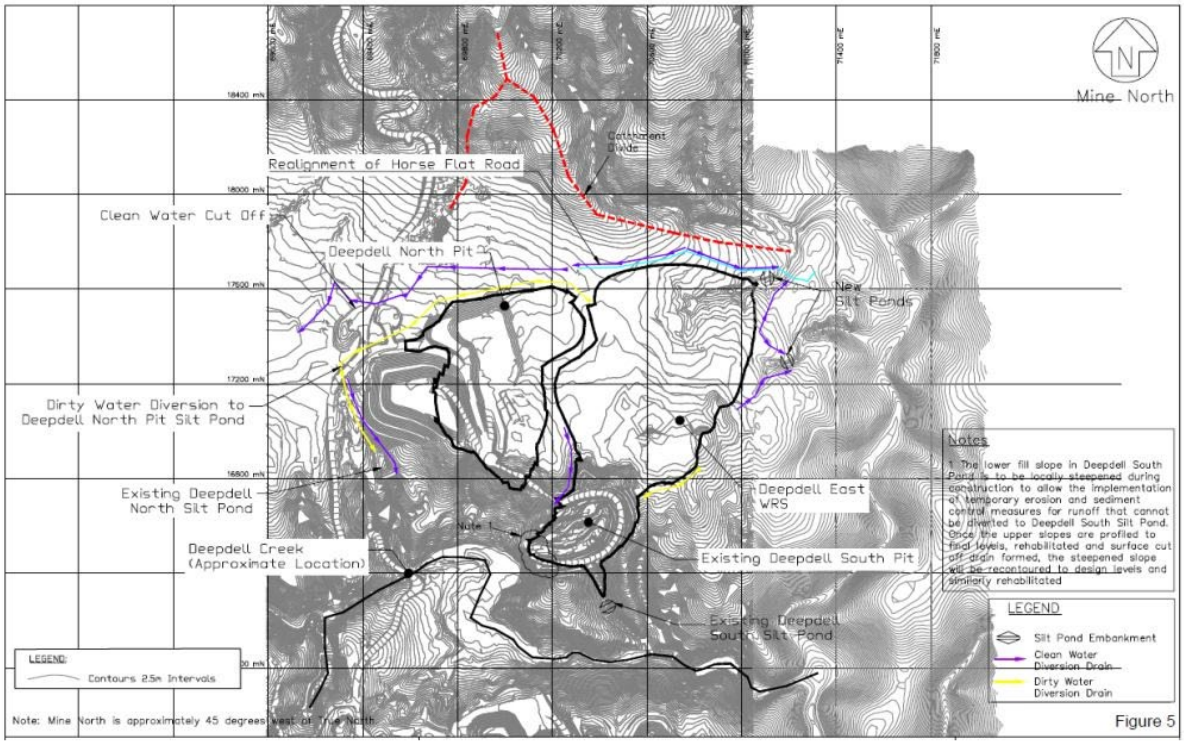

Figure 23: Deepdell North Stage III Waste Rock Stack and Pit erosion and sediment control features.

Figure 4.6: Deepdell North Stage III Waste Rock Stack Seepage Monitoring Locations

4.7 Mixed Tailings Impoundment Groundwater Monitoring

Under the Compliance and Monitoring Schedule attached to Discharge Permit RM 2006.305 V4, groundwater monitoring is required of surrounding groundwater bores and the phreatic surface for the mixed tailings impoundment. Water level is recorded prior to sampling.

Representative samples of groundwater shall be obtained from the following points for compliance monitoring:

- GW 18-GW 25, located in Maori Tommy Gully
- GW 3, and GW38 northwest of Mixed Tailings Impoundment
- GP01 northeast of Mixed Tailings Impoundment
- P1 southwest of the Mixed Tailings Impoundment

These samples should be analysed for the following parameters at monthly and quarterly intervals, as shown in Table 26 below. Locations for these bores are shown in Figure 4.8 below.

Table 4.7a: Mixed Tailings Impoundment Groundwater Compliance monitoring parameters

Constituent	Monthly	Quarterly
Major cations:		
calcium	✓	
magnesium	✓	
potassium	✓	
sodium	✓	
Major anions:		
bicarbonate	✓	
carbonate	✓	
chloride	✓	
sulphate	✓	
pH	✓	
Conductivity	✓	
Arsenic	✓	
Iron		✓
Lead		✓
Cyanide (WAD)		✓
Total Inorganic Nitrogen		✓
Copper		✓

Representative samples should also be taken from the following groundwater bores for detection monitoring;

- GW 43, GW 46-53 in Maori Tommy Gully
- GW 30-33 northwest of Mixed Tailings Impoundment
- PV501 northeast of Mixed Tailings Impoundment
- Surrounding groundwater bores GW01, GW02, GW04, Vickery House (Macraes Township), MMCL House (Macraes Township)

These samples should be analysed for the following parameters at monthly and quarterly intervals, as shown in Table 4.7b below.

Table 4.7b: Mixed Tailings Impoundment Groundwater Detection Monitoring Schedule

Constituent	Quarterly	Annually
Major cations:		
calcium	✓	
magnesium	✓	
potassium	✓	
sodium	✓	
Major anions:		
bicarbonate	✓	
carbonate	✓	
chloride	✓	
sulphate	✓	
pH	✓	
Conductivity	✓	
Arsenic	✓	
Copper		✓
Iron		✓
Lead		✓
Cyanide (WAD)		✓
Total Inorganic Nitrogen		✓

Phreatic water levels are monitored at all sites above, with water levels recorded prior to sampling. Phreatic surface monitoring is also monitored at bores GW06, GW07, GW09-GW16, GW26-29, GW37, GW41, GW42, GW45, P4, P5 and PDH70. The locations of these bores are shown in Figure 4.7 below.

Figure 4.7: Mixed Tailings Impoundment Groundwater Bore locations

4.8 Southern Pit 11 Groundwater Monitoring

Under the Compliance and Monitoring Schedule attached to Discharge Permit RM 2006.306, RM2006.307 and RM2006.308 V3, groundwater monitoring is required of surrounding groundwater bores and the phreatic surface around the Southern Pit 11 tailing storage facility. Water level of all bores is recorded prior to sampling. If there is sufficient flow, a sample is usually also collected from the Golden Point Adit, although this is not a consent requirement.

4.8.1 Southern Pit 11 Compliance Monitoring

Representative samples of groundwater shall be obtained from the following bores:

- SMPW06 and SPMW07, between the north wall of Golden Point Pit and Deepdell Creek
- SPMW08 adjacent to Battery Creek in the Golden Point Historic Reserve

These samples will be analysed for the following parameters at monthly and quarterly intervals, as shown in Table 4.8.1 below. The locations of these bores are shown in Figure 4.8 below.

Table 4.8.1: Southern Pit 11 Compliance Monitoring Parameters

Constituent	Monthly	Quarterly
Major cations:		
calcium	✓	
magnesium	✓	
potassium	✓	
sodium	✓	
Major anions:		
bicarbonate	✓	
carbonate	✓	
chloride	✓	
sulphate	✓	
pH	✓	
Conductivity	✓	
Arsenic	✓	
Iron		✓
Lead		✓
Cyanide (WAD)		✓
Total Inorganic Nitrogen		✓
Copper		✓

4.8.2 Southern Pit 11 Detection Monitoring

Representative samples should also be taken from the following sites for detection monitoring:

- Bores SPMPW03, SPMP04, SPM05, SPMP10 and SPMP12
- Bore SPMPW01, within Battery Creek, adjacent to the historic reserve
- Within any spring found along the right bank of Deepdell Creek in the vicinity of Golden Point Pit
- SPMP3 at Northern Gully Silt Pond

These samples should be analysed for the following parameters at monthly and quarterly intervals, as shown in Table 29 below.

Table 4.8.2: Southern Pit 11 Groundwater Detection Monitoring Schedule

Constituent	Quarterly	Annually
Major cations:		
calcium	✓	
magnesium	✓	
potassium	✓	
sodium	✓	
Major anions:		
bicarbonate	✓	
carbonate	✓	
chloride	✓	
sulphate	✓	
pH	✓	
Conductivity	✓	
Arsenic	✓	
Copper		✓
Iron		✓
Lead		✓
Cyanide (WAD)		✓
Total Inorganic Nitrogen		✓

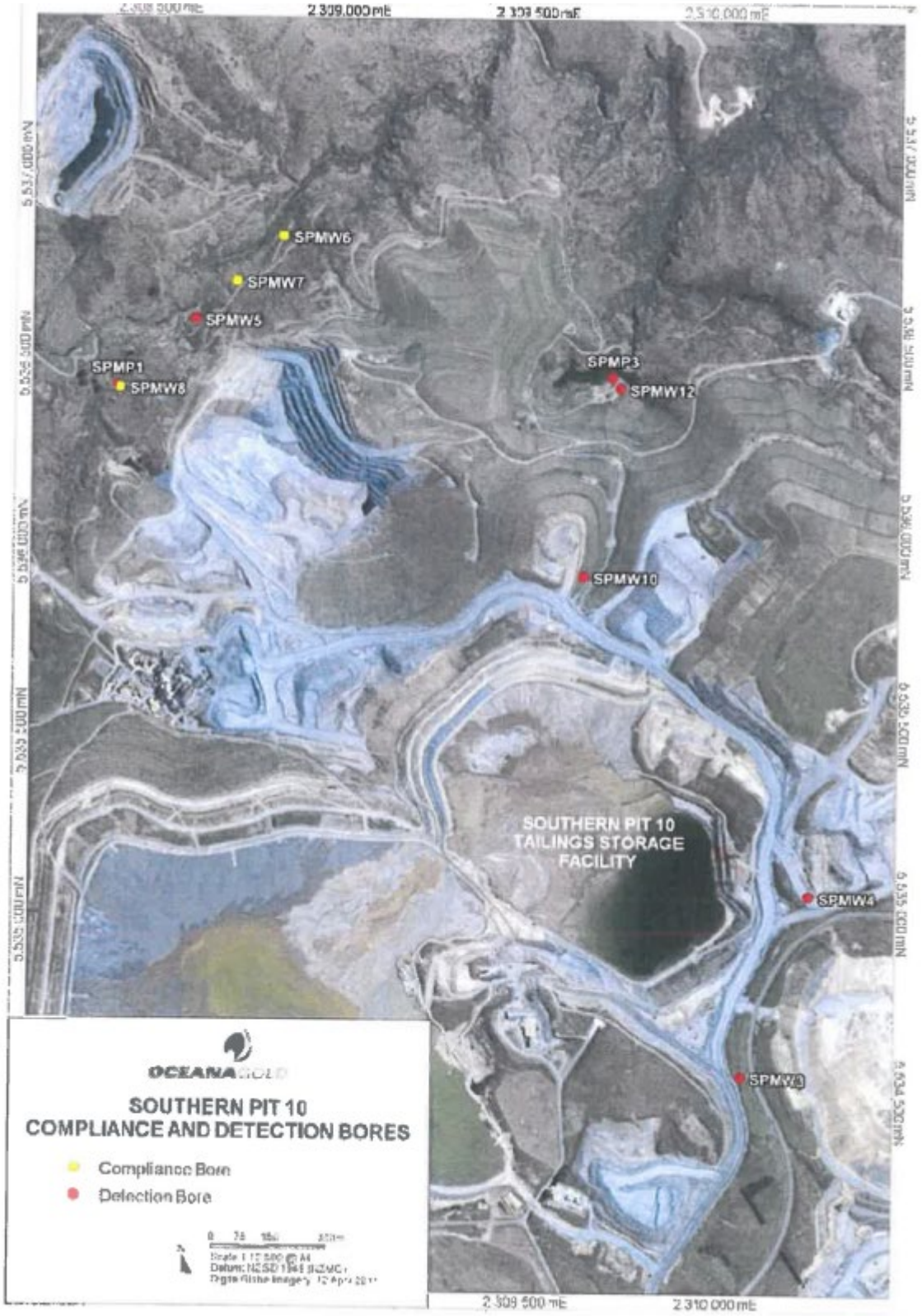

Figure 4.8: Southern Pit 11 Groundwater monitoring bore locations

4.9 Golden Point Underground Groundwater Monitoring

Under the compliance and monitoring schedule attached to discharge permits RM20.130.02, RM20.130.04, RM20.130.05 and RM20.130.06, groundwater monitoring and monitoring of waste rock stack seepage is required.

4.9.1 GPUG Groundwater Monitoring

Representative samples of groundwater shall be obtained monthly from the following bores:

- SPMW5
- SPMW6
- SPMW7
- SPMW10

Samples will be analysed for the following parameters, as shown in Table 4.9.1 below. The locations of these sites are shown in Figure 4.8 above.

Table 4.9.1: GPUG Groundwater Monitoring Schedule

Constituent	Monthly	Quarterly
Major cations:		
calcium	✓	
magnesium	✓	
potassium	✓	
sodium	✓	
Major anions:		
bicarbonate	✓	
carbonate	✓	
chloride	✓	
sulphate	✓	
pH	✓	
Conductivity	✓	
Arsenic		✓
Iron		✓
Lead		✓
Total Inorganic Nitrogen		✓
Copper		✓

4.9.2 Waste Rock Stack Seepage

Representative samples of groundwater shall be obtained from the toe of the Golden Point Underground Waste Rock Stacks, providing there has been sufficient seepage water to allow a sample to be collected.

Samples shall be collected monthly from the following sites:

- Round Hill Pit Sump; and
- Battery Creek Silt Pond.

Samples will be analysed for the following parameters, as shown in Table 31 below.

Table 4.9.2: GPUG Waste Rock Stack Seepage Monitoring

Constituent	Monthly	Quarterly
Major cations:		
calcium	✓	
magnesium	✓	
potassium	✓	
sodium	✓	
Major anions:		
bicarbonate	✓	
carbonate	✓	
chloride	✓	
sulphate	✓	
pH	✓	
Conductivity	✓	
Arsenic		✓
Copper		✓
Iron		✓
Lead		✓
Total Inorganic Nitrogen		✓

4.10 Frasers West Pit Project Groundwater Monitoring

Under the compliance and monitoring schedule attached to RM20.167.01, RM20.167.02, RM20.167.03, RM20.167.04, representative samples of groundwater shall be obtained monthly from the following bores:

- FDB10
- FDB07
- FDB06
- FDB03

The locations of these sites are shown in Figure 4.10. Phreatic surface level will be recorded prior to sampling. Samples will be analysed for the following parameters, as shown in Table 4.10 below.

Table 4.10: Frasers Pit Project Groundwater Monitoring Schedule

Constituent	Monthly	Quarterly
Major cations:		
calcium	✓	
magnesium	✓	
potassium	✓	
sodium	✓	
Major anions:		
bicarbonate	✓	
carbonate	✓	
chloride	✓	
sulphate	✓	
pH	✓	
Conductivity	✓	
Arsenic		✓
Iron		✓
Lead		✓
Total Inorganic Nitrogen		✓
Copper		✓

Figure 4.10: Frasers West Monitoring Sites

4.11 Golden Bar Groundwater Monitoring

Under the compliance and monitoring schedule attached to 2002.490, 2002.493, and 2002.760 representative samples of groundwater shall be obtained at quarterly and annual intervals. The water level in the bores is recorded prior to sampling. Samples will be analysed for the following parameters, as shown in Table 4.11.

- RCH2535
- RCH2613
- RCH2871
- RCH 3004 which is a control bore away from possible influence from mining activities.

Bore RCH2585 which has been included in the previous monitoring regime was thought to have been incorrectly labelled as RCH2535 in the consent (as listed above). Bore RCH2871 has been replaced by bore RCH2775.

Table 4.11: Golden Bar Groundwater Monitoring Schedule

Constituent	Quarterly	Annually
Major cations:	✓	
calcium	✓	
magnesium	✓	
potassium	✓	
sodium	✓	
Major anions:	✓	
bicarbonate	✓	
carbonate	✓	
chloride	✓	
sulphate	✓	
Conductivity	✓	
Arsenic	✓	
Iron	✓	
Lead		✓
Total Inorganic Nitrogen	✓	
Copper		✓

5 SILT PONDS

5.1 TTTSF Silt Pond Monitoring

Under the Compliance and Monitoring Schedule attached to Discharge Permits RM10.351.16 V3, RM10.351.17 V3 and RM10.351.20 monitoring of water contained in the silt pond for the TTTSF is required.

Representative samples of water from the TTTSF Silt Pond/Sump known as Seepage Collection Sump shall be collected. The location of this silt pond is shown in Figure 5.1. Samples shall be analysed for the parameters stated in Table 5.1 at quarterly and annual intervals.

Table 5.1: TTTSF Seepage Collection Sump Monitoring Parameters

Constituent	Quarterly	Annually
pH	✓	
Conductivity	✓	
Arsenic	✓	
Iron	✓	
Cyanide	✓	
Copper		✓
Lead		✓
Total Inorganic Nitrogen		✓

5.2 Frasers Waste Rock Stack Silt Pond Monitoring

Under the Compliance and Monitoring Schedule attached to Discharge Permits RM10.351.10 V1 and RM10.351.11, monitoring of water contained in silt ponds is required for the Frasers Waste Rock Stack.

Representative samples of water from the silt ponds known as Murphys Creek Silt Pond and Frasers West Silt Pond shall be collected. The location of these silt ponds is shown in Figure 5.1. Samples shall be analysed for the parameters stated in Table 5.2 at quarterly and annual intervals.

Table 5.2: Murphys Creek and Frasers West Silt Pond Monitoring Parameters

Constituent	Quarterly	Annually
pH	✓	
Conductivity	✓	
Arsenic	✓	
Iron	✓	
Copper		✓
Lead		✓
Total Inorganic Nitrogen		✓

Figure 5.1 Tipperary Seepage Sump and Silt Pond Locations

5.3 Mixed Tailings Impoundment Silt Pond Monitoring

Under the Compliance and Monitoring Schedule attached to Discharge Permits RM10.351.33, RM10.351.34, 2006.303, 2006.304, and 2006.305, monitoring of water from the silt pond known as Maori Tommy Gully Silt Pond is required.

Representative samples of water from the Maori Tommy Gully Silt Pond shall be collected. Samples shall be analysed for the parameters stated in Table 5.3 at quarterly and annual intervals.

Table 5.3: Maori Tommy Gully Silt Pond Monitoring Parameters.

Constituent	Quarterly	Annually
pH	✓	
Conductivity	✓	
Arsenic	✓	
Iron	✓	
Cyanide	✓	
Copper		✓
Lead		✓
Total Inorganic Nitrogen		✓

5.4 Southern Pit 11 Silt Pond Monitoring

Under the Compliance and Monitoring Schedule attached to Discharge Permits RM2006.306, RM2006.307 and RM2006.308 V3, monitoring of water from the silt pond known as Northern Gully Silt Pond is required.

Representative samples of water from the Northern Gully Silt Pond shall be collected. Samples shall be analysed for the parameters stated in Table 5.4 at quarterly and annual intervals.

Table 5.47: Northern Gully Silt Pond Monitoring Parameters

Constituent	Quarterly	Annually
pH	✓	
Conductivity	✓	
Arsenic	✓	
Iron		✓
Copper		✓
Lead		✓
Total Inorganic Nitrogen		✓

5.5 Golden Bar Silt Pond Monitoring

Under the Compliance and Monitoring Schedule attached to 2002.763 monitoring shall occur at quarterly intervals for four years and annually thereafter.

Representative samples of water from sites listed below shall be collected.

- Golden Bar Pit (pit sump)
- Remnant Golden Bar Pit lake (post-mining)
- Golden Bar Creek downstream of pit lake outlet (GB03, post-mining)

Samples shall be analysed for the parameters stated in Table 5.5.

Table 5.5 Golden Bar Pit Monitoring

Constituent	Quarterly	Annually
Major cations:	✓	
calcium	✓	
magnesium	✓	
potassium	✓	
sodium	✓	
Major anions:	✓	
bicarbonate	✓	
carbonate	✓	
chloride	✓	
sulphate	✓	
pH	✓	
Arsenic	✓	
Iron	✓	
Lead	✓	
Total Inorganic Nitrogen	✓	
Copper	✓	
Suspended Solids	✓	
Total Hardness	✓	

Additionally, Clydesdale Creek Silt Pond must be sampled and at the following frequency for the following parameters as shown in Table 5.6 below.

Table 5.6 Clydesdale Creek Silt Pond Monitoring

Constituent	Quarterly	Annually
Major cations:	✓	
calcium	✓	
magnesium	✓	
potassium	✓	
sodium	✓	
Major anions:	✓	
bicarbonate	✓	
carbonate	✓	
chloride	✓	
sulphate	✓	
pH	✓	
Arsenic	✓	
Iron	✓	
Lead	✓	
Conductivity	✓	
Copper		✓
Lead		✓
Total Inorganic Nitrogen		✓

5.6 Battery Creek Silt Pond Monitoring

Under the Compliance and Monitoring Schedule attached to Discharge Permit RM20.424.01 monitoring of water from the silt pond known as Battery Creek Silt Pond is required at quarterly and annually intervals. Samples will be collected and analysed at the frequencies specified and for the criteria shown in Table 5.6.

Table 5.6: Battery Creek Silt Pond Surface Water Monitoring Schedule

Parameter	Quarterly	Annually
pH	✓	
Conductivity	✓	
Arsenic	✓	
Iron	✓	
Copper	✓	
Lead		✓
Total Inorganic Nitrogen		✓

5.7 Northern Gully Silt Pond

Under the Compliance and Monitoring Schedule attached to Discharge Permit RM20.424.03, monitoring of water from the silt pond known as Northern Gully Silt Pond is required at quarterly and annually intervals.

Samples will be collected and analysed at the frequencies as specified and for the criteria shown in Table 5.7.

Table 5.7: Northern Gully Silt Pond Surface Water Monitoring Schedule

Parameter	Quarterly	Annually
pH	✓	
Conductivity	✓	
Arsenic	✓	
Iron	✓	
Copper	✓	
Lead		✓
Total Inorganic Nitrogen		✓

5.8 Maori Tommy Gully Silt Pond

Under the Compliance and Monitoring Schedule attached to Discharge Permit RM20.424.02 monitoring of water from the silt pond known as Māori Tommy Gully Silt Pond is required at quarterly and annually intervals. Samples will be collected and analysed at the frequencies specified and for the criteria shown in Table 5.8.

Table: 5.8 Maori Tommy Gully Silt Pond

Parameter		Quarterly	Annually
pH		✓	
Conductivity		✓	
Arsenic		✓	
Iron		✓	
Copper		✓	
Cyanide WAD		✓	
Lead			✓
Total Inorganic Nitrogen			✓

6 COMPLIANCE CRITERIA

6.1 TTTSF Monitoring Compliance Criteria

Under consents RM10.351.14 V5, RM10.351.16 V6, RM10.351.17 V6, RM10.351.22 V5, RM10.351.25 V4, RM10.351.26 V4 and RM10.351.27 V3 the following compliance criteria apply:

6.1.1 Narrative Standard for Receiving Waters

The waters of Tipperary Creek, McCormicks Creek, Cranky Jims Creek and the Shag River shall at all times be free of contaminants attributable to mineral processing and associated activities in concentrations which adversely affect directly or indirectly water uses or which adversely affect humans, animals, plants and/or aquatic life.

6.1.2 Numerical Compliance Criteria

6.1.2.1 Shag River Compliance Point 2 (Shag River at McCormicks)

Surface water within the Shag River at Compliance Point 2 (Shag River @ McCormicks Creek) shall not exceed the water quality compliance criteria shown in Table 6.1.2.1, unless infallible evidence can be provided that the level of a parameter is either naturally occurring or unrelated to mining activities.

Table 6.1.2.1: Shag River at McCormicks Surface Water Quality Compliance Criteria

Constituent	Standard (g/m^3)
Arsenic	0.01
$Cyanide_{WAD}$	0.1
Copper	0.009
Iron	0.2
Lead	0.0025
Zinc	0.12
Sulphate	250
pH (range)	7.0 – 8.5

6.1.2.2 Tipperary Creek Compliance (TC01)

Surface water within Tipperary Creek at TC01 shall not exceed the water quality compliance criteria shown in Table 6.1.2.2, unless infallible evidence can be provided that the level of a parameter is either naturally occurring or unrelated to mining activities.

Table 6.1.2.2: TC01 Surface Water Quality Compliance Criteria

Constituent	Standard (g/m^3)
Arsenic	0.15
$Cyanide_{WAD}$	0.1
Copper	0.009
Iron	1.0
Lead	0.0025
Zinc	0.12
Sulphate	1,000
pH (range)	6.0 – 9.5

6.1.2.3 Cranky Jims Creek Compliance (CJ01)

Surface water within Cranky Jims Creek at CJ01 shall not exceed the water quality compliance criteria shown in Table 6.1.2.3, unless infallible evidence can be provided that the level of a parameter is either naturally occurring or unrelated to mining activities.

Table 6.1.2.3: CJ01 Surface Water Quality Compliance Criteria

Constituent	Standard (g/m^3)
Arsenic	0.15
$Cyanide_{WAD}$	0.10
Copper	0.009
Iron	1.0
Lead	0.0025
Zinc	0.12
Sulphate	1000
pH (range)	6.0 – 9.5

6.1.2.4 TTTSF Groundwater Compliance

Groundwater quality at compliance points bores TT01 to TT04 shall not exceed the water quality compliance criteria shown in Table 6.1.2.4, unless infallible evidence can be provided that the level of a parameter is either naturally occurring or unrelated to mining activities. The iron compliance limit for these bores was increased from 1.0 g/m^3 to 5.0 g/m^3 in 2020 due to high background iron levels, which is reflected in the updated set of resource consents.

Table 6.1.2.4: TTTSF Groundwater Compliance Standards

Constituent	Standard (g/m^3)
Arsenic	0.15
Cyanide$_{WAD}$	0.10
Copper	0.009
Iron	5.0
Lead	0.0025
Zinc	0.12
pH (range)	6.0 – 9.5

6.2 Frasers Waste Rock Stack Monitoring Compliance Criteria

Under consents 96808 V3, 2004.359 V1, RM10.351.09 V1, RM10.351.10 V1 and RM10.351.11, the following compliance criteria apply:

6.2.1 Narrative Standard for Receiving Waters

The waters of the North Branch of the Waikouaiti River, Murphys Creek, and all their tributaries, shall at all times be free of contaminants attributable to mineral processing and associated activities in concentrations which adversely affect directly or indirectly water uses or which adversely affect humans, animals, plants and/or aquatic life.

6.2.2 Numerical Compliance Criteria

6.2.2.1 North Branch Waikouaiti River Compliance Point 1 – (NBWRRF)

Surface water within the North Branch of the Waikouaiti River at NBWRRF (NZTM 1401021 4967166) shall not exceed the water quality compliance criteria (where the metals standards are all soluble determinations) shown in Table 6.2.2.1, unless infallible evidence can be provided that the level of a parameter is either naturally occurring or unrelated to mining activities.

Table 6.2.2.1: NBWRRF Compliance Criteria

Constituent	Standard (g/m^3)
Arsenic	0.15
Cyanide$_{WAD}$	0.1
Copper	0.009
Iron	1.0
Lead	0.0025
Zinc	0.12
Sulphate	1000
pH (range)	6.0 – 9.5

6.2.2.2 North Branch Waikouaiti River Compliance Point 2 – (NB03)

Surface water within the North Branch of the Waikouaiti River at NB03 (NZTM 1405803 4964562) shall not exceed the water quality compliance criteria (where the metals standards are all soluble determinations) shown in Table 6.2.2.2 , unless infallible evidence can be provided that the level of a parameter is either naturally occurring or unrelated to mining activities.

Table 6.2.2.2: NB03 Compliance Criteria

Constituent	Standard (g/m^3)
Arsenic	0.01
$Cyanide_{WAD}$	0.1
Copper	0.009
Iron	0.2
Lead	0.0025
Zinc	0.12
Sulphate	250
pH (range)	6.0 – 9.5

6.2.2.3 Murphys Creek Compliance – (MC01)

Surface water within Murphys Creek at MC01 (NZTM 1403023 4969560) shall not exceed the water quality compliance criteria (where the metals standards are all soluble determinations) shown in Table 6.2.2.3, unless infallible evidence can be provided that the level of a parameter is either naturally occurring or unrelated to mining activities.

Table 6.2.2.3: MC01 Compliance Criteria

Constituent	Standard (g/m^3)
Arsenic	0.15
$Cyanide_{WAD}$	0.10
Copper	0.009
Iron	1.0
Lead	0.0025
Zinc	0.12
Sulphate	1,000
pH (range)	6.0 – 9.5

6.3 Coronation Project

Under consents RM12.378.03, RM12.378.04 and RM12.378.05 the following compliance criteria apply:

6.3.1 Narrative Standard for Receiving Waters

The waters of the Mare Burn, Deepdell Creek and the Shag River, shall at all times be free of contaminants attributable to mineral processing and associated activities in concentrations which adversely affect directly or indirectly water uses or which adversely affect humans, animals, plants and/or aquatic life.

6.3.2 Numerical Compliance Criteria

6.3.2.1 Mare Burn Compliance Point (MB01) and Deepdell Creek Compliance Point (DC08)

Surface water within the Mare Burn at the Mare Burn Compliance Point and within Deepdell Creek at DC08 shall not exceed the water quality compliance criteria shown in Table 6.3.2.1, unless infallible evidence can be provided that the level of a parameter is either naturally occurring or unrelated to mining activities.

Table 6.3.2.1: MB01 and DC08 Compliance Criteria

Constituent	Standard (g/m^3)
Arsenic	0.15
$Cyanide_{WAD}$	0.1
Copper	0.009
Iron	1.0
Lead	0.0025
Zinc	0.12
Sulphate	1,000
pH (range)	6.0 - 9.5 pH units

6.3.2.2 Shag River Compliance Point 1 (Shag @ Loop)

Surface water within the Shag River at the Loop Road northern crossing shall not exceed the water quality compliance criteria shown in Table 6.3.2.2, unless infallible evidence can be provided that the level of a parameter is either naturally occurring or unrelated to mining activities.

Table 6.3.2.2: Shag at Loop Road Compliance Criteria

Constituent	Standard (g/m^3)
Arsenic	0.01
$Cyanide_{WAD}$	0.1
Copper	0.009
Iron	0.2
Lead	0.0025
Zinc	0.12
Sulphate	250
pH (range)	7.0 - 8.5 pH units

6.4 Coronation North Project

Under consents RM16.138.04, RM16.138.05 and RM16.138.09 the following compliance criteria apply:

6.4.1 Narrative Standard for Receiving Waters

The waters of the Mare Burn shall at all times be free of contaminants attributable to mineral processing and associated activities in concentrations which adversely affect directly or indirectly water uses or which adversely affect animals, plants and/or aquatic life.

6.4.2 Numerical Compliance Criteria

6.4.2.1 Mare Burn Compliance Point MB02

Surface water within the Mare Burn at the Mare Burn Compliance Point, MB02 shall not exceed the water quality compliance criteria stated in Table 46.4.2.1(where the metals standards are all soluble determinations), unless infallible evidence can be provided that the level of a parameter is either naturally occurring or unrelated to mining activities.

Table 6.4.2.1: MB02 Compliance Criteria

Constituent	Standard (g/m^3)
Arsenic	0.15
$Cyanide_{WAD}$	0.1
Copper	0.009
Iron	1.0
Lead	0.0025
Zinc	0.12
Sulphate	1000
pH (range)	6.0 - 9.5 pH units
Nitrate	2.4
Ammonia	0.24
Turbidity	30-50% Change in clarity
Suspended Solids	30-50% Change in clarity

6.5 Deepdell North Stage III Project

Under consents RM20.024.09 and RM20.024.14 the following compliance criteria apply:

6.5.1 Narrative Standard for Receiving Waters

The waters of Deepdell Creek and Highlay Creek must at all times be free of contaminants attributable to mineral processing and associated activities in concentrations which adversely affect directly or indirectly water uses or which adversely affect humans, animals, plants and/or aquatic life.

6.5.2 Numerical Compliance Criteria

6.5.2.1 Highlay Creek, Deepdell Creek and Shag River

Surface water within the Deepdell Creek at the Deepdell Creek Compliance Point (DC08), in the waters of Shag River at Loop Road and Highlay Creek at HC02 (immediately upstream of the confluence with Deepdell Creek) must be sampled for the following constituents on a monthly basis. The samples must not exceed the following water quality compliance criteria (where the metals standards are all soluble determinations), and unless infallible evidence can be provided that the level of a parameter is either naturally occurring or unrelated to mining activities, as shown in the tables below.

Table 6.5.2.1a: HC02 Compliance Criteria

Constituent	Standard (g/m^3)
Arsenic	0.013
$Cyanide_{WAD}$	N/A
Copper	0.0014
Iron	0.3
Lead	0.0034
Zinc	0.008
Sulphate	1,000
pH (range)	6.0 - 9.5 pH units
Nitrate Nitrogen (mg/L as an annual median)	=<2.4
Nitrate Nitrogen (mg/L as 95^{th} percentile)	<3.5

Table 6.5.2.1b: DC08 Compliance Criteria

Constituent	Standard (g/m^3)
Arsenic	0.15
$Cyanide_{WAD}$	0.1
Copper	0.009
Iron	1.0
Lead	0.0025
Zinc	0.12
Sulphate	1,000
pH (range)	6.0 - 9.5 pH units
Nitrate Nitrogen (mg/L as an annual median)	=<2.4
Nitrate Nitrogen (mg/L as 95^{th} percentile)	<3.5

Table 6.5.2.1c: Shag River at Loop Road Compliance Criteria

Constituent	Standard (g/m^3)
Arsenic	0.01
$Cyanide_{WAD}$	0.1
Copper	0.009
Iron	0.2
Lead	0.0025
Zinc	0.12
Sulphate	250
pH (range)	7.0 - 8.5 pH units

For HC02 the median concentration calculated on a rolling basis from 36 consecutive monthly samples must not exceed the water quality compliance criteria for arsenic, copper, lead and zinc, until such time that the consent holder has developed site specific guidelines values in accordance with Water Quality Management Framework set out in the Australian & New Zealand Guidelines for Fresh & Marine Water Quality.

Note: Copper, lead and zinc standards are hardness related limits in accordance with an assumed hardness value of 100g/m3 CaCO3 and will vary depending on actual hardness according to established calculation methodologies.

6.6 Mixed Tailings Impoundment and Southern Pit 11

Under consents RM10.351.33, RM10.351.34, RM2006.303, RM2006.304, RM2006.305, RM10.351.33, RM10.351.34, 2006.303, 2006.304 and 2006.305, the following compliance criteria apply.

6.6.1 Narrative standard for receiving waters

The waters of Deepdell Creek, Battery Creek, their associated tributaries, the North Branch of the Waikouaiti River and the Shag River, shall at all times be free of contaminants attributable to mineral processing and associated activities in concentrations which adversely affect directly or indirectly water uses or which adversely affect animals, plants and/or aquatic life.

6.6.2 Numerical Compliance Criteria

6.6.2.1 MTI and SP11 Groundwater Compliance

Groundwater quality at compliance points bores GW18-GW25, GW3, GW38, GP01, P1 SPM306, SPMW07 and SPMW08 shall not exceed the water quality compliance criteria shown in Table 6.6.2.1 , unless infallible evidence can be provided that the level of a parameter is either naturally occurring or unrelated to mining activities.

Table 6.6.2.1: TTTSF and SP11 Groundwater Compliance Standards

Constituent	Standard (g/m^3)
Arsenic	0.15
$Cyanide_{WAD}$	0.10
Copper	0.009
Iron	1.0
Lead	0.0025
Zinc	0.12
pH (range)	6.0 – 9.5

6.6.2.2 Shag River Compliance Point 1 (Shag River at Loop Road)

Surface water within the Shag River at Loop Road (NZTM 1409502 4978231) shall not exceed the following water quality compliance criteria (where the metals criteria are all soluble determinations), unless infallible evidence can be provided that the level of a parameter is either naturally occurring or unrelated to mining activities, as shown in Table 6.6.2.2.

Table 6.6.2.2: Shag at Loop Road Compliance Criteria

Constituent	Standard (g/m^3)
Arsenic	0.01
Cyanide$_{WAD}$	0.1
Copper	0.009
Iron	0.2
Lead	0.0025
Zinc	0.12
Sulphate	250
pH (range)	7.0 - 8.5 pH units

6.6.2.3 Deepdell Creek Compliance Point (DC08)

Surface water within Deepdell Creek at DC08 (NZTM 1401801 4976083) shall not exceed the following water quality compliance criteria (where the metals criteria are all soluble determinations), unless infallible evidence can be provided that the level of a parameter is either naturally occurring or unrelated to mining activities, as shown in Table 6.6.2.3.

Table 6.6.2.3: DC08 Compliance Criteria

Constituent	Standard (g/m^3)
Arsenic	0.15
Cyanide$_{WAD}$	0.1
Copper	0.009
Iron	1.0
Lead	0.0025
Zinc	0.12
Sulphate	1,000
pH (range)	6.0 - 9.5 pH units

6.6.2.4 North Branch Waikouaiti River Compliance Point 1 (NBWRRF)

Surface water within the North Branch of the Waikouaiti River at NBWRRF (NZTM 1401021 4967166) shall not exceed the following water quality compliance criteria (where the metals criteria are all soluble determinations), unless infallible evidence can be provided that the level of a parameter is either naturally occurring or unrelated to mining activities, as shown in Table 6.6.2.4.

Table 6.6.2.4: NBWRRF Compliance Criteria

Constituent	Standard (g/m^3)
Arsenic	0.15
Cyanide$_{WAD}$	0.1
Copper	0.009
Iron	1.0
Lead	0.0025
Zinc	0.12
Sulphate	1,000
pH (range)	6.0 - 9.5 pH units

6.6.2.5 North Branch Waikouaiti River Compliance Point 2 (NB03)

Surface water within the North Branch of the Waikouaiti River at NB03 (NZTM 1405803 4964562) shall not exceed the following water quality compliance criteria (where the metals criteria are all soluble determinations), unless infallible evidence can be provided that the level of a parameter is either naturally occurring or unrelated to mining activities, as shown in Table 6.6.2.5.

Table 6.6.2.5: NB03 Compliance Criteria

Constituent	Standard (g/m^3)
Arsenic	0.15
Cyanide$_{WAD}$	0.1
Copper	0.009
Iron	1.0
Lead	0.0025
Zinc	0.12
Sulphate	250
pH (range)	6.0 - 9.5 pH units

6.7 Golden Point Underground

Under consents RM20.130.04, RM20.130.05 and RM20.130.06, the following compliance criteria apply.

Note: No specific numerical compliance standards are in place for groundwater/seepage at GPUG.

6.7.1 Narrative Standard for Receiving Waters

The waters of the Deepdell Creek shall at all times be free of contaminants attributable to mineral processing and associated activities in concentrations which adversely affect directly or indirectly water uses or which adversely affect humans, animals, plants and/or aquatic life.

6.7.2 Numerical Compliance Criteria

Surface water within the Deepdell Creek at the Deepdell Creek Compliance Point (DC08), in the waters of Shag River at Loop Road must be sampled for the following constituents on a monthly basis. The samples must not exceed the following water quality compliance criteria (where the metals standards are all soluble determinations), and unless infallible evidence can be provided that the level of a parameter is either naturally occurring or unrelated to mining activities, as shown in Table 6.7.2 below.

Table 6.7.2: GPUG Surface Water Compliance Criteria (sampled monthly)

Constituent	DC08	Shag at Loop Road
Arsenic	0.15	0.01
$Cyanide_{WAD}$	0.1	0.1
Copper	0.009	0.009
Iron	1.0	0.2
Lead	0.0025	0.0025
Zinc	0.12	0.12
Sulphate	1,000	250
pH (range)	6.0 - 9.5	7.0 - 8.5
Nitrate Nitrogen (mg/L as an annual	=<2.4	
Nitrate Nitrogen (mg/L as 95^{th}	<3.5	

The median concentration calculated on a rolling basis from 36 consecutive monthly samples must not exceed the water quality compliance criteria for Nitrate.

Note: Copper, lead and zinc standards are hardness related limits in accordance with an assumed hardness value of 100g/m3 CaCO3 and will vary depending on actual hardness according to established calculation methodologies.

6.8 Frasers West Pit Project Compliance Criteria

Under the compliance and monitoring schedule attached to RM20.167.01, RM20.167.02, RM20.167.03, RM20.167.04, the following compliance criteria apply.

Note: no specific numerical groundwater compliance criteria are in place for Frasers West Pit consents, only surface water.

6.8.1 Narrative Standard for Receiving Waters

The waters of the North Branch of the Waikouaiti River, Murphys Creek and all their tributaries must at all times be free of contaminants attributable to mineral processing and associated activities in concentrations which adversely affect directly or indirectly water uses or which adversely affect humans, animals, plants and/or aquatic life.

6.8.2 Numerical Compliance Criteria

Surface water within the North Branch of the Waikouaiti River at NBWRRF (NZTM E1401021 N4967166) must not exceed the following water quality compliance criteria (where the metals standards are all soluble determinations), unless infallible evidence can be provided that the level of a parameter is either naturally occurring or unrelated to mining activities, as shown in Table 6.8.2 below:

Table 6.8.2: NBWRRF Compliance Criteria

Constituent	Standard (g/m^3)
Arsenic	0.15
$Cyanide_{WAD}$	0.1
Copper	0.009
Iron	1.0
Lead	0.0025
Zinc	0.12
Sulphate	1,000
pH (range)	6.0 - 9.5 pH units

6.9 Golden Bar Compliance Criteria

Under the Golden Bar consents, the following compliance criteria apply. The waters of the North Branch of the Waikouaiti River and Murphys Creek shall at all times be free of contaminants attributable to mineral processing and associated activities in concentrations which adversely affect directly or indirectly water uses or which adversely affect humans, animals, plants or aquatic life.

6.9.1 Numerical Compliance Criteria

Surface water at the MC02 compliance point on Murphys Creek must not exceed the following criteria, where all metals are soluble determinations.

Table 6.9.1a MC02 Compliance Criteria

Constituent	Standard (g/m3)
Arsenic	0.15
Copper	0.009
Iron	1.0
Lead	0.0025
Zinc	0.12
pH (range)	6.0 - 9.5 pH units

Surface water at the compliance point NB03 on the North Branch of the Waikouaiti River must not exceed the following criteria.

Table 6.9.1b NB03 Compliance Criteria

Constituent	Standard (g/m3)
Arsenic	0.01
Copper	0.009
Iron	1.0
Lead	0.0025
Zinc	0.12
pH (range)	6.0 - 9.5 pH units

Pit Lake and lake overflow water quality must not exceed the following standards.

Table 6.9.1c Golden Bar Pit Lake Compliance Criteria

Constituent	Standard (g/m3)
Arsenic	0.15
Copper	0.009
Iron	1.0
Lead	0.0025
Zinc	0.12
pH (range)	6.0 - 9.5 pH units

6.10 Battery Creek Silt Pond Compliance Criteria

Under consent RM20.424.01, the following compliance criteria apply. Note that no groundwater monitoring is required under this consent and no specific compliance criteria apply for the actual silt pond.

6.10.1 Numerical Compliance Criteria

Surface water sampled from Battery Creek at SPMP1, and Deepdell Creek at DC08, must not exceed the following criteria (where metals are all soluble determinations), as shown in the tables below.

Table 6.10.1a SPMP1 Compliance Criteria

Constituent	Standard (g/m3)
Arsenic	0.15
$Cyanide_{WAD}$	0.1
Copper	0.009
Iron	1.0
Lead	0.0025
pH (range)	6.0 - 9.5 pH units

Table 6.10.1b DC08 Compliance Criteria

Constituent	Standard (g/m3)
Arsenic	0.15
$Cyanide_{WAD}$	0.1
Copper	0.009
Iron	1.0
Lead	0.0025
Zinc	0.12
pH (range)	6.0 - 9.5 pH units

6.11 Northern Gully and Maori Tommy Silt Pond Compliance Criteria

Under consent RM20.024.02 and RM20.424.03, the following compliance criteria apply. Note that no groundwater monitoring is required under these consent and no specific compliance criteria apply for the actual silt ponds.

6.11.1 Numerical Compliance Criteria

Surface water sampled from Deepdell Creek at DC08, must not exceed the following criteria (where metals are all soluble determinations), as shown in the table below.

Table 6.11.1 DC08 Compliance Criteria

Constituent	Standard (g/m3)
Arsenic	0.15
$Cyanide_{WAD}$	0.1
Copper	0.009
Iron	1.0
Lead	0.0025
Zinc	0.12
pH (range)	6.0 - 9.5 pH units

7 AQUATIC BIOLOGICAL MONITORING

Under resource consents 96808, 2004.359, RM10351.09, RM10.351.10, RM 10.351.11, RM 10.351.14, RM10.351.16, RM10.351.17, RM10.351.22, RM10.351.25, RM10.351.26, RM10.351.27, RM12.378.03, RM12.378.04, RM12.378.05, RM16.138.04, RM16.138.05, RM16.138.09, RM20.024.09, RM20.024.14 RM20.130.02, RM20.130.04, RM20.130.05 and RM20.130.06, RM20.167.01, RM20.167.02, RM20.167.03, and RM20.167.04, an aquatic biological monitoring programme is required to be designed undertaken by a suitably qualified and experienced freshwater biologist.

The following sites must be monitored.

- Deepdell Creek at DC08
- Deepdell Creek at DC00, upstream of the Camp Creek confluence
- DC01 Deepdell Creek
- DC03 Deepdell Creek
- HC02 Highlay Creek, immediately above the confluence with Deepdell Creek
- Trimbells Gully at TG01, downstream of the confluence with Maori Hen Creek
- Camp Creek at CC02, approx. 750m upstream of Horse Flat Road
- Murphys Creek at MC01
- North Branch of the Waikouaiti River at NBWRRF
- Tipperary Creek at TC01, downstream of TTTSF
- Cranky Jims at CJ01 (Hocking Road Stone Culvert)
- Mare Burn at MB01
- Mare Burn at MB02

Monitoring of macro-invertebrates and periphyton must be carried out at each of the sites on one occasion during each of the following periods each year, unless there are insufficient flows to support any significant aquatic community. A flow reading must also be completed on each monitoring occasion.

- December to February inclusive
- March to May inclusive
- June to August inclusive
- September to November inclusive

If the following nuisance algae growth or nitrate triggers are detected, an investigation will be required and appropriate response undertaken.

Monitoring Location	Periphyton Trigger	Nitrate Toxicity
Deepdell Creek DC08 Deepdell Creek at DC03 Highlay Creek HC02	30% filamentous algae cover >2cm long	The median nitrate concentration to exceed =<2.4 mg/L and the 95th percentile nitrate concentration to exceed <3.5

Macroinvertebrate sampling must include calculation and consideration of Macroinvertebrate Community Index (MCI), its semi-quantitative variant (SQMCI), the percentage of EPT taxa and the percentage of EPT individuals.

An annual electric fishing survey must be carried out at each of the sites (unless there are insufficient flows) during the period 1 February to 31 March inclusive. A flow reading must be completed at each site.

Electric fish surveying must be consistent with the method developed and documented under Compliance and Monitoring Schedules for the Consent Holders existing resource consents.

This method must be followed for all fish surveys undertaken in accordance with this schedule.

All aquatic biology monitoring must be undertaken during low or stable flows.

Components to be monitored:

- Benthic macroinvertebrates – the taxonomic composition and abundances must be monitored at all sites.
- Fish – the taxonomic composition and abundances of fish must be monitored by an electric fishing survey at each of the sites.
- Benthic algae – a qualitative assessment of the height and percentage cover of dominant species of benthic algae must be made at all sites.
- A visual estimation from the stream bank of the habitat length (in metres) and the percentage of stream bed within the wetted area covered by sediment < 2 millimetres in size, for each riffle, run and pool present and take a representative photograph.

8 MONITORING AND REPORTING

8.1 Review of Monitoring Results

Surface and groundwater monitoring results are reviewed upon receipt from the laboratory and compared with the compliance limits specified in Section 6 of this WQMP. This is to ensure that the compliance criteria detailed in Section 6 are not exceeded unless infallible evidence can be provided to the Council that the level of a parameter is either naturally occurring or unrelated to mining activities.

If OceanaGold identifies any non-compliance it will inform the Otago Regional Council in accordance with Section 8.2 and investigate the non-compliance.

8.2 Reporting of Non-Compliance

OceanaGold will report any non-compliance with the compliance criteria to the Otago Regional Council (compliance@orc.govt.nz) within 24 hours of the non-compliance first being detected.

8.3 Environmental Compliance Reporting

OceanaGold presents results of all compliance monitoring to the Otago Regional Council in a comprehensive quarterly environmental monitoring report.

Should upward trends in surface and ground water quality be identified, a review will be conducted to determine if the trends are likely to continue to a point they reach the compliance limit and to identify when this is likely to occur so that mitigation measures can be put into place prior to exceeding the compliance criteria.

If non-complaint results are identified OceanaGold will conduct a review of water quality to determine whether additional mitigation measures should be adopted. It should be noted that there are a number of sites that report historical non compliances at each sampling event. These have been discussed with the Otago Regional Council and generally involve groundwater bores that had levels of iron in excess of the compliance limit prior to commencement of monitoring.

9 WATER QUALITY MITIGATION OPTIONS

9.1 TTTSF and Frasers Waste Rock Stack

The primary issues for water quality compliance in association with the MPIII expansion activities are sulphate, arsenic and iron (Golder Associates, 2011). Sulphate is less likely to become naturally attenuated in the surface water system than other minerals; therefore mitigation is focused around ensuring compliance with the sulphate criteria. Water quality issues associated with erosion and sediment control are detailed in a separate Erosion and Sediment Control Plan.

Water quality mitigation options were assessed in 2011 by Golder Associates, and a mitigation approach agreed which combines a suite of measures to address projected water quality issues in the receiving water bodies around the Macraes Gold Project (MGP). The mitigation options proposed are subject to adaptive management changes following ongoing monitoring, investigation and testing of treatment technologies during the mine operational phase (Golder Associates, 2011). A full suite of mitigation options under consideration for both operational and mine closure phases are detailed in Table 1 of the following report:

- Macraes Phase III Project, *Water Quality Effects Mitigation Options, April 2011* (Golder Associates).

Potential mitigation options assessed for mine operation and post-mine closure in relation to the TTTSF are summarised in Table *59*.

Table 59: TTTSF Potential Mitigation Options

Mitigation Type	Mitigation Option	Applicability
Intercept and re-route Mine Influenced Water (MIW) to location other than directly to surface water catchments	Underdrains at new TSF	TTTSF
	Pump TSF discharges and groundwater seepage to Frasers Pit	MTI, SP11 and TTTSF discharges following TSF closure
	Divert TSF discharge to Frasers Pit permanently	TTTSF
Creek base flow augmentation through construction of freshwater dams to allow for dilution of surface water bodies which receive direct discharge of MIW	Tipperary Creek freshwater dam, upstream location, possibly with augmentation from Taieri or other	Tipperary Creek and Shag River during operation or closure stages
	Tipperary Creek freshwater dam, downstream location	
	Groundwater bores to supplement flows in Tipperary Creek	

Mitigation Type	Mitigation Option	Applicability
	Low permeability cap on TTTSF	Tipperary Creek and Shag River post-closure
	Partial low permeability liner of base of TTTSF	
	Full low permeability liner on base of TTTSF	
Hydraulic control of MIW and reduction of potential for leaching through construction of low permeability caps and liners	Full encapsulation of TTTSF	Tipperary Creek and Shag River post-closure
	Active treatment of process water	
	Active treatment of TSF drain discharges and groundwater seepage	
	Passive treatment of TSF drain discharges and groundwater seepage	

Mitigation options investigated as options during mine operation and post-mine closure in relation to the Frasers Waste Rock Stack are summarised in Table *60*.

Table 60: Frasers Waste Rock Stack Potential Mitigation Options

Mitigation Type	Mitigation Option	Applicability
Intercept and re-route Mine Influenced Water (MIW) to location other than directly to surface water catchments	Underdrains at new WRS	Frasers South Waste Rock Stack.
	Pump WRS runoff and shallow groundwater seepage to Frasers Pit or Golden Point Pit	Frasers Waste Rock Stack.
	Divert WRS runoff and shallow groundwater seepage to Frasers Pit or Golden Point Pit	Frasers South and East Waste Rock Stack.

Mitigation Type	Mitigation Option	Applicability
Dilute groundwater contaminant plumes prior to discharge	Enhanced recharge of WRS runoff to groundwater (managed groundwater recharge)	Frasers West Waste Rock Stack.
Hydraulic control of MIW and reduction of potential for leaching through construction of low permeability caps and liners	Low Permeability cap on WRS	All surface receiving bodies post-closure
	Passive treatment of WRS groundwater seepage	All affected surface receiving water bodies where mitigation indicated
	Covered evaporation basins for WRS runoff and groundwater seepage.	

9.2 Coronation Project

The primary issues for water quality compliance in association with the Coronation Project activities are sulphate, arsenic and iron (URS, 2013). Sulphate is less likely to become naturally attenuated in the surface water system than other minerals; therefore mitigation is focused around ensuring compliance with the sulphate criteria.

Water quality issues associated with erosion and sediment control and related mitigation options are detailed the Oceana Gold (NZ) Ltd, Erosion and Sediment Control Plan.

Water quality mitigation options were assessed in 2013 by URS, and a mitigation approach agreed which combines a suite of measures to address projected water quality issues in the receiving water bodies around the Coronation Project.

Potential mitigation options assessed for mine operation and post-mine closure in relation to the Coronation Project are summarised as follows:

- Increase the frequency of sampling in Deepdell Catchment (DC08) to monthly to improve the dataset already established at the Macraes Gold Operation;
- Minimise the extent of the Waste Rock Stack that is in the Deepdell Catchment;
- Keep tight control on disturbed areas through proactive revegetation. This will minimize exposure times of disturbed rock to no longer than necessary which in turn will minimize water and oxygen ingress, particularly for the Waste Rock Stack; and
- Ensure that any water discharge from the proposed Coronation Pit Lake is substantially diluted prior to reaching the Mare Burn compliance point (MB01).

9.3 Coronation North Project

Elevated concentrations of sulphate, arsenic and iron are expected in surface water from Coronation North WRS (Golder Associates, 2016). Arsenic and iron are likely to be naturally attenuated in the surface water before reaching the compliance point and are unlikely to exceed the compliance criteria. Mitigation options will be required to ensure that the sulphate compliance criteria at MB02 can be met, as modelling indicates the compliance limit will be exceeded during low flow periods.

The Coal Creek Freshwater Dam was consented as part of the Coronation Project to provide water quality mitigation. This consent has not yet been exercised. It will be used to increase the base flow of the Mare Burn by providing a constant discharge upstream of MB02. Coal Creek Freshwater Dam will only be constructed if a Best Practicable Option Report identifies it as being essential to achieve compliance.

The resource consent compliance limit for sulphate at MB02 was originally set at 400g/m^3 which was significantly lower than the 1000g/m^3 limit that was proposed as part of the resource consent application. Toxicity testing was undertaken on Taieri flathead galaxias to determine their susceptibility to sulphate and a consent variation application submitted justifying an increase in the limit to 1000g/m3.

As with the Coronation Project, proactive revegetation of Coronation North Waste Rock Stack will occur to minimise exposure times of disturbed rock. The waste rock stack has been reduced in size from its original design to avoid several ecological and heritage features, thus reducing the overall volume of waste rock influencing catchment water quality. Construction of the stack has involved the encapsulation of high sulphate material in the center of the stack.

Water quality issues associated with erosion and sediment control and related mitigation options are detailed the Oceana Gold (NZ) Ltd, Erosion and Sediment Control Plan.

9.4 Golden Point Underground

The potential effects of Golden Point Underground on flows in Deepdell Creek are considered to be less than minor, hence mitigation measures will not be required to address post-closure effects on flow rate. However, potential seepage from the Golden Point Underground into Deepdell will require mitigation measures to reduce the risk of any water quality compliance exceedances at DC08 and further downstream in the Shag River.

Following closure, the developing Golden Point Pit lake will be managed separately from the flooded Golden Point Underground. This step is similar in intent to the sealing of the historical underground workings that is incorporated in the current mine closure plan. Water levels in Golden Point Pit are projected to rise to elevations of approximately 370 mRL (Golder 2011d) following MGP closure. If the Golden Point Underground mine workings offer open flow paths from Golden Point Pit to Deepdell Creek, the discharges that eventuate can be expected to exceed those recorded from the historical workings in the past. These past discharges led to non-compliance with the sulfate limit applicable at DC08.

Minimising the potential flows from Golden Point Pit into the underground workings would require effective sealing of the mine portal. Furthermore, mine planning would need to ensure that any chimney collapse above the shallowest mine stopes would not daylight in the lower slopes of Golden Point Pit wall. If water inflows from Golden Point Pit to Golden Point Underground are minimised, the issue of managing mine water discharges from Golden Point Underground to Deepdell Creek is also predominantly managed. Under this scenario, most of the groundwater seepage entering Golden Point Pit over the long term will be derived from downward seepage through Northern Gully WRS. If Golden Point Underground were not developed, this seepage would instead flow into Northern Gully and be discharged to Deepdell Creek at that point.

Currently consented post-closure water quality mitigation measures take into account the discharge of seepage and run-off water from Northern Gully WRS. These measures enable OceanaGold to meet existing water quality criteria at both DC08 and downstream in Shag River following mine closure. Diverting these WRS seepage flows through the underground workings would not substantially change the overall rate of mine water discharge to Deepdell Creek.

9.5 Deepdell North Stage III

The mitigation measures noted by Golder that are most relevant to the Deepdell North III project are ongoing monitoring to confirm model projections and assess effects, ongoing pumping of Tailings Storage Facility (TSF) water, as well as various collection systems across the mine that intercept water in ponds and drains for process re-use, and to prevent release. Pumping of TTTSF and other water sources to Frasers Pit following cessation of mine operations for up to 20 years following closure of each facility will also allow discharge flow rates to decrease to the point where other passive mitigation measures can be installed if deemed necessary.

A potential water quality mitigation option is construction of a fresh water dam on Camp Creek to provide a base flow to Deepdell Creek, allowing us to manage and effectively mitigate sulphate concentrations in Deepdell Creek and in the Shag River as far as the confluence with McCormicks Creek.. The dam would also provide the opportunity for seasonal or flow matched discharges of freshwater to effectively mitigate the sulphate concentrations in the Shag River. OGNZL holds the appropriate resource consents for the construction of this dam, however construction has not yet been deemed necessary.

9.6 Frasers West Pit Project

Documented and peer reviewed mine water models of the site used to support consenting of the MPIII Project (Golder 2011b, 2011c) indicate the water level in Frasers Pit would not come within 100 m of the pit overflow elevation over a 150-year projection period. Pit lake water is therefore not projected to contribute to off-site surface water flows or influence off-site water quality. Overall, the planned development of the FWP, the Frasers South Backfill, the Frasers Slip Backfill and the noise control bund is not expected to have a measurable effect on off-site water quality, either during the operational period of the MGP or following site closure, therefore no mitigation is planned.

10 WATER QUALITY MITIGATION – IMPLEMENTATION TIMELINE

The following mitigation options have been screened and represent the suite of ‘preferred’ options which may be necessary to implement based on on-going monitoring and compliance results and the phase of mining (i.e. concurrent with operations (“Operational Phase”), or “Post-closure”).

Anticipated timing of the implementation of these mitigation options is separated into both operational and post-closure phases in *Tables 61, 62,63 and 64* below:

10.1 Tipperary Creek and Shag River Compliance – Operational Phase

Table 61: Tipperary Creek and Shag River Mitigation – Operational Phase

Mitigation Option	Implementation Timeline
Capture TTTSF drains and groundwater seepage in silt pond/sump. Pump back into impoundment	Prior to deposition of tailings in TTTSF with pumping continuing for the duration of the operational phase of the TTTSF.

10.2 Tipperary Creek and Shag River Compliance – Post-closure

Table 62: Tipperary Creek and Shag River Mitigation – Post Closure

Mitigation Option	Implementation Timeline
Pump TTTSF drains and groundwater seepage to Frasers Pit for up to 20 years	Upon decommissioning of TTTSF
Inject water to Frasers Underground on long-term basis	Upon decommissioning of FRUG and TTTSF
Passive treatment at TSF (drain and groundwater seepage)	Upon decommissioning of TTTSF

10.3 Murphys Creek and North Branch Waikouaiti River Compliance - Operational Phase

Table 63: Murphy's Creek and North Branch Waikouaiti River Mitigation – Operational Phase

Mitigation Option	Implementation Timeline
Pump WRS runoff and groundwater seepage to Frasers Pit.	Pumping occurs on an as required basis at times when flows in Murphys Creek are low on a prolonged basis and when the Murphys Silt pond is near to capacity.
Flow regime in upper Murphys catchment extended during dry periods by use of small farm dams to provide a base flow.	A number of farm dams are already in place.
Silt pond outlet closed and releases timed for periods of good creek base flow and rainfall events	Currently utilised at Murphys Creek Silt pond on an ongoing basis.

10.4 Murphys Creek and North Branch Waikouaiti River Compliance – Post-closure

Table 64: Murphys Creek and North Branch Waikouaiti River Mitigation – Post Closure

Mitigation Option	Implementation Timeline
Interception drains for shallow groundwater down-gradient from the Frasers West WRS in the NBWR catchment with discharge to Frasers Pit.	Upon decommissioning of FRUG and Frasers Pit
Interception drains around the southern side of the proposed Frasers South WRS with discharge to the existing backfill in the Golden Ridge Pit (Southern extent of Frasers Pit).	Upon decommissioning of FRUG and Frasers Pit
Collection of WRS seepage and piping to Frasers Pit	Upon decommissioning of FRUG and Frasers Pit
Passive treatment of runoff and groundwater seepage from WRS's	Upon decommissioning of Frasers Pit and FRUG

10.5 Coronation Project

The increase in the frequency of sampling in Deepdell Catchment (DC08) to monthly to improve the dataset already established at the Macraes Operation commenced in October 2014.

The extent of the Waste Rock Stack that is in the Deepdell Catchment has already been minimised through the consenting of the revised waste rock stack design plans.

A tight control will be kept on disturbed areas through proactive revegetation throughout the operations phase. This will minimise exposure times of disturbed rock to no longer than necessary which in turn will minimise water and oxygen ingress, particularly for the Waste Rock Stack.

Water discharge from the proposed Coronation Pit Lake will be monitored once the Pit Lake has been filled to ensure that there is sufficient dilution prior to the Mare Burn compliance point to ensure the integrity of the water quality.

10.6 Coronation North Project

The current mitigation option for downstream water quality in the Mare Burn catchment is the construction of the Coal Creek Freshwater Dam, which was consented as part of the Coronation Project. Modelling of water quality as part of the Coronation North resource consent application indicated that the Coal Creek Freshwater Dam would be required approximately six years after commencement of construction of the Waste Rock Stack. This dam will only be constructed if a Best Practicable Option Report identifies it as being essential to achieve compliance.

The discharge from the main waste rock stack seepage point will be monitored on a continual basis and combined with the water quality data will allow for prediction of downstream water quality and provide an indication of when mitigation measures will need to be implemented.

11 CORONATION NORTH PROJECT TSS AND NTU MONITORING

The monitoring schedule for Coronation North includes the requirement to monitor surface water for Total Suspended Sediment (TSS) and Nephelometric Turbidity Unit (NTU) parameters. A compliance limit of 30 – 50% change in clarity is specified for both turbidity and suspended solids. This is included in the compliance criteria for the updated consent, RM16.138.04 V1.

OceanaGold proposes to undertake TSS and NTU monitoring at the surface water sites on a monthly basis to establish a dataset of baseline information for determination of appropriate compliance limits. To support the assessment site specific monitoring at MB02 will occur under various flow regimes along with a review of TSS and NTU data and information in surface waters within the Shag and Taieri Rivers catchments.

12 RESPONSIBILITIES

OceanaGold as the consent holder has the ultimate responsibility to ensure that all statutory requirements and conditions of consent relating to water quality are complied with and mining activities are carried out in accordance with the WQMP.

Specifically, the following roles share operational responsibility for ensuring mining activities are carried out in accordance with this WQMP:

- The General Manager Macraes Operation;
- The Open Pit Mine Manager;
- The Process Manager; and
- The Community and Environment Manager.

These roles have overall responsibility at the site for ensuring that potential water quality effects are avoided or mitigated as far as practicable.

The Environment and Community Manager has the following associated responsibilities:

- Responsibility to ensure that the surface water and groundwater monitoring programme is carried out as required; and
- Responsibility to ensure the WQMP is current and reviewed annually.

All contractors and staff working on site are to ensure that their activities comply with the requirements of the WQMP.

13 REPORTING

OceanaGold will:

- Inform the Otago Regional Council (ORC) of any non-compliances as evident from water quality results obtained from monitoring as outlined in Sections 3, 4 and 6;
- Report water quality results in a Quarterly Monitoring Report, submitted to ORC within 30 days of the end of each quarter.
- Provide ORC with an updated copy of the WQMP if any significant revisions of the WQMP are made during the year; and/or
- Provide ORC with a copy of the WQMP following annual review, as part of the Project Overview and Annual Work and Rehabilitation Plan.

14 WQMP REVIEW PROCEDURE

The WQMP shall be reviewed annually and updated as necessary.

APPENDIX A - SITE PERSONNEL CONTACT PHONE NUMBERS

(Complaints and Emergencies)

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