Engineering Geology Ltd
CONSULTING GEOTECHNICAL, GEOLOGICAL AND EARTHQUAKE ENGINEERS

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Ref: 8122

OCEANA GOLD (NEW ZEALAND) LTD
MACRAES GOLD PROJECT
CORONATION NORTH PROJECT
COAL CREEK FRESHWATER DAM
TECHNICAL REPORT

Prepared for:

12 May 2016

Oceana Gold (NZ) Ltd
P O Box 5442
Dunedin
OTAGA

CONTENTS

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1.0 INTRODUCTION

Oceana Gold (New Zealand) Limited (OceanaGold) propose to construct a freshwater storage dam in Coal Creek, north of the Macraes Gold Project, at Macraes Flat in East Otago (refer Figure 1). The dam is referred to as the Coal Creek Freshwater Dam and is located north west of the Coronation North Project as shown in Figure 2.

Golder Associates have carried out water management studies for the Coronation North Project and the Coal Creek Dam is a potential mitigation requirement of this work (Ref.1). Their water modelling studies show that the dam requires a storage volume of approximately 685,000m^3.

Engineering Geology Ltd (EGL) has been contracted by OceanaGold to assess the feasibility of constructing the Coal Creek Freshwater Dam and prepare a technical report. This report describes the technical aspects of the proposed dam and is to support the application for Resource Consent. Detailed design will be carried out for Building Consent following Resource Consent approval and confirmation that the dam is required for the development of the Coronation North Project. The final design will be documented in a Design Report which will be used to support the application for a Building Consent.

The maximum height of the dam (crest to downstream toe) is about 27m with a reservoir area, ie at normal top water level, of about 9.3ha. The fill volume required for the embankment construction is about 30,000m3. No detailed hypothetical dam breach study has been carried out for the Coal Creek Freshwater Dam and preliminary review of the downstream catchment indicates that it will be either Low or Medium PIC. For this technical report a Medium PIC has conservatively been adopted. The detailed dam breach study will be carried out prior to the detailed design.

2.0 SITE GRID

All plan grids, references and geological orientations are to mine north which is approximately 45 degrees anti-clockwise from true north.

3.0 SITE SETTING

3.1. General

The location of the proposed Coal Creek Freshwater Dam is shown in Figures 2 and 3. It is to the north-west of the Coronation North Project and is located in Coal Creek, which flows into the Mare Burn, before flowing into the Taieri River about 7.5km downstream of the Coal Creek Freshwater Dam. The dam embankment spans north-east south-west across a narrow gulley. The northern abutment is at about 1V:2.2H and the southern abutment about 1V:2.5H. The gully floor at the embankment site slopes downstream at about 1V:40H.

3.2. Site Climate

The mean annual rainfall for the site is about 650mm. From previous hydrological studies carried out at the Macraes Gold Project it is estimated that about 80% of the mean rainfall is lost from the area through evaporative process. These processes include evaporation from surface water features (e.g. streams and ponds) and the soil capillary fringe, as well as transpiration.

4.0 GEOLOGY

4.1. Regional Geology

The basement rock in Central and East Otago comprises Otago schist. The Otago schist is primarily composed of psammitic and pelitic grey schist derived from metamorphism of Mesozoic age sandstone and mudstone. In the area of Macraes Flat, the rocks have been metamorphosed to green schist metamorphic facies, giving a strongly foliated fabric of dark grey micaceous and light grey quartz-rich laminations.

From previous geotechnical investigations and mining operations on site it is apparent that the prominent geological structures at the Macraes Gold Project site include a well-developed schistosity with two dominant fault sets. West of the Footwall Fault that is associated with the Hyde – Macraes Shear Zone (HMSZ) the schistosity is folded and has a varying trend over the project area revealing a series of anticlines and synclines. Foliation dips either to the northwest, to the north or to the west and south west. East of the Footwall Fault the schistosity has more of an easterly trend. The Coal Creek Freshwater Dam is located east of the Footwall Fault.

The major set of faults has an eastern trend. They exhibit Miocene (recent tectonic) deformations and are related to the formation of the Alpine Fault. This deformation has faulted and folded the surface within Central and East Otago to produce the present-day basin and range topography. The major east trending fault closest to the proposed dam is the Taieri Ridge Fault that runs along the foothills to the east of the dam site.

4.2. Site Geology

A site walkover was conducted on 7th April 2016. The area of the dam is covered by topsoil with Schist rock exposures on the slopes of the gully. Site specific geotechnical investigation and geological mapping will be carried out for the detailed design.

4.2.1. Soil

Based on previous investigations for the Macraes Gold Project it is anticipated that the depth of soils will typically vary between 0.3m and 2.0m comprising top soil, loess, colluvium and residual soil. The loess generally comprises silt with some clay and occasionally minor amounts of fine sand and fine schist gravel. The colluvium soil generally comprises a mixture of silt and angular schist gravel and cobbles or gravelly silt with minor clay where the silt is derived from reworked loess. The gravel consists of highly weathered angular fine pebble sized clasts of schist.

4.2.2. Schist

The soils are directly underlain by schist comprising well foliated fine grained pelite to coarser grained psammite.

4.2.2.1. Weathering

The depth of weathering of schist rock is generally relatively shallow. Typically the depth of highly or moderately weathered schist (i.e. where weathering has not significantly affected the strength of the schist) is between 2 to 5m depth. Slightly weathered rock (having some discolouration, but not significant strength loss) is often encountered to 30m depth or more.

4.2.2.2. Strength

The unconfined compressive strength for the unweathered schist is generally between about 20MPa and 40MPa normal to the bedding. Schist typically has a lower unconfined compressive strength along the foliation, which reflects the layered nature of the rock and the presence of weak, mica-rich laminations.

4.3. Groundwater Conditions

No direct measurements of groundwater have been made at the proposed dam site. During the site walkover there was no evidence of seepage exiting the slopes and water was present sitting in the gully floor with a very marginal apparent flow. Downward seepage gradients are often apparent on ridges and upward seepage gradients in the valley floors.

Permeability tests have been undertaken at various other dam locations at the Macraes Gold Project. Typical values vary from between about 5×10^{-6}m/s to 5×10^{-9}m/s. These values are from packer tests which measure the permeability over a limited distance. The rock mass permeability is expected to be lower as defects within schist bedrock are generally not persistent.

5.0 SUITABILITY OF SITE

The geological conditions at the proposed dam site are expected to be similar to those elsewhere at the Macraes Gold Project where existing water retention dams, silt ponds and tailings storage facilities have been constructed and have performed successfully for a number of years. We would expect suitable materials for constructing low permeability fill to be obtained from locally derived weathered schist blended with loess and colluvial soils where necessary. As much fill as possible should be derived from within the spillway excavation and the reservoir area, as this will involve the least disturbance to adjacent ground and increase the water storage capacity. Rockfill for the shoulders of the dam and riprap can also be expected to be obtained locally, with most expected to be obtained from the auxiliary spillway excavation. Site specific geotechnical investigation and field mapping will be carried out for the detailed design.

It is noted that there are some features of historical interest on site and OceanaGold has included them in the archaeological investigations for the Coronation North Project.

6.0 SEISMIC HAZARD

In 2005 Geological and Nuclear Sciences (GNS) was engaged to undertake a seismic hazard study for the Macraes Gold Project site (Ref.3). The site is located in an area of relatively low historic seismic activity. However, there are some nearby faults that are capable of generating large earthquakes up to M_w 7. The recurrence intervals for these faults are not known with great accuracy. Recurrence intervals in the range of between about 3,000 and 25,000 years have been considered by GNS in the analyses for the Billy's Ridge and Taieri Ridge faults and between about 1,600 and 10,000 years for the Hyde Fault. The closest active fault to the site is the northern segment of the Taieri Ridge Fault, which is 11km east of the Coal Creek Freshwater Dam embankment.

7.0 IN-SITU ROCK AND EMBANKMENT FILL CHARACTERISTICS

7.1. In-situ Rock

The in-situ rock beneath the proposed Coal Creek Freshwater Dam is assumed to be similar to that used in the design of the water storage dams, silt ponds and tailings storage facilities at the Macraes Gold Project. The following shear strength parameters have been adopted for design.

Effective cohesion	= 50kPa
Effective friction angle	= 40 degrees

7.2. Embankment Fill

Existing tailings and water storage embankments at the site have been successfully constructed using rock from mine waste (varies from slightly to highly weathered schist) with local borrow material (primarily loess and colluvium consisting of loess and highly to completely weathered schist) blended with waste rock where necessary to produce low permeability Zone A1 fill. The Coal Creek Freshwater Dam will be constructed from similar materials borrowed locally rather than obtained from mine waste. However, we would expect the locally borrowed materials to have similar characteristics to the mine waste. A large amount of laboratory and field testing has

been undertaken on mine waste materials, both prior to construction commencing on site and during the operation of the mine. The design parameters have been established accordingly. These same parameters are to be adopted for detailed design for stability analyses of the Coal Creek Freshwater embankment and are summarised below. The shear strength functions for Zones A1 and B are presented below.

Zones A1 and B

Density	22.5 kN/m^3
Shear strength (τ)	$\tau = 2.43\sigma_v'^{0.83}$ where σ_v' is the effective vertical overburden pressure

8.0 DESIGN STANDARDS

The dam is to be designed in accordance with the New Zealand Society of Large Dams (NZSOLD) Dam Safety Guidelines (Ref.2). The design criteria are dependent on the potential impact classification (PIC). No detailed hypothetical dam breach study has been carried out for the Coal Creek Freshwater Dam and preliminary review of the downstream catchment indicates that it will be either Low or Medium PIC. For this technical report a Medium PIC has conservatively been adopted. The detailed dam breach study will be carried out prior to the detailed design.

8.1. Flood Design

For medium potential impact dams NZSOLD recommends the Inflow Design Flood (IDF) for sizing spillways be taken between 1 in 1,000 and 1 in 10,000 AEP. We have adopted a 1 in 5,000 AEP for design.

8.2. Freeboard

NZSOLD Guidelines recommend a minimum freeboard of 0.9m above the IDF which is the criteria adopted at this stage. The size of the spillways has been designed to meet these criteria. The freeboard takes into account wind set up and wave run up affects which will be considered for detailed design.

8.3. Stability

Embankment stability will be analysed during detailed design. The Criteria follows:

- For stability assessment under static (short term and long term) and rapid drawdown conditions the conventional factors of safety of F≥1.5 and F≥ 1.2 will be adopted respectively.

- To assess stability under earthquake loads NZSOLD recommends two performance criteria. The lower level known as the Operating Basis Earthquake (OBE) is based on a 150 year return period level shaking. Embankments should withstand this load with no significant damage (i.e. only minor, repairable damage permitted). The higher level known as the Safety Evaluation Earthquake (SEE) has been taken equal to the medium ground motion associated with a 2,500 year return period. This is recommended for a Medium PIC dam.

9.0 GENERAL DESIGN FEATURES

9.1. General Description

The dam will be designed in accordance with the New Zealand Society Dams (NZSOLD) Dam Safety Guidelines (Ref.2). A layout plan for the proposed dam, including the reservoir is shown in Figure 3. It is formed by an embankment on the north eastern side of the reservoir within a "V" shaped incised gulley. Important features of the proposed dam are summarised below:

Crest level	RL487
Maximum height of dam (crest to downstream toe)	27m
Embankment fill volume	30,000m^3
Normal top water level	RL484
Freeboard at normal top water level	3.0m
Storage at normal top water level	685,000m^3
Maximum depth of water in reservoir at normal top water level	21.5m
Reservoir area at normal top water level	9.3ha
Primary Spillway	Pipe, located on west abutment
Auxiliary Spillway (option A)	Open channel, North abutment Cut Volume 21,000m^3
Auxiliary Spillway (Option B)	Open channel, South abutment Cut Volume 60,000m^3

9.2. Catchment Area

The catchment area for the dam is approximately 650 hectares as shown in Figure 2.

9.3. Water Storage Capacity

The elevation-storage curve for the reservoir is presented in Figure 6. The storage capacity at normal operating level is 685,000m^3. This storage volume includes no allowance for any possible excavation of borrow material from within the reservoir area which could increase the storage volume.

9.4. Spillway

The main objective of the design is to have an economical spillway with a capacity to safely discharge flood flows from a rare event (5000 year design rainfall). This is achieved by equipping the dam with a primary and auxiliary spillway. The primary spillway is located on the west abutment. Two options for the auxiliary spillway have been considered. Option 1 is on the northern abutment and Option 2 on the southern abutment, as shown in Figure 3. Flood routing has been undertaken to assess the performance of the spillways. This is described in detail in Section 10.6.

10.0 DAM DESIGN

10.1. Embankment

The embankment is zoned earthfill/rockfill with the crest at RL487 as shown in Figure 5. It comprises a 5m wide crest with upstream and downstream shoulder slopes of 1V:2H. The materials used to construct the embankment will be sourced mainly from the excavations from the spillway and supplemented by burrow material if deemed necessary. The volume of fill required for construction is approximately 30,000m^3, excluding fill for the foundation excavation.

10.2. Embankment Zoning

Comments of the principal features of the embankment zoning shown in Figure 5 follow:

Zone A1

The primary function of this zone is to limit seepage. It will have a maximum specified permeability of 10^{-7}m/s. It also provides sufficient strength to prevent the likelihood of instability, particularly when subject to the design seismic loads. The low permeability Zone A1 is intended to be formed from locally borrowed weathered schist, supplemented with loess and colluvium where necessary. Zone A1 will require appropriate blending of materials, conditioning and heavy compaction to achieve the specified permeability (10^{-7} m/s).

Zone B

Zone B is a structural rockfill zone forming the upstream and downstream shoulders of the embankment. It will be placed in 0.6m lift heights and subjected to compaction. Zone B fill will be borrowed locally, with most expected to be sourced from the excavation required to form the auxiliary spillway.

Chimney Drain

A 1.0m wide vertical chimney drain is provided, located near the downstream side of Zone A1. It performs two important functions. It functions to intercept seepage so as to limit the development of pore pressures in the downstream shoulder of the embankment. It is also designed to function as a filter to prevent internal erosion and loss of Zone A1 material into Zone B. The top of the chimney drain corresponds to the invert level of the primary spillway (RL484). The chimney drain will be constructed from Type A1 drainage material. It is filter compatible with Zone A1.

10.3. Riprap

Selected durable rock (psammitic schist) will be placed on the upstream shoulder to ensure that wave action will not result in erosion of the upstream shoulder.

10.4. Embankment Drainage

The embankment includes a chimney drain to intercept seepage and to act as a filter to prevent internal erosion (refer Figure 5). Seepage into the chimney drain will move vertically to the chimney drain base collector. The chimney drain base collector consists of Type B drainage material (refer Figure 8). This is free draining

gravel with specific limits on particle size. A perforated pipe is incorporated in the base collector drain. The outlet from the chimney drain is located beneath the downstream shoulder of the dam.

10.5. Spillway Design

Modelling has been undertaken to optimise the design of the spillways and to ensure their performance will meet design objectives.

The primary spillway is located on the west abutment and consists of a 1500mm diameter manhole entry structure with a 710mm diameter polyethylene outlet pipe (710OD, SDR26, PE100) as shown in Figures 3, 4, 7, 10 and 11.

The auxiliary spillway has been sized to safely discharge a 1 in 5,000 event rainfall with a freeboard of 1m (refer Figures 4 and 5). The spillway consists of an open channel excavated into rock with a 20m base width at the inlet control weir. Two spillway options have been considered, including Option 1 which is located on the northern abutment and Option 2 which is situated on the southern abutment, as shown in Figure 3. The spillway size will be finalised during the detailed design in accordance with the detailed dam breach analyses.

10.6. Modelling of Spillway Performance

The elevation-storage curve for the proposed impoundment is shown on Figure 6. Storage effects and the discharge capacity of the outlet works can attenuate the inflow to the reservoir so that the outflow discharge is reduced. Rainfall intensities up to 100 year events at Longdale Road, Macraes Flat were obtained from the NIWA High Intensity Rainfall System (HIRDS v3).

Estimates of the 1 in 5,000 AEP rainfall event have been derived using Gumbel's extreme value distribution theory. Flood routing through the reservoir for the 1 in 5,000 AEP design rainfall event to determine spillway performance and peak water elevations has been modelled with the program HEC-HMS (Hydrologic Modelling System from the Hydrologic Engineering Centre) (Ref.4).

There is no defined temporal rainfall pattern for this area. The design rainfall has been based on a 72 hour design rainfall event with critical rainfall intensities for all durations between 10 minutes and 72 hours included. This assumption is conservative.

The overall catchment area of the reservoir system is 650 ha. It was assumed that at the beginning of the design rainfall event the water level is at the maximum normal operating level, i.e. RL484. The reservoir level will rise under flood conditions and water will flow down the primary pipe spillway and the auxiliary spillway channel. The results of flood routing are shown in Figure 12. The peak inflow for the 1 in 5,000 AEP IDF into the reservoir is estimated to be approximately $66m^3/s$. The peak outflow over the auxiliary spillway is estimated to be $55m^3/s$. The reservoir water level rises to a maximum level of RL 486. This occurs about 37 hours after the start of the IDF. The primary spillway will operate the entire duration of the storm whereas the auxiliary spillway will be engaged for about 12 hours. The minimum freeboard is 1.0m ignoring any wind and wave run up effects and long term embankment settlement.

10.7. Water Discharge Outlet Pipe

Water is to be constantly discharged from the dam at a rate of about 5l/s to augment the downstream flow in Coal Creek. The discharge will be via a pipe laid beneath the embankment as shown on the plan in Figures 3, 4 and 7 and 9. The pipe is 250OD, SDR17, PE100 and located in the northern side of Coal Creek.

10.8. Rehabilitation and Erosion Protection

Riprap comprising 100 to 400mm size durable rock (psammitic schist) is to be placed 0.5m thick on the upstream shoulder of the dam. Topsoil and grass is to be placed on the downstream shoulder of the embankment.

10.9. Seepage Estimates

No seepage estimates from the proposed dam have been made. Estimates will be made during the detailed design stage. Seepage should be less than 2 litres/second based on the performance of other existing water storage dams at the Macraes Gold Project.

10.10. Embankment Settlement

Settlements, following construction of the dam, are expected to be small given the nature of the foundations and the proposed fill. This is supported by the performance to date of existing embankments at the Macraes Gold Project where observed settlements are small.

11.0 OPERATION, MAINTENANCE AND SURVEILLANCE

An Operation, Maintenance and Surveillance Manual will be prepared that sets out the operational and maintenance requirements necessary to ensure the ongoing safety of the dam. Monitoring and inspections are a fundamental part of the dam safety process. These range from routine regular inspections to more comprehensive reviews at longer periods. Specific requirements in accordance with NZSOLD Dam Safety Guidelines (Ref.2) will be prepared for the dam.

Operation of the dam will be under the control of OceanaGold.

Operational activities include clearing debris that may accumulate around spillway inlets and channel, clearing any rockfalls within the auxiliary spillway and ensuring unobstructed discharge of the seepage drains and outlet water pipe

Maintenance activities include repairing any erosion around the perimeter of the reservoir, maintaining riprap on the upstream shoulder, removing weeds or trees from the upstream and downstream shoulders or crest of the dam, maintaining the grass cover on the downstream shoulder and dam crest and maintenance of the outlet valve.

To ensure the safety of the dam regular inspections are to be undertaken. Standard forms will be provided for this purpose. More detailed inspections will be required on first filling. Thereafter inspections will be undertaken on a monthly basis and during periods of heavy rain.

12.0 CONSTRUCTION ASPECTS

12.1. Construction Volumes

The estimated construction volumes for the Coal Creek Freshwater Dam embankment are summarised below.

Zone A1	13,000m^3
Zone B	30,000m^3
Chimney Drain	1,600m^3
Riprap	1,600m^3
Total	46,200m^3

Note that the above fill quantities include for an average of 2m depth of foundation excavation below the existing ground level.

12.2. Embankment Construction

Embankment construction would be undertaken either by a Contractor employed by OceanaGold or with OceanaGold's own equipment. Material to construct the embankment will be borrowed locally.

Materials for Zones A1 and B are placed in thin layers (350mm for Zone A1 and 600 mm for Zone B) and compacted to achieve the specified gradation, density and permeability requirements. Zone A1 may need to be blended and conditioned prior to compaction to achieve the specified gradation and permeability.

Compaction of Zone A1 can be achieved using sheepsfoot or vibrating pad foot rollers. Zone B is compacted by loaded truck movements and vibrating drum roller.

12.3. Flood Diversion Arrangements

A temporary cofferdam and bypass pipe, supplemented by pumping if required, will initially be used to bypass flows during foundation excavation. The water discharge pipe will then be constructed and base flows in Coal Creek diverted through it during construction of the dam. In the event of larger floods, water will be channelled across the top of the embankment fill, against the abutment on the southern side of Coal Creek, and discharged over insitu rock back into the creek. Construction of the dam will be undertaken over summer and is expected to take approximately 3 to 6 months, allowing for a favourable weather window. The period of risk is relatively short.

12.4. Foundation Preparation

The foundations for the dam will be situated on natural ground. Foundation preparation of the natural ground beneath the embankment will consist of stripping vegetation and excavating loess, colluvium and alluvium and shaping of the schist bedrock to achieve an acceptable geometry prior to placement of fill.

Foundation surfaces below Zone A1 will need to be cleaned off with compressed air to enable observation of defects and assessment of the need for any special treatment such as slush or pressure grouting or the installation of additional subsoil drainage.

Experience to date with the schist bedrock and insitu permeability testing elsewhere at the Macraes Gold Project indicates that it has a relatively low permeability. Generally slush grouting has been necessary to infill any small fractures apparent following foundation excavation with low pressure grouting used to infill open defects in the schist rock.

Any irregularities in the excavated foundation surface that cannot be removed by excavation will be treated with dental concrete.

12.5. Erosion and Sediment Control

Good earthworks practices will be required to reduce the quantity of silt laden runoff. This includes:

- construction of temporary sediment retention facilities immediately downstream of the works
- clean water diversion drains around borrow areas
- silt ponds or decanting earth bunds and other sediment control devices at borrow areas (e.g. silt fences, lined channels from silt ponds to natural water courses)
- minimising areas of loose, uncompacted material
- providing a reasonable buffer distance between borrow areas and Coal Creek
- Providing a culvert to divert flows from Coal Creek below the embankment during construction

A site specific erosion and sediment control plan will be prepared at the final design stage which will detail specific requirements for construction.

Experience to date at the Macraes Gold Project indicates that only small quantities of silt laden runoff are generated because most of the fill is rockfill and runoff percolates down through the downstream rockfill shoulder. This acts as a filter to remove silt.

12.6. Construction Control and Management

Construction of the embankment will be under the direct supervision of staff from OceanaGold. A number of staff, assisted by surveyors and the designer as necessary, will be dedicated to this task drawing from their experience gained during the construction of the existing facilities at the Macraes Gold Project including ongoing raising of TSF's. They assist the Contractor in planning construction activities and observe all construction activities. In addition, they undertake control testing of fill placed in the embankment as detailed in the Contract Specification and undertake regular visual inspections as part of the surveillance requirements.

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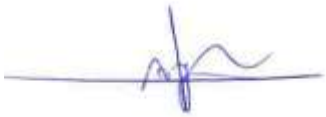
Report Prepared by

J Wu (Geotechnical Engineer)



R Amigh (CPEng)

Reviewed by

J A Yeats (CPEng)

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FIGURES

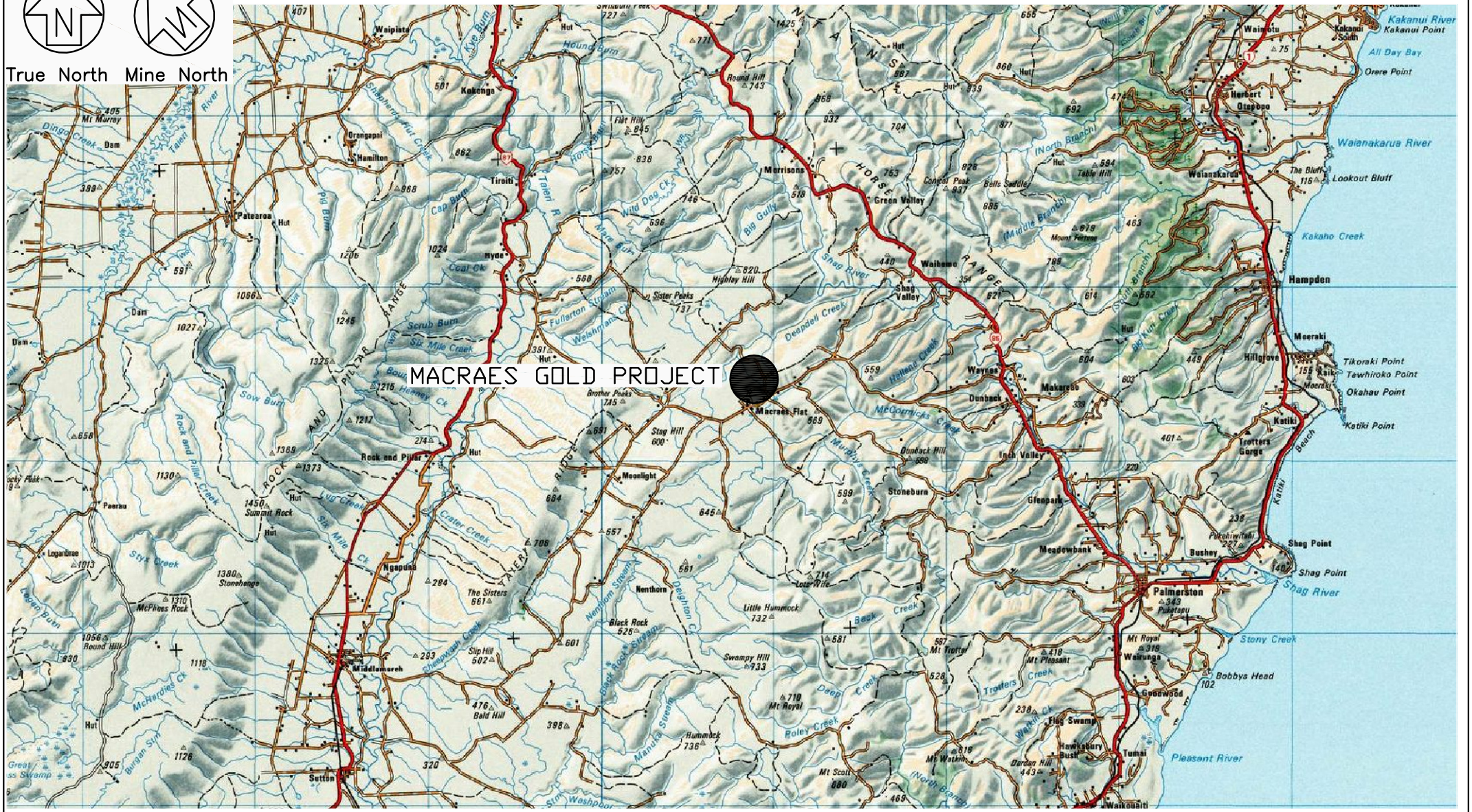

Figure 1

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OCEANA GOLD
MACRAES GOLD PROJECT
Locality Plan

Drawing No.	8122-Fig 1
Date:	May 2016
Drawn:	JS
Scale:	1:300,000 (@A4)
Filename:	8122-Fig 1.dwg

LEGEND

Footprint of Coronation North Project

Catchment boundary of Proposed Coal Creek Fresh Water Dam

0 1 2 3 4 5km

Mine North True North

Proposed Coal Creek Freshwater Dam

Proposed Coronation North Waste Rock Stack

Coal Creek

Proposed Extension to Coronation Pit

ProposedCoronation North Pit

Camp Creek

MACRAES GOLD PROJECT

Figure 2

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OCEANA GOLD (New Zealand) LTD, MACRAES GOLD PROJECT
Coronation North Project
Proposed Coal Creek Freshwater Dam
Locality Plan

Drawing No.	8122-Fig 2
Date:	April 2016
Drawn:	JS
Scale:	1:50,000 (@A3)
Filename:	8122-Fig2.dwg

Mine North True North

Top of Water RL484
Storage Capacity = 685,000m3
Surface Area = 93,000m2

Primary Spillway

Proposed Dam Crest RL487

Auxiliary Spillway
Option 1

Chimney Drain Outlet Pipe

Discharge Outlet Pipe

500
495
490
485
480
475
470
465
465
470
475
480
485
490
495
500

Auxiliary Spillway
Option 2

LEGEND

Rock wall Archeological Features

Figure 3

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OCEANA GOLD (New Zealand) LTD, MACRAES GOLD PROJECT
Coronation North Project
Proposed Coal Creek Freshwater Dam
Site Plan

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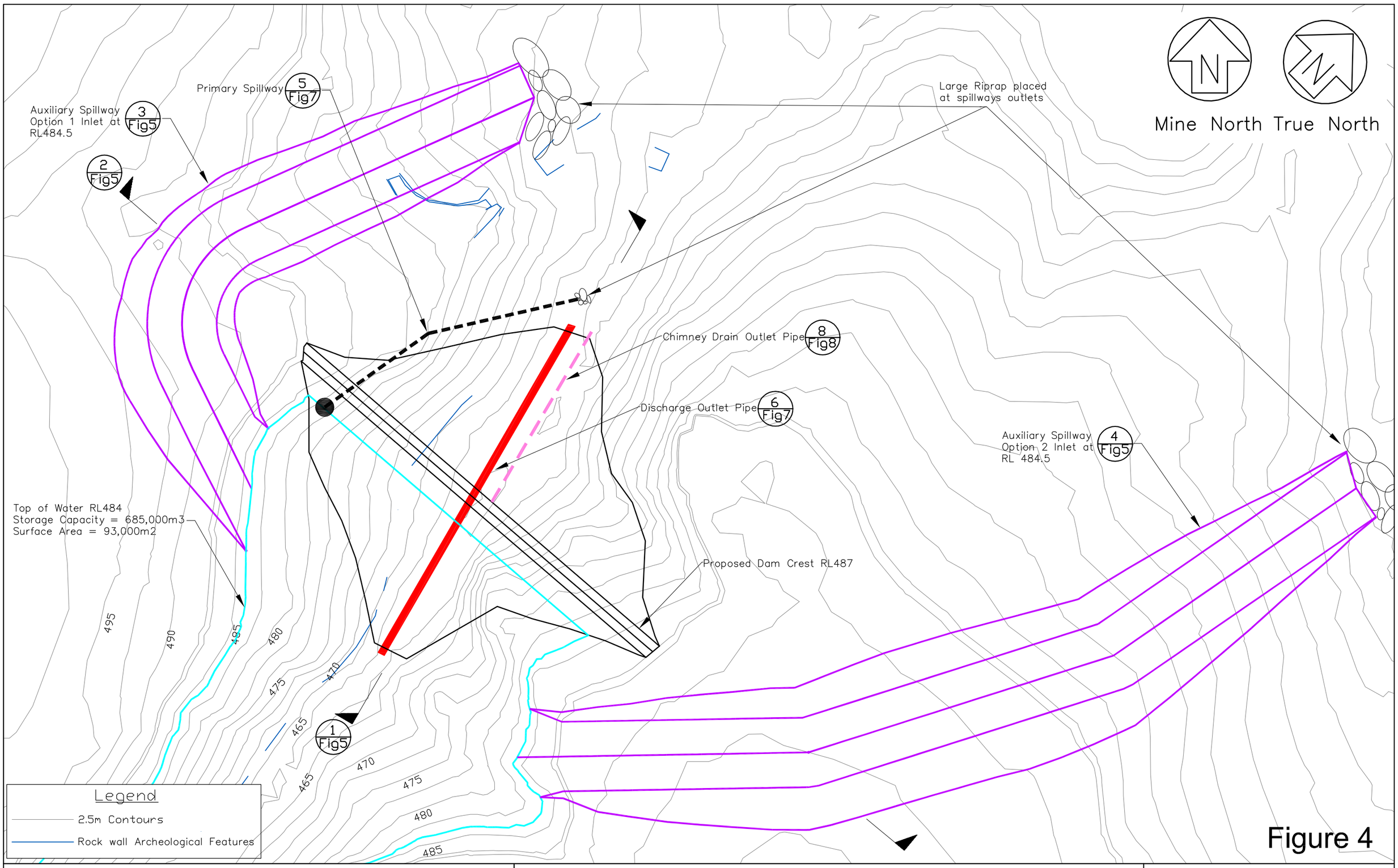

Figure 4

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OCEANA GOLD (New Zealand) LTD, MACRAES GOLD PROJECT
Coronation North Project
Proposed Coal Creek Freshwater Dam
Embankment Layout

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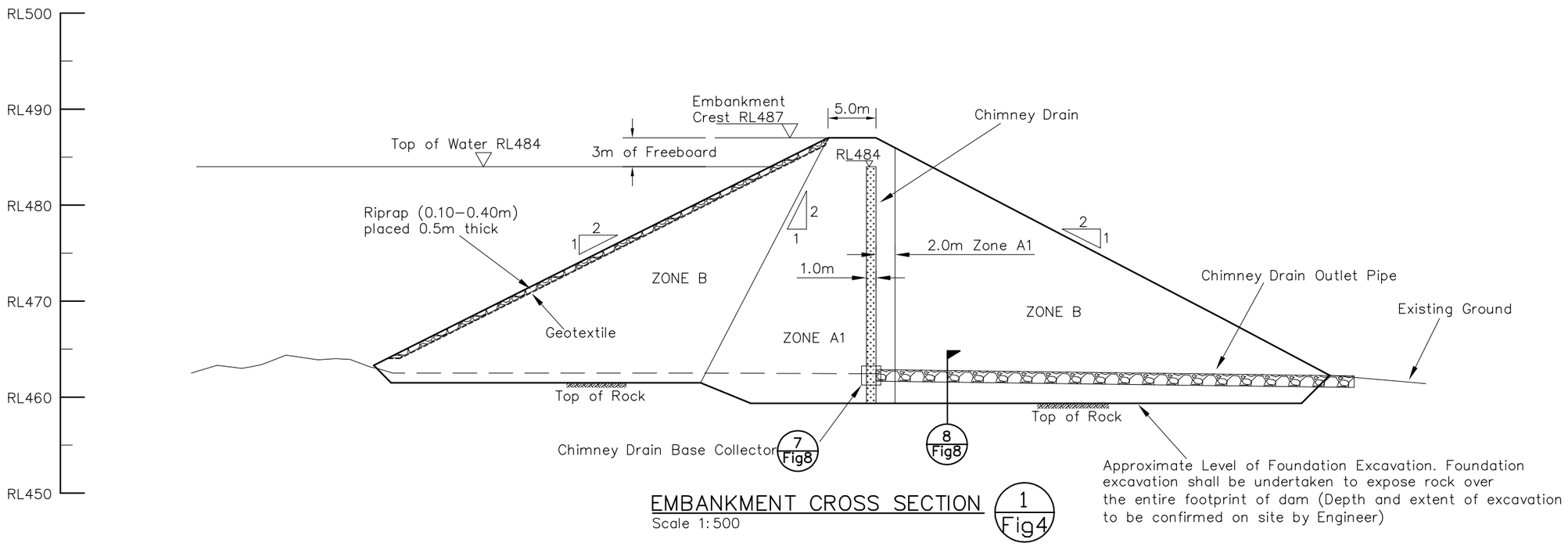
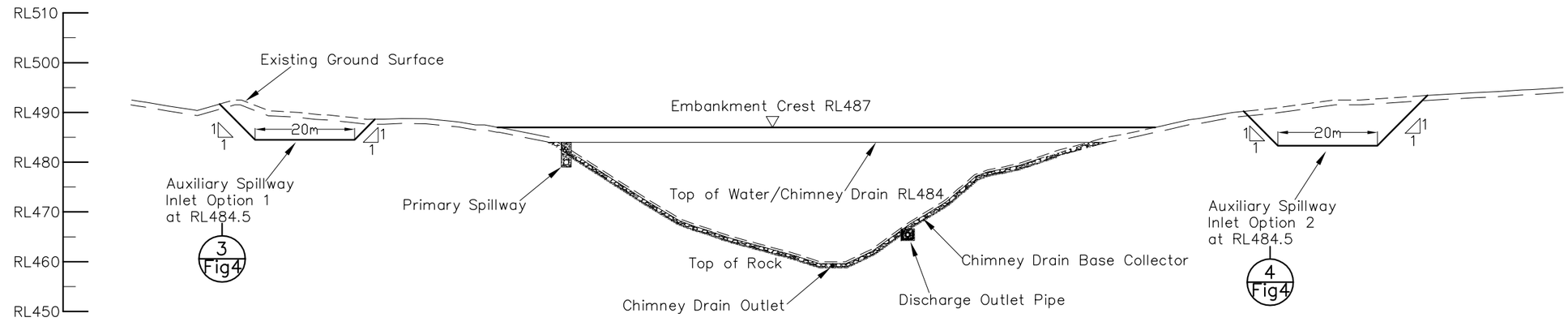


EMBANKMENT CROSS SECTION 1 Fig4
Scale 1:500



EMBANKMENT LONG SECTION 2 Fig4
Scale 1:1000

Figure 5

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OCEANA GOLD (New Zealand) LTD, MACRAES GOLD PROJECT
Coronation North Project
Proposed Coal Creek Freshwater Dam
Embankment Cross and Long Sections

Drawing No.	8122–Fig 5
Date:	May 2016
Drawn:	JS
Scale:	As shown (@A3)
Filename:	8122–Fig5.dwg

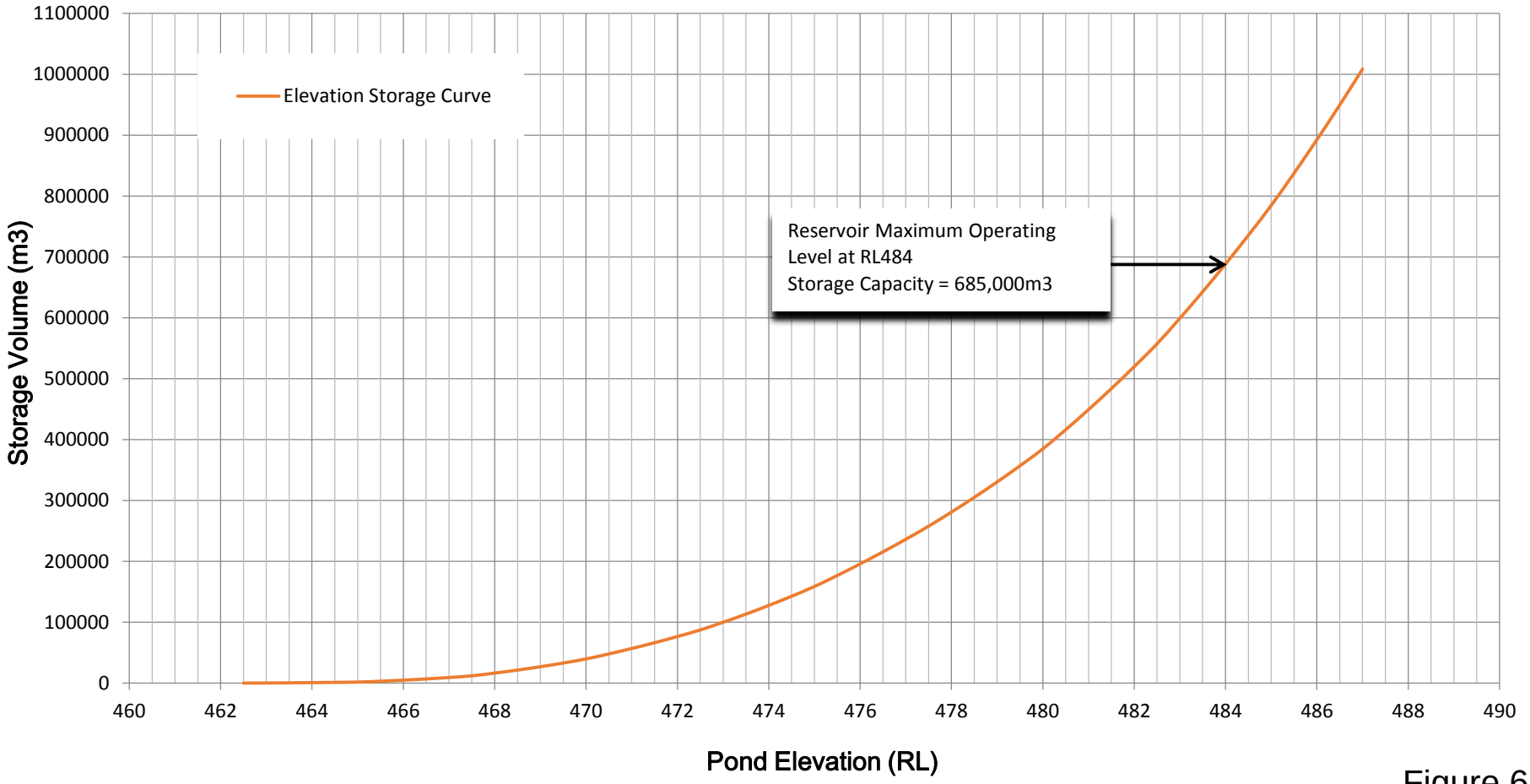

Figure 6

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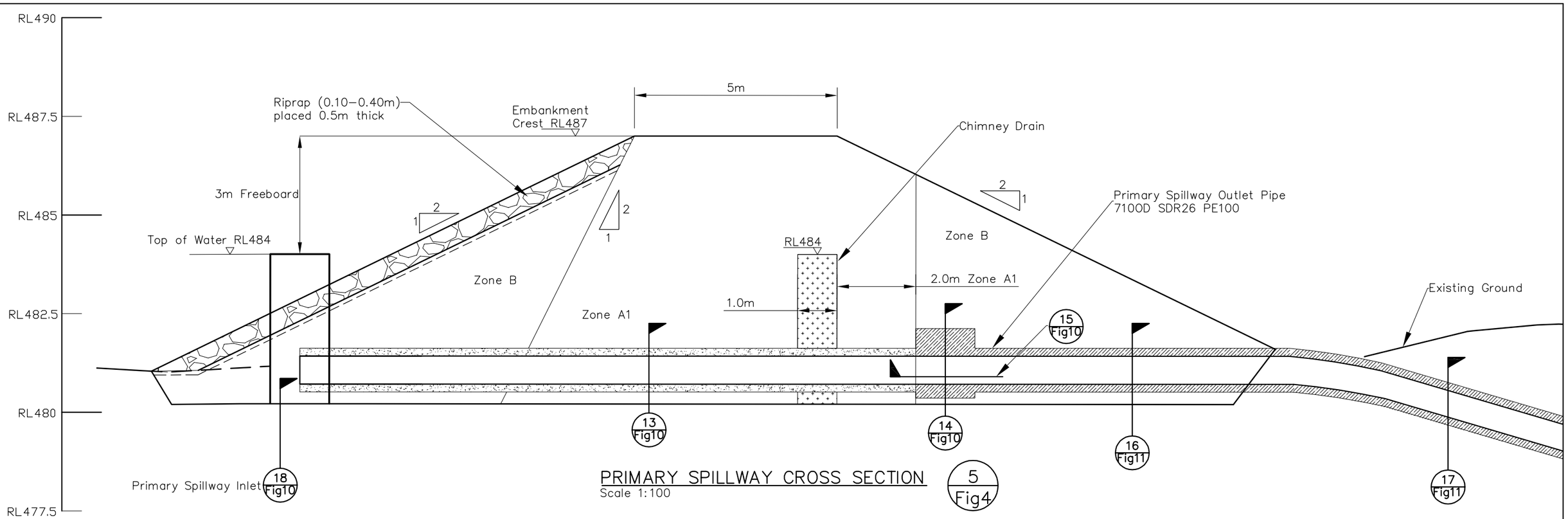
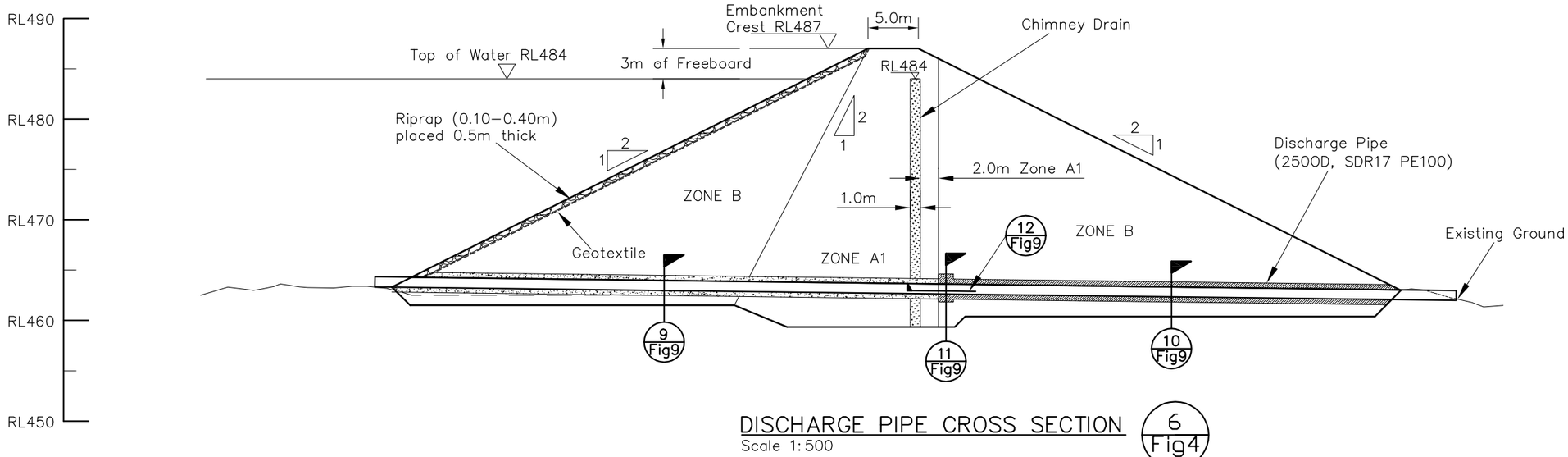
OCEANA GOLD (NZ) LTD, Macraes Gold Project
Proposed Coal Creek Freshwater Dam
Elevation - Storage Curve

Ref. No: 8122
Date: May 2016
Drawn: JW
File: 8122



PRIMARY SPILLWAY CROSS SECTION
Scale 1:100

5 Fig4



DISCHARGE PIPE CROSS SECTION
Scale 1:500

6 Fig4

Figure 7

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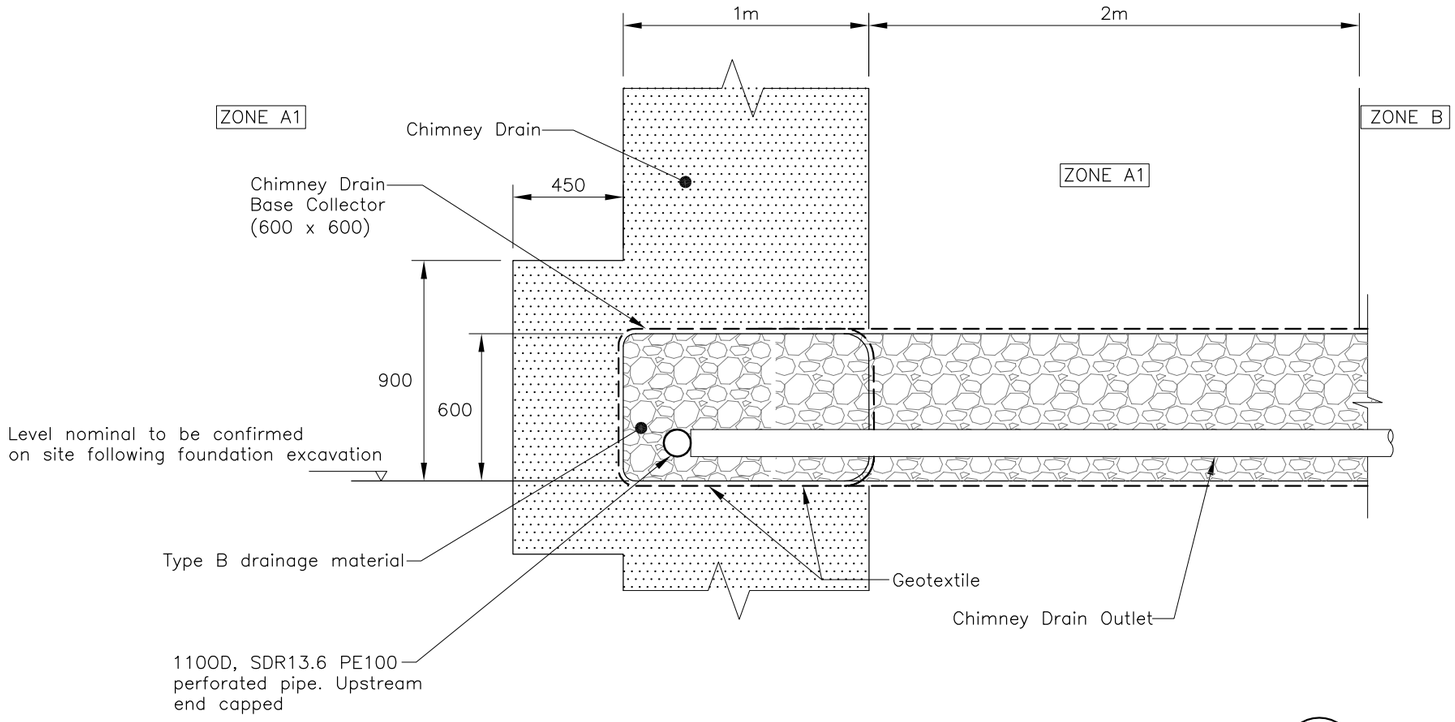
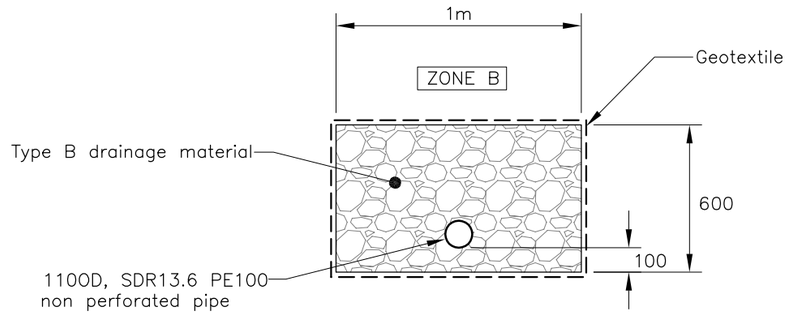
OCEANA GOLD (New Zealand) LTD, MACRAES GOLD PROJECT
Coronation North Project
Proposed Coal Creek Freshwater Dam
Primary Spillway and Discharge Pipe Cross Sections

Drawing No.	8122–Fig 7
Date:	May 2016
Drawn:	JS
Scale:	As shown (@A3)
Filename:	8122–Fig7.dwg



CHIMNEY DRAIN – DETAIL AT OUTLET DRAIN LOCATION (7 / Fig5)

Note: Perforated pipe in chimney drain base collector extends up to RL484 on both abutments.



CHIMNEY DRAIN OUTLET (8 / Fig5)

Figure 8

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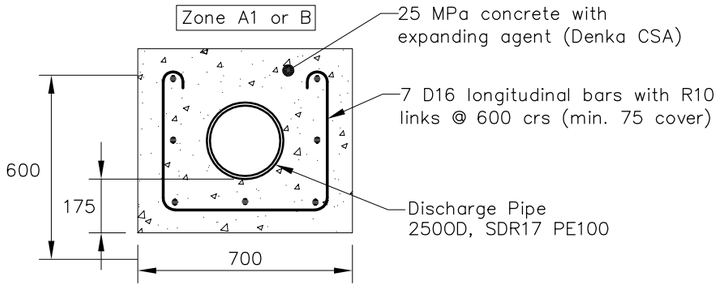
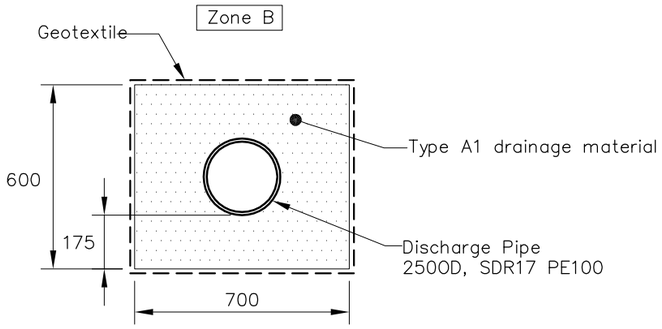
OCEANA GOLD (New Zealand) LTD, MACRAES GOLD PROJECT
Coronation North Project
Proposed Coal Creek Freshwater Dam
Chimney Drain Details

Drawing No.	8122–Fig 8
Date:	May 2016
Drawn:	JS
Scale:	1:25 (@A3)
Filename:	8122–Fig8.dwg

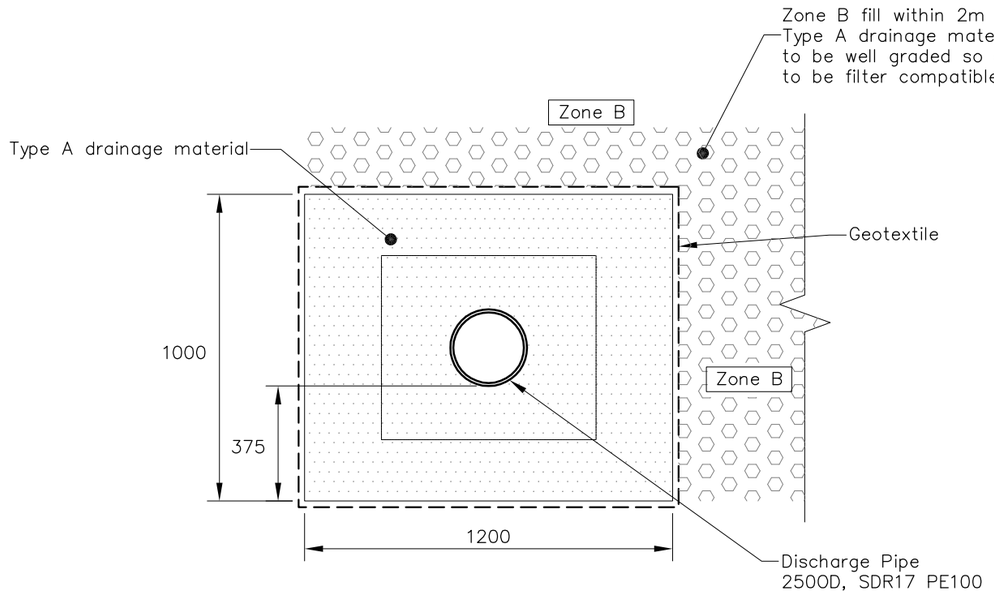


DISCHARGE PIPE THROUGH ZONES A1 & B (UPSTREAM SHOULDER ONLY) 9 Fig7

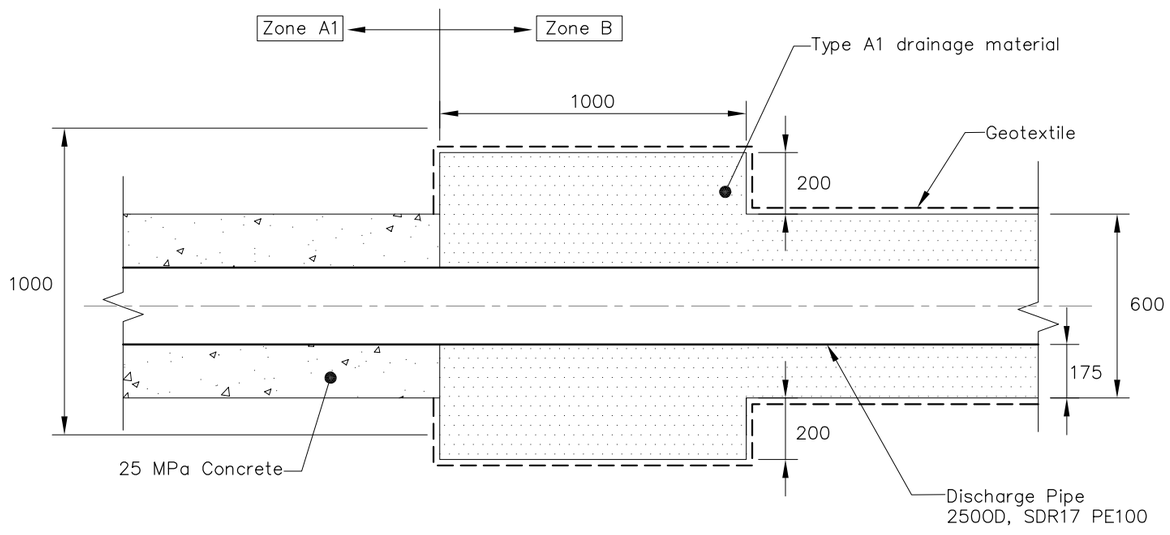


DISCHARGE PIPE THROUGH ZONE B (DOWNSTREAM SHOULDER) 10 Fig7

Note: Concrete shall have an expanding agent added to it (Denka CSA (No. 20) or equivalent). Immediately following placement of concrete the top of the concrete shall be covered with polythene and 1.5m of loose fill placed above. The loose fill shall be removed after 24 hours and the specified compacted fill place above after 5 days.



DISCHARGE PIPE THRU FILTER/ SEEPAGE INTERCEPTOR DRAIN 11 Fig7



DISCHARGE PIPE THROUGH FILTER/SEEPAGE INTERCEPTOR DRAIN 12 Fig7

Figure 9

ENGINEERING GEOLOGY LTD
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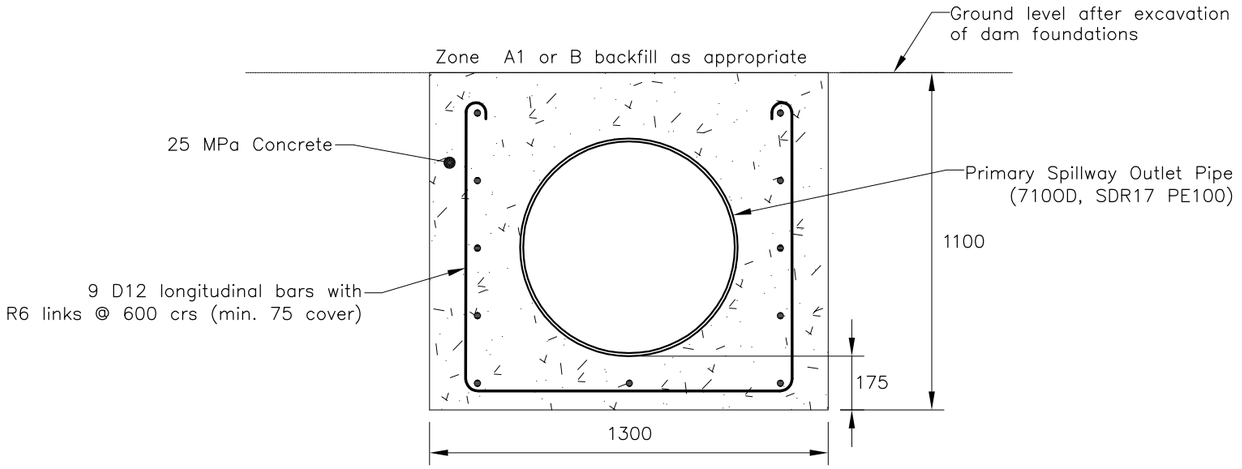
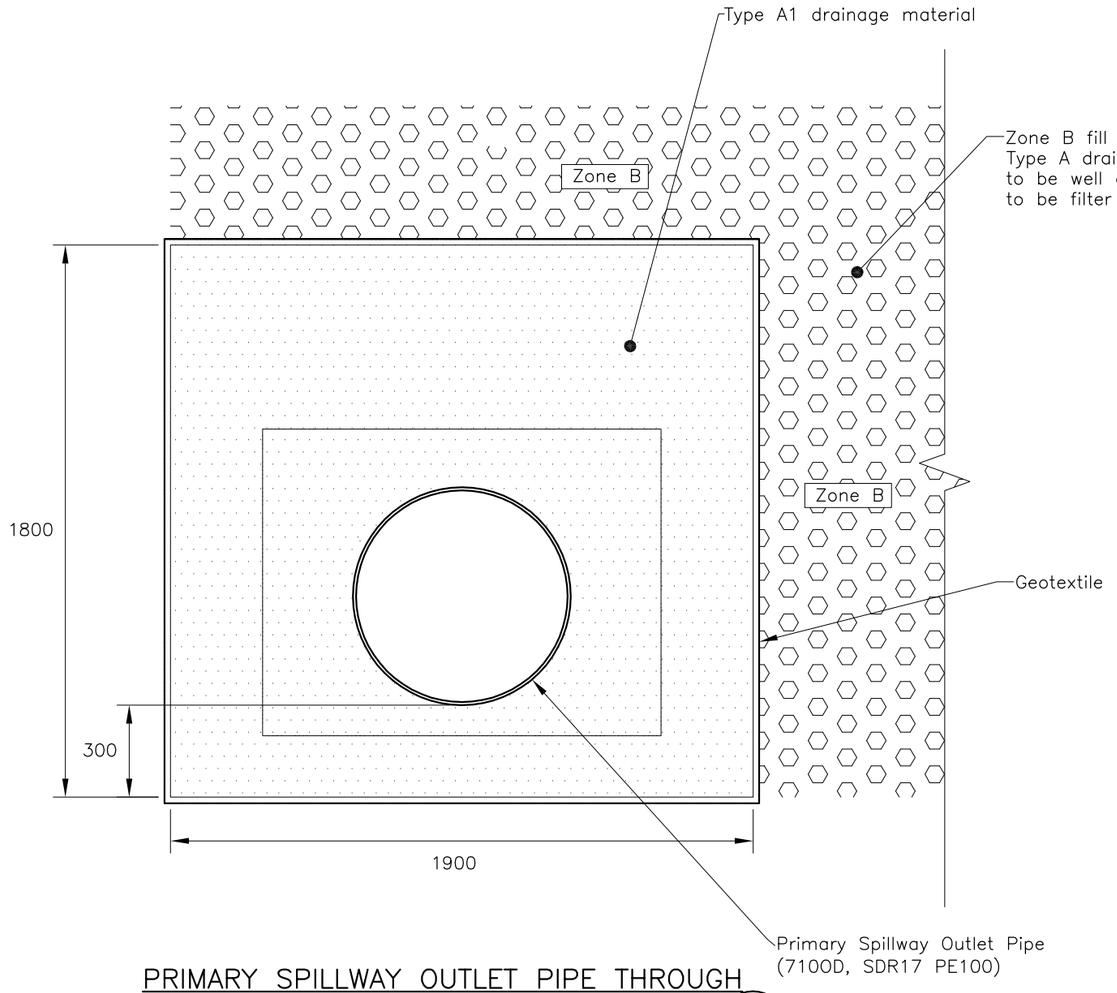
OCEANA GOLD (New Zealand) LTD, MACRAES GOLD PROJECT
Coronation North Project
Proposed Coal Creek Freshwater Dam
Discharge Pipe Details

Drawing No.	8122-Fig 9
Date:	May 2016
Drawn:	JS
Scale:	1:20 (@A3)
Filename:	8122-Fig9.dwg

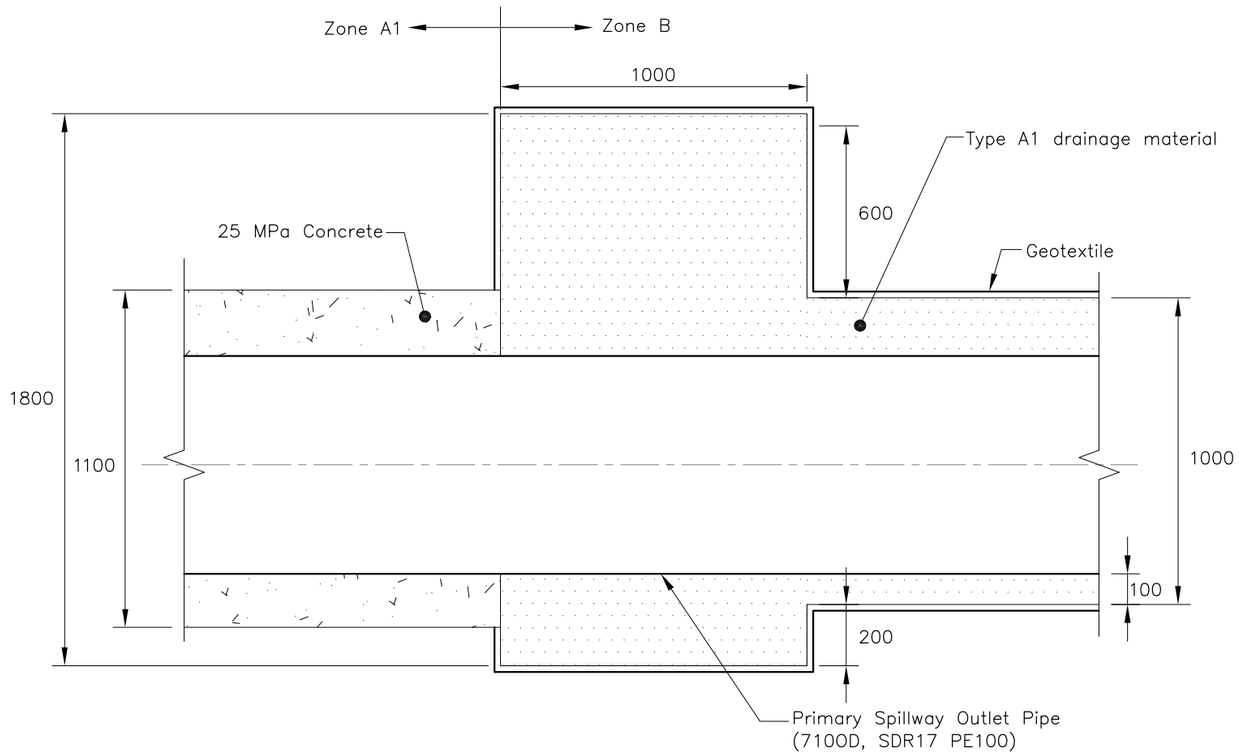
Note: Concrete shall have an expanding agent added to it (Denka CSA (No. 20) or equivalent). Immediately following placement of concrete the top of the concrete shall be covered with polythene and 1.5m of loose fill placed above. The loose fill shall be removed after 24 hours and the specified compacted fill placed above after 5 days.



PRIMARY SPILLWAY OUTLET PIPE BENEATH ZONES A1 & B (UPSTREAM SHOULDER ONLY) 13 Fig 7



PRIMARY SPILLWAY OUTLET PIPE THROUGH FILTER/SEEPAGE INTERCEPTOR DRAIN 14 Fig 7



PRIMARY SPILLWAY OUTLET PIPE THROUGH FILTER/SEEPAGE INTERCEPTOR DRAIN 15 Fig 7

Figure 10

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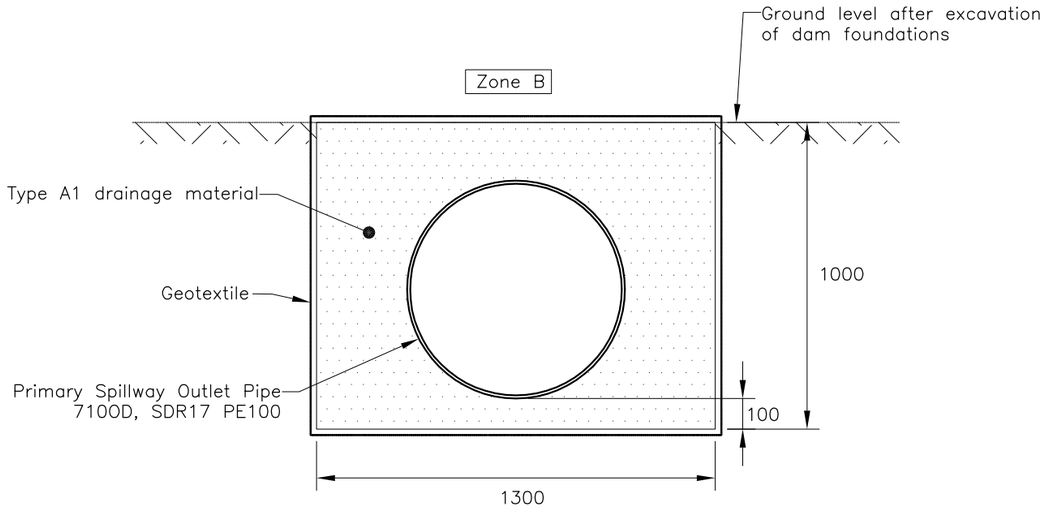
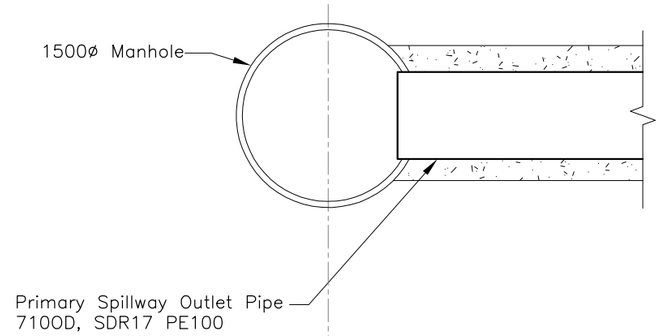
OCEANA GOLD (New Zealand) LTD, MACRAES GOLD PROJECT
Coronation North Project
Proposed Coal Creek Freshwater Dam
Primary Spillway Details 1

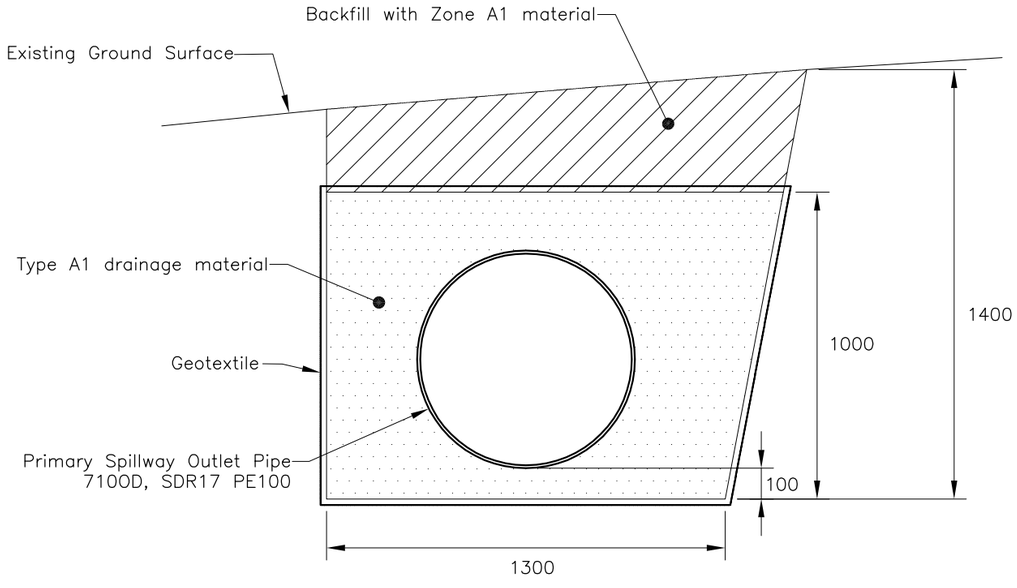
Drawing No.	8122-Fig 10
Date:	May 2016
Drawn:	JS
Scale:	1:20 (@A3)
Filename:	8122-Fig10.dwg



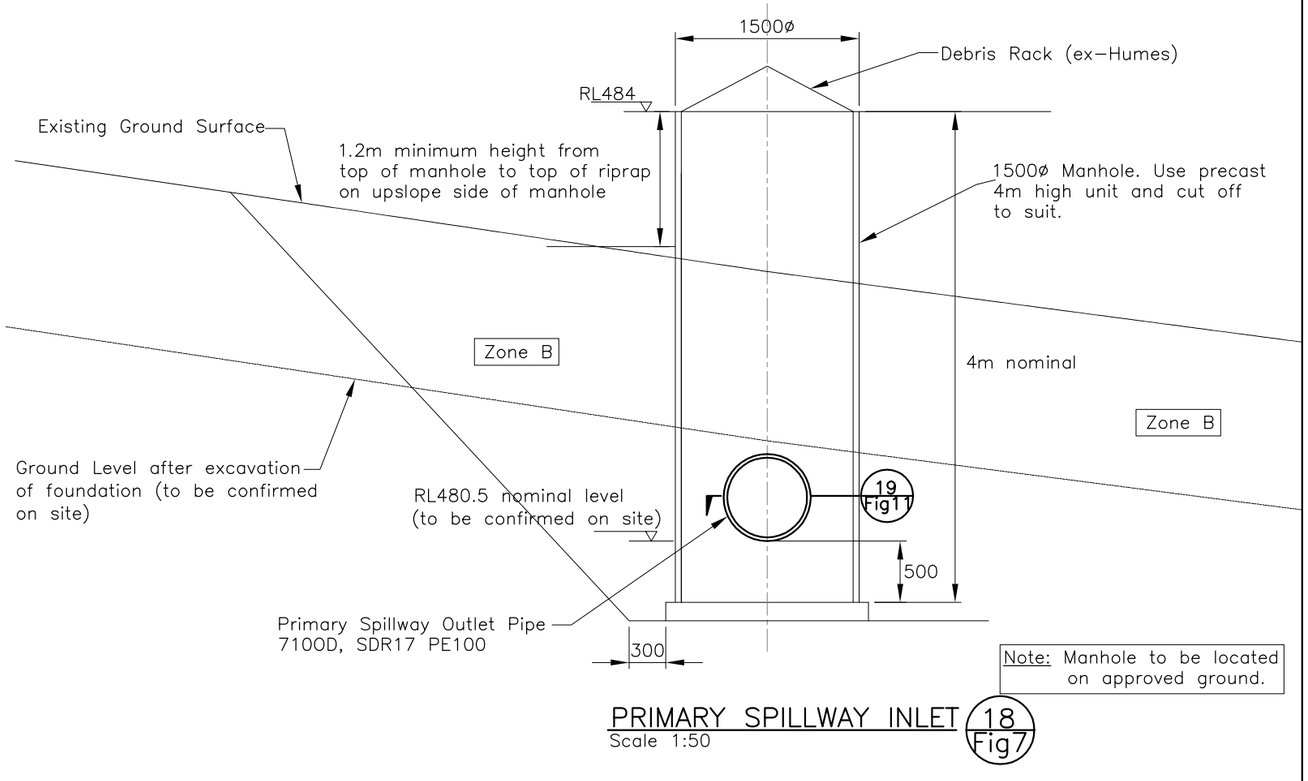
PRIMARY SPILLWAY OUTLET PIPE BENEATH ZONE B (DOWNSTREAM SHOULDER) 16 Fig7
Scale 1:20



PRIMARY SPILLWAY INLET SECTION 19 Fig11
Scale 1:50



PRIMARY SPILLWAY OUTLET PIPE DOWNSTREAM OF EMBANKMENT 17 Fig7
Scale 1:20



PRIMARY SPILLWAY INLET 18 Fig7
Scale 1:50

Figure 11

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OCEANA GOLD (New Zealand) LTD, MACRAES GOLD PROJECT
Coronation North Project
Proposed Coal Creek Freshwater Dam
Primary Spillway Details 2

Drawing No.	8122-Fig 11
Date:	May 2016
Drawn:	JS
Scale:	As shown (@A3)
Filename:	8122-Fig11.dwg

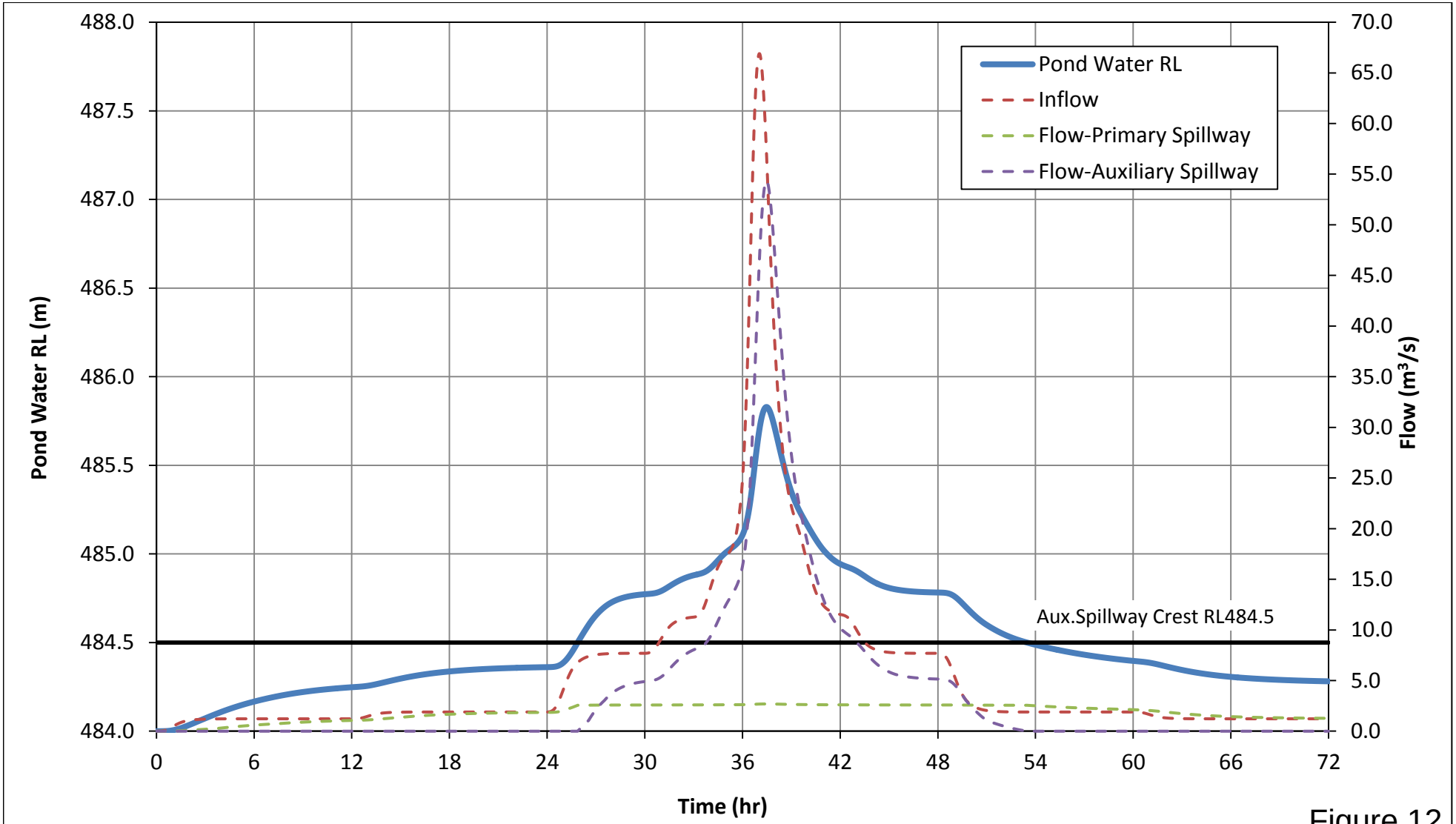

Figure 12

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Albany, Auckland

OCEANA GOLD (NZ) LTD, Macraes Gold Project
Coal Creek Freshwater Dam
Hydraulic Routing Curves - 5000 Year Design Rainfall Event

Ref. No: 8122
Date: May 2016
Drawn: JW