

5 April 2019

Dunedin City Council
PO Box 5045
Moray Place
Dunedin 9058

Dear Andrew

PROPOSED EXTENSION OF CORONATION NORTH PIT AND RECONFIGURATION OF WASTE ROCK STACKS - REQUEST FOR FURTHER INFORMATION

Referring to DCC's letter dated 15 March 2019, the following provides the response to the request for information related to Maps, Matheson Road Alignment and Temporary Pedestrian Access, Pit Wall Stability Layback, Landscape, Ecology and Noise. Where necessary specialists' reports have been prepared in response to the request and these reports are featured in the appendices to this letter.

1. Maps

In response to the request, the following maps have been prepared and can be found in Appendix I.

- Coronation Pit and Trimbells Waste Rock Stack on large scale, titled '*Coronation North Extension 2019 Project WDC/DCC LUC Consents*'.
- Amended from LUC-2016-230 and 201.2016.779, Figures 1 titled '*Macraes Gold Project, Coronation North Extension S-92 Figure 1b*', Figure 2 titled '*Coronation North Extension: 2019 WDC/DCC Roading*' and Map 1 titled '*Coronation North Extension Proposed Pit Extension and Waste Rock Stack.*'
- Amended Plan 1 from LUC-2016-230 and 201.2016.779, titled '*Coronation North Extension: March 2019 WDC/DCC Land Use Consent Plan 1*'.

2. Matheson Road Alignment and Temporary Pedestrian Access

The final Matheson Road Alignment will be modified very slightly with the re-design of the Waste Rock. The changes will be in the slight elevation changes over the Trimbells Waste Rock Stack however the alignment remains close to the crest of the Taieri ridge. The alignment should not lead to any discernible changes in traffic time when compared with that of the originally consented alignment for the Coronation North Project.

The Temporary Pedestrian Access has been modified on the eastern alignment to allow for potential pit wall instability. Changes to the alignment remain limited to approximately 250m of track.

3. Pit Wall Stability Layback

A response to the Pit Wall Stability Layback request has been prepared by Andrew Winneke, OceanaGold Geotechnical Engineer, and is presented in Appendix II.

4. Landscape

- a) As per Consent Condition 4.3 of land use consent¹, a report was prepared by Opus International Consultants Ltd and submitted to the DCC on 21st June 2017.

The Landscape Report responded to Condition 4.7 in particular and has been referenced in OceanaGold's Coronation North Operations and Management Plan to ensure when the Coronation North WRS is constructed, OceanaGold achieve the final form to meet landscape compliance.

Section 3.1.3. *Condition 4.7 (c) A detailed discussion on how the proposed waste rock stack meets the principles set out in condition 4.4 (a) – (f) of the 2017 Landscape Report responds to the various clauses of Consent Condition 4.4. What is stated there has followed through to what is now proposed altered Coro Nth WRS and the proposed Trimbells WRS. As with the altered WRS, the proposed WRS, will be shaped to match nearby natural slopes and the skyline shall be variable and curved, simulating natural skylines.*

As noted in Appendix D of the Assessment of Environmental Effects for the Coronation North Extension Project:

In regard to the proposed Coronation North Expansion, the potential waste rock stack-related landscape and visual effects will remain much as before, but with the lesser landscape effect of having a strip of land left untouched between what would be the smaller, stand-alone Coronation WRS and the proposed Trimbells WRS. While this strip of land is not directly visible from Vpt 12 on Longdale Road, it's retention will have positive ecological outcome.

- b) Sections of the Trimbells Waste Rock stack will utilise the seedbank contained in the freshly stripped topsoil to return the surface to a similar vegetation community to the pre-mining condition. This practice is commonly known as 'direct return' of topsoil. It is not expected that the entire Waste Rock Stack will be covered with native vegetation, only those sections where direct return of topsoil is possible.

It is well understood within the mining industry that use of topsoil as soon as possible after stripping has significant benefits including maintaining the viability of the seedbank contained within the topsoil. These benefits (of direct return) are highlighted in the Landcare Report, 'Guidelines for mine rehabilitation in Westland'². In addition, a 2016 study conducted on mine land rehabilitation³ found that the native seed bank contained within topsoil is a valuable resource in post-mining rehabilitation and that seedling emergence of perennial species was more than 4-fold greater in fresh topsoil than in the 1-year-old stockpiles.

Annual monitoring will be conducted on the slopes and compared with reference sites close by to determine appropriate densities of tussock are being met. In the event that monitoring shows the rehabilitation is not meeting densities within reference sites, planting will be undertaken

5. Ecology

Responses to the information requests related to ecology have been prepared by Dr Mike Thorsen (ERA Ecology) and are presented in the Appendix III.

¹ CORONATION & CORONATION NORTH" – OCEANA GOLD (NEW ZEALAND) LTD. WDC Reference: 201.2016.779 and 201.2013.360.1 and DCC Reference: LUC-2016-234 and LUC-2013-225A.

² Simcock, R, Ross, C. Guidelines for mine rehabilitation in Westland. 2014. Landcare Research

<https://www.wcrc.govt.nz/Documents/Environmental%20Management/Guidelines%20for%20mine%20rehabilitation%20in%20Westland.pdf>

³ Golos, P. J., Dixon, K. W. and Erickson, T. E. (2016), Plant recruitment from the soil seed bank depends on topsoil stockpile age, height, and storage history in an arid environment. *Restor Ecol*, 24: S53-S61. doi:10.1111/rec.12389

6. Noise

Attended noise monitoring results (ie results from a hand-held meter) are presented in Appendix IV.

Following concerns about night time noise raised by the closest affected party, Craig and Erin Howard, OceanaGold installed an unattended monitor close to the Howards residence between November – December 2017 and February – March 2018. Due to privacy concerns raised by the Howards, this meter was not installed at the compliance location (ie 20m from the dwelling) and was used for management purposes to further understand the night time noise issue.

After further negotiations with the Howards, an unattended noise monitor was installed at the compliance location. This noise monitor was used in conjunction with a weather station to provide realtime feedback to OceanaGold's Mine Control centre, to manage the noise level from mining activities and track compliance. A summary of this monitoring is contained in the report '*Response to MDA peer review queries*', prepared by Acoustic Engineering Services and presented in Appendix V.

Finally, updated noise modelling of the Coronation North Extension, completed by Acoustic Engineering Services, is presented in Appendix VI. As indicated in the Assessment of Environmental Effects, OceanaGold is committed to no night time hauling until an agreement has reached with the Howards.

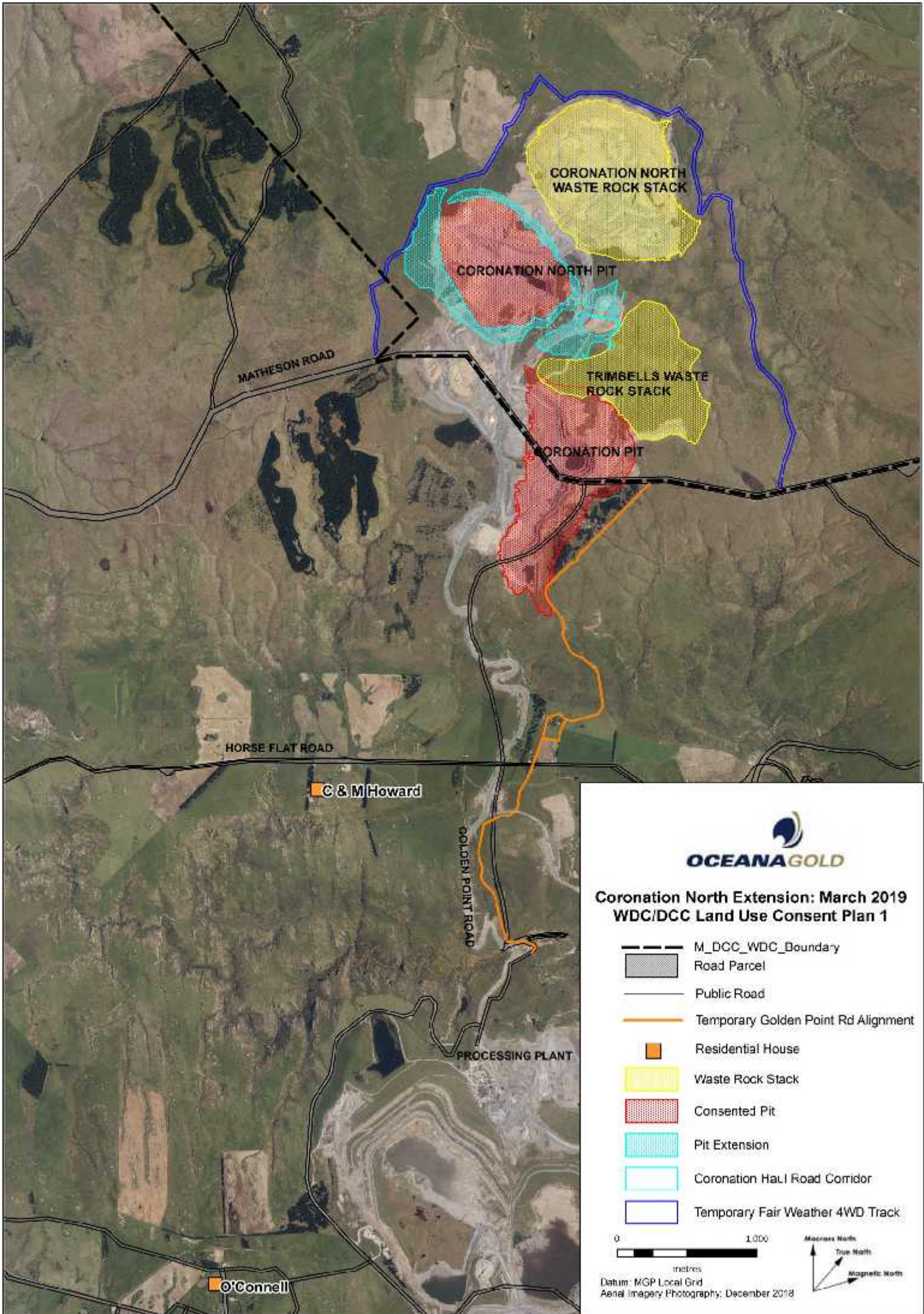
Every effort has been made to provide the most up to date information for this request for information. Should there be any further changes in design or conditions, I will endeavour to inform you as soon as possible.

Yours Sincerely



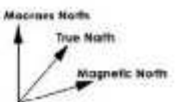
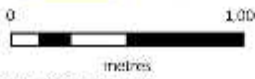
Gavin Lee
Community and Environment Manager

Appendix I
Maps





**Coronation North Extension: March 2019
WDC/DCC Land Use Consent Plan 1**

-  M_DCC_WDC_Boundary
-  Road Parcel
-  Public Road
-  Temporary Golden Point Rd Alignment
-  Residential House
-  Waste Rock Stack
-  Consented Pit
-  Pit Extension
-  Coronation Hall Road Corridor
-  Temporary Fair Weather 4WD Track



Datum: MGP Local Grid
Aerial Imagery Photography: December 2018

 O'Connell

 C & M Howard

68,000 mE

68,000 mE

70,000 mE

72,000 mE

74,000 mE

28,000 mN

24,000 mN

22,000 mN

20,000 mN

18,000 mN

WATER DISTRICT BOUNDARY
COUNCIL CITY BOUNDARY

WATER DISTRICT BOUNDARY
COUNCIL CITY BOUNDARY

Vanderley (Deepdell Station)
HORSE FLAT ROAD
C & M Howard

COAL CREEK FRESHWATER DAM

O'Neill

O'Neill

James Paddle (Lorgdale)

CORONATION NORTH WASTE ROCK STACK

CORONATION NORTH PIT EXTENSION

TRIMBELL'S WASTE ROCK STACK

CORONATION PIT

Peddie

Howard

GOLDEN POINT HISTORIC RESERVE

PROCESSING PLANT

ROUND HILL MP 52 038

O'Connell, B.

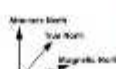
O'Connell, R.

MACRAES EXTENSION MP41 054

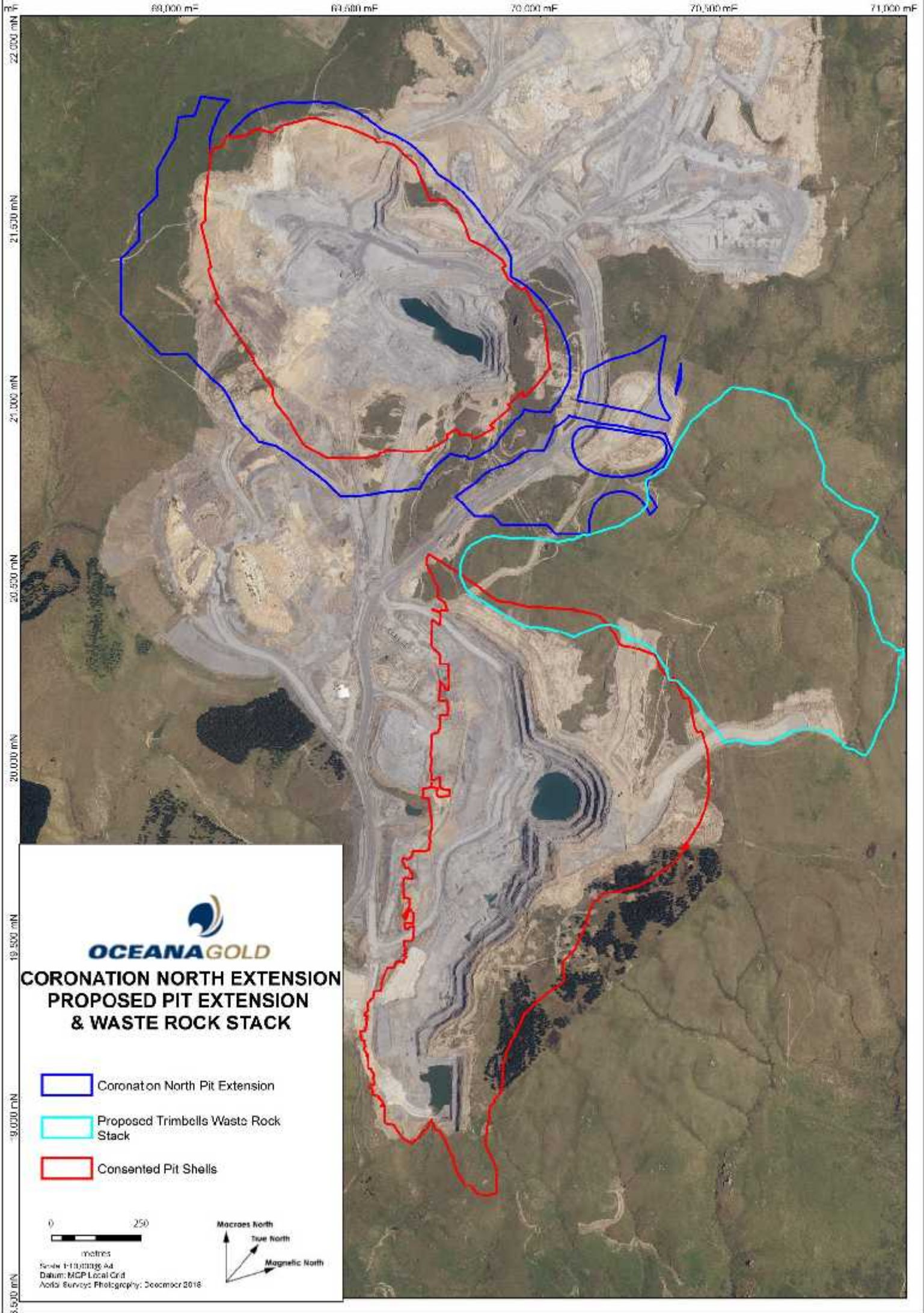


Coronation North Extension 2019 Project WDC/DCC LUC Consents

- Properties of interest
- Golden Point Road Alignment
- Waste Rock Stack
- Waste filling Zone
- WDC/DCC Boundary
- Temporary Tail Heap/AVG Traps
- Strip Hill Road to Plant
- Controlled Pit
- Proposed Coronation North Extension
- Lease Areas
- TNS 157 Property, Lease Area
- O&L 152 On 151 Land Parcel
- Recommended Area for Protection

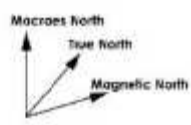


Datum: WGS 1984
Aerial Imagery: December 2015



**CORONATON NORTH EXTENSION
PROPOSED PIT EXTENSION
& WASTE ROCK STACK**

- Coronat North Pit Extension
- Proposed Trimbells Waste Rock Stack
- Consented Pit Shells



Scale: 1:10,000 @ A4
Datum: MCP Local Grid
Aerial Survey: Photography: December 2018

89,000 mE

70,000 mE

71,000 mE

72,000 mE

73,000 mE

74,000 mE

22,000 mN

21,000 mN









20,000 mN

19,000 mN



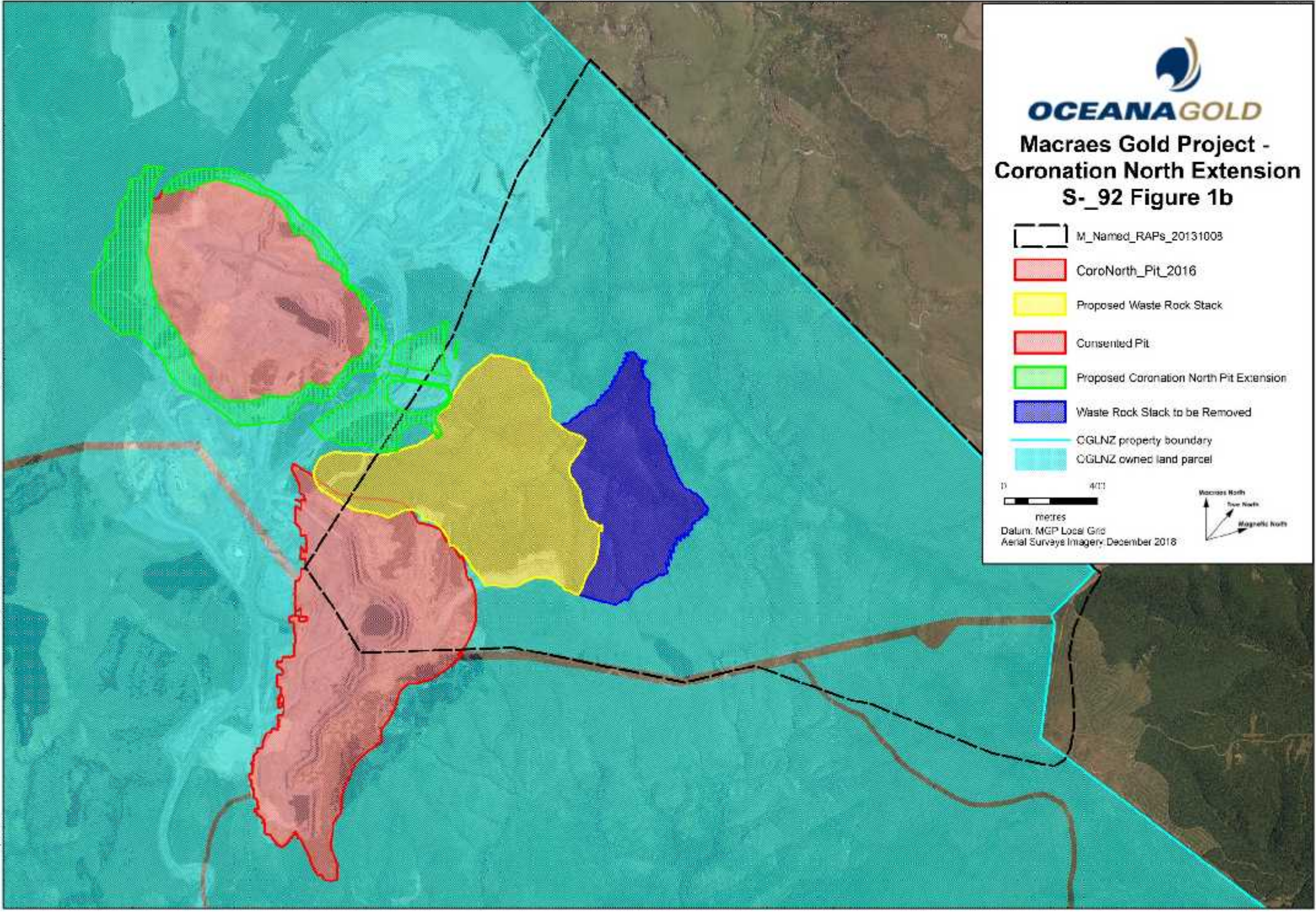
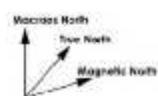
OCEANAGOLD

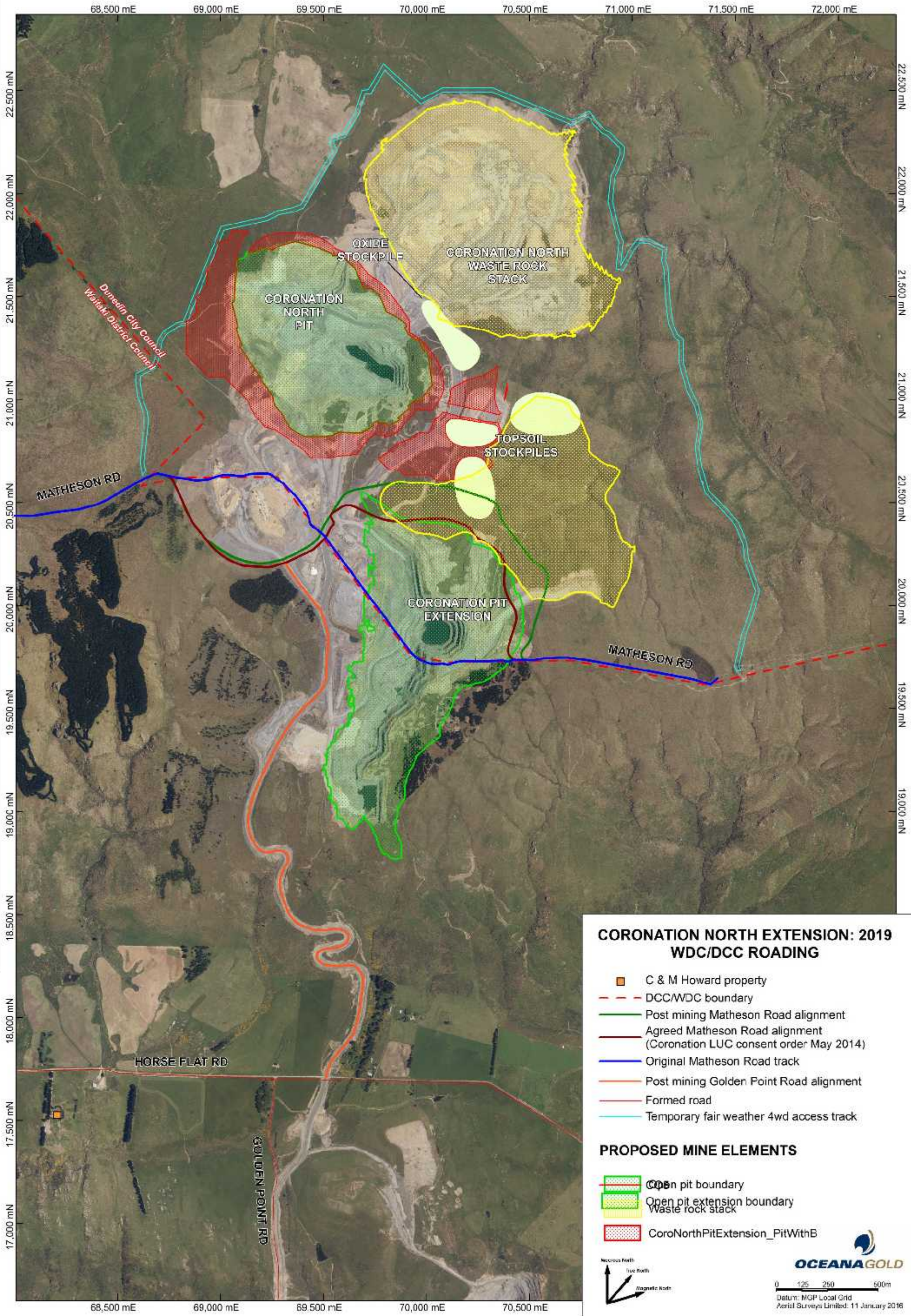
Macraes Gold Project - Coronation North Extension S-92 Figure 1b

-  M_Named_RAPs_20131003
-  CoroNorth_Pit_2016
-  Proposed Waste Rock Stack
-  Consented Pit
-  Proposed Coronation North Pit Extension
-  Waste Rock Stack to be Removed
-  CGLNZ property boundary
-  CGLNZ owned land parcel



Datum: MGP Local Grid
Aerial Surveys Imagery: December 2018





CORONATION NORTH EXTENSION: 2019 WDC/DCC ROADING

- C & M Howard property
- - - DCC/WDC boundary
- Post mining Matheson Road alignment
- Agreed Matheson Road alignment (Coronation LUC consent order May 2014)
- Original Matheson Road track
- Post mining Golden Point Road alignment
- Formed road
- Temporary fair weather 4wd access track

PROPOSED MINE ELEMENTS

- Open pit boundary
- Open pit extension boundary
- Waste rock stack
- CoroNorthPitExtension_PitWithB

Natural North

True North

Magnetic North

0 125 250 500m

Datum: MGP Local Grid
Aerial Surveys Limited: 11 January 2016

Created by M. Duncan 20161013. Workspace: M. CoronNorth_Fields_Status_20161013.kor

Appendix II
Memo on Response to Request for Geotechnical Information on Coronation North
Extension

MEMORANDUM

To: Gavin Lee
From: Andrew Winneke, Geotechnical Engineer
Item: Response to Request for Geotechnical Information on Coronation North Extension
Date: 5th April 2019

Dear Gavin

The following memo is in response to the request for information from the Dunedin City Council for the Coronation North Extension Consent Application.

3a Reasons why the pit wall is unstable

Excavation of the Coronation North (CRN) Stages 1 and 2 pits revealed significant areas of weak materials that failed in modes that were unexpected and therefore not reflected in earlier pit designs. As a result, further exploration drilling and mapping was undertaken in the Stage 3 Pit and finally redesigned early in 2018 to reflect these areas of weakness and to improve slope performance. The primary redesign referred to areas of ground around the western margin of the final pit walls indicated in the plan below (Figure 1).



Figure 1. Aerial view of the Coronation North pit showing the area required to be laid back.

Instability in this area is largely the result of a band of saprolitic schist rock that underlies the sediments and volcanic/pyroclastic material in this region of the pit. The inherent weakness of the saprolite is the combined result of weathering, high clay content, and relict foliation planes. The foliation unfavourably

dips into the pit-void in this area. The underlying un-weathered schist rock behaves in much the same way as the rest of the grey schist rock in the Macraes region.

3b Construction and sequence

The redesign was essentially aimed at projecting the base of the saprolite up to the topographical surface at the typical angle of foliation dip, i.e. around 17 - 20° below horizontal (Figure 2). The weak materials, which includes deeply weather volcanic ash and boulders, sediments as well as the saprolite (typically around 20 m total thickness in the pit wall area) were excavated at 17 - 20°. The overall wall has since remained stable. Mining of the layback was conducted simultaneously with mining of the remaining pit.

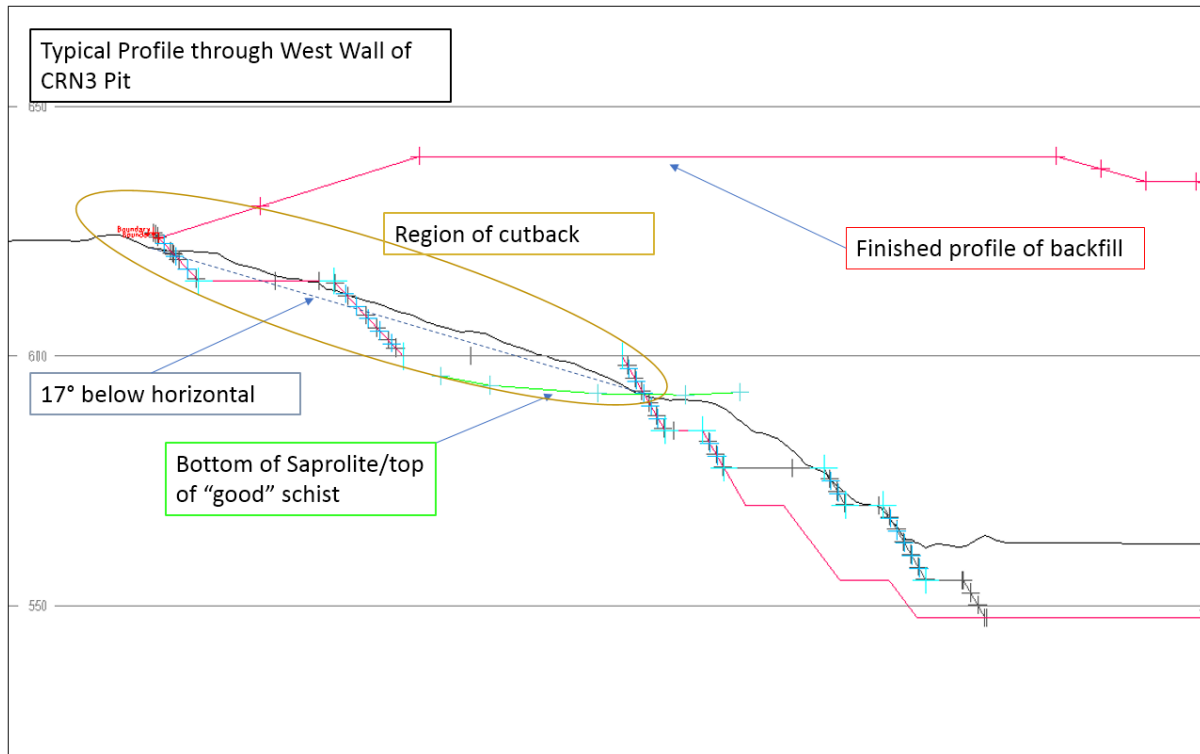


Figure 2. Section through the west wall showing the re-designed slope.

3c Expected outcomes

The “as built” slopes are generally expected to remain stable without significant tension-cracking beyond the present pit crest though localised areas of “creep” movement (e.g. in response to heavy rain events) from time to time may occur. Further, the planned back-filling of this area of the Stage 3 pit during mining of stage 4, with un-weathered schist rock, will complete the long-term stability of these weak wall zones.

3d Residual risk

There is no known structural mechanism that might lead to instability in the long-term, post-closure Coronation North pit area. The back-fill covers this area (See Figure 2).

Andrew Winneke

Geotechnical Engineer

Appendix III
Memo on Response to Ecological Questions in the Coronation North Extension



Reference:

19 March 2019

Gavin Lee
OceanaGold

Dear Gavin,

Re: *Response to ecological questions in the Coronation North Extension Section 92 request from Dunedin City Council 15 March 2019*

The responses to the DCC S92 request for the Coronation North Extension project are:

Q. 5a. Please clearly identify by way of larger-scale maps the spatial extent of the various indigenous vegetation communities within the proposed extension area and the communities being retained as a consequence of changes in the waste rock stack footprints.

See file CoronationNorthExtension_S92_Vegetation_UnconsentedExtension.jpeg for a larger-scale map of the vegetation within the unconsented area of the Coronation North pit extension area, file CoronationNorthExtension_S92_Vegetation_UnconsentedTrimbells WRS.jpeg for a larger-scale map of the vegetation of the Trimbells WRS unconsented area, and file CoronationNorthExtension_S92_Vegetation_GiveUpArea.jpeg for a larger-scale map of the vegetation within the area now being retained.

Q. 5b. Please clearly identify by way of larger-scale maps the spatial extent of areas of significant vegetation and significant habitats of indigenous fauna as defined by the district plans within the proposed extension area and those areas being retained as a consequence of changes in the waste rock stack footprints.

As stated in the file note *Terrestrial biodiversity of Coronation North Pit Extension, Trimbells WRS and impact of Extension and WRS* dated 17 January 2019 and the Coronation North Project Ecological



Impact Assessment to which the file note refers, ALL of the vegetation within the Coronation North Extension is considered significant under the DCC District Plans and the Proposed Otago Regional Policy Statement as they harbour rare plant and animal species as described in that file note.

To provide further detail the following comments are made:

While no Areas of Significant Conservation Value have been identified under Schedule 25.4 of the operative DCC District Plan, all of the areas (or parts thereof) under consideration meets all the listed criteria excepting criteria (a) (existing protected areas) and (c) (sites listed by ORC as having significant conservation value), and would qualify for nomination to such a listing.

All of the areas (or parts thereof) under consideration meets criteria c. i. (rare species), ii. (rare LENZ; see file CoronationNorthExtension_S92_LENZ.jpg for map of this feature), iii. (originally rare wetlands: seepages); d. (representativeness); e. iii. (distinctive vegetation: basalt seepage wetlands); g. (species diversity; give-up area only) listed in Policy 2.2.3.2 of the 2GP Plan (appeals version).

All of the areas (or parts thereof) under consideration meets criteria I (representativeness); 2. a. (rare species), b. (rare LENZ; see file CoronationNorthExtension_S92_LENZ.jpg for map of this feature), c. (originally rare ecosystems: seepages; excepting the give-up area); 4. c. (distinctive vegetation: basalt seepage wetlands; pit extension area only) listed in Schedule 4 of proposed Otago Regional Policy Statement (decisions version).

No maps in addition to those produced in response to Q. 5a. are needed as all of the vegetation on these maps is considered significant as meeting one or more of the criteria in the District Plans and proposed Otago RPS.

Q. 5c. Please detail the hectares for areas identified under questions 5a and 5b.

Vegetation Type	Coronation Pit Extension (Unconsented Area)	Trimbells WRS (Unconsented Area)	Overlap between unconsented areas of the	
			Extension and WRS	Give-Up area
Basalt contact seepage wetlands	1.5			
Bluff vegetation	1.3			2.0
Gully Slope Mosaic	0.1			
Narrow-leaved tussock grassland	23.3	17.4	0.1	50.1
Riparian herbfield & sedgeland	0.7	0.1	0.0	0.4
Seepage wetlands		0.1		
Short tussock grassland	12.4			
Shrubland	1.7			
Grand Total	39.9	17.6	0.1	52.6

Table 1. Extent (in hectares) of vegetation communities with the areas identified under questions 5a and 5b. Note: there is a small area of overlap between the unconsented portions of the pit extension and Trimbells WRS which needs to be removed from the totals for these sites.

Q. 5d. Please provide further details of the species present and the ecological value of the basalt contact seepage wetland being lost by the extension.

These wetlands are described in Section 5.2.1.2 of the Coronation North Project Ecological Impact Assessment to which the file note *Terrestrial biodiversity of Coronation North Pit Extension, Trimbells WRS and impact of Extension and WRS* dated 17 January 2019 refers. This description is repeated here:

“The basalt contact seepage wetlands at the basalt/schist rock contact zone of the Sisters Peak cone cover 3.9ha, and are comprised of a mix of indigenous and native herbs, sedges, rushes and grasses, such as *Carex gaudichaudiana*, *Ranunculus glabrifolius*, *Juncus effusus*, *Eleocharis acuta*, *Juncus articulatus*, areas of *Carex coriacea* sedgeland, and they are often bordered by *Carex testacea*. These wetlands are often heavily pugged by cattle, which results in the formation of raised hummocks.

This natural vegetation community appears to be classified by Singers and Rogers (2014) as WL22: *Carex*, *Schoenus pauciflorus* sedgeland. The wider distribution of this wetland community, where it is formed through seepage of water flowing along the contact zone between schist basement rock and overlying basalt rock, is unknown. Basalt cones overlying schist are present at several localities in eastern Otago and it is possible that this vegetation community is present at some of these sites. In species composition and hydrological function is analogous to schist-based seepage wetlands that are scattered throughout Central Otago.”

The Coronation North Project Ecological Impact Assessment considered this form of wetland a rare ecosystem type, as a National Priority for Protection (Ministry for Environment and Department of Conservation 2007) and as significant under the operative DCC District Plan and ORC Regional Plan: Biota. It was considered that the Coronation North Project would have an effect: “Water draw-down and altered subsurface flow along the basalt-schist contact zone resulting from construction of the Coronation North pit is expected to result in the drying of 3.9ha of basalt contact seepage wetlands which will change the species composition and cover towards plant species better adapted to moist, rather than wet, soil moisture.”

Recent visits to these sites appear to show that these sites have to some degree become de-watered and some species, mainly the exotic rush *Juncus articulatus* and the indigenous *Carex dipsacea* appear to have proliferated (though some changes observed may also be a result of the cessation of grazing in the area).

This vegetation type is also now known to occur within the nearby Highlay Hill Covenant.

Q. 5e. Please provide further detail on the proposed rehabilitation options for the Highlay hill Covenant wetland.

The basalt contact seepage wetlands in the Highlay Hill Covenant are of higher indigenous species diversity, several very rare species, and lower weed-loading. It is proposed that in two of these wetlands that:

- 1) A weed surveillance programme be initiated to detect any arrival of wetland-transforming species (such as the rush *Juncus subnodulosus* and the grass *Narduus stricta* that are both known from rare sites within the Macraes E.D.).
- 2) Rare indigenous species present in the Coronation North seepages but rare or absent from the Highlay Hill seepages are introduced into the Highlay Hill seepages. Currently only the sedge *Carex testacea* “red” would fit these criteria. Previous translocation of the ecologically-

similar *Carex kaloides* in the Tipperary Creek has been successful with 100% survival of translocated plants for at least 5 years post translocation. It is thought translocation of *Carex testacea* "red" would similarly have a high chance of success.

Yours sincerely,

A handwritten signature in black ink, appearing to read "M. Thorsen". The signature is fluid and cursive, with a long horizontal stroke at the end.

Dr Michael J. Thorsen
Director & Principal Ecologist
ERA Ecology NZ Ltd



OceanaGold Coronation North Pit Extension Project

Vegetation of Give-Up Area

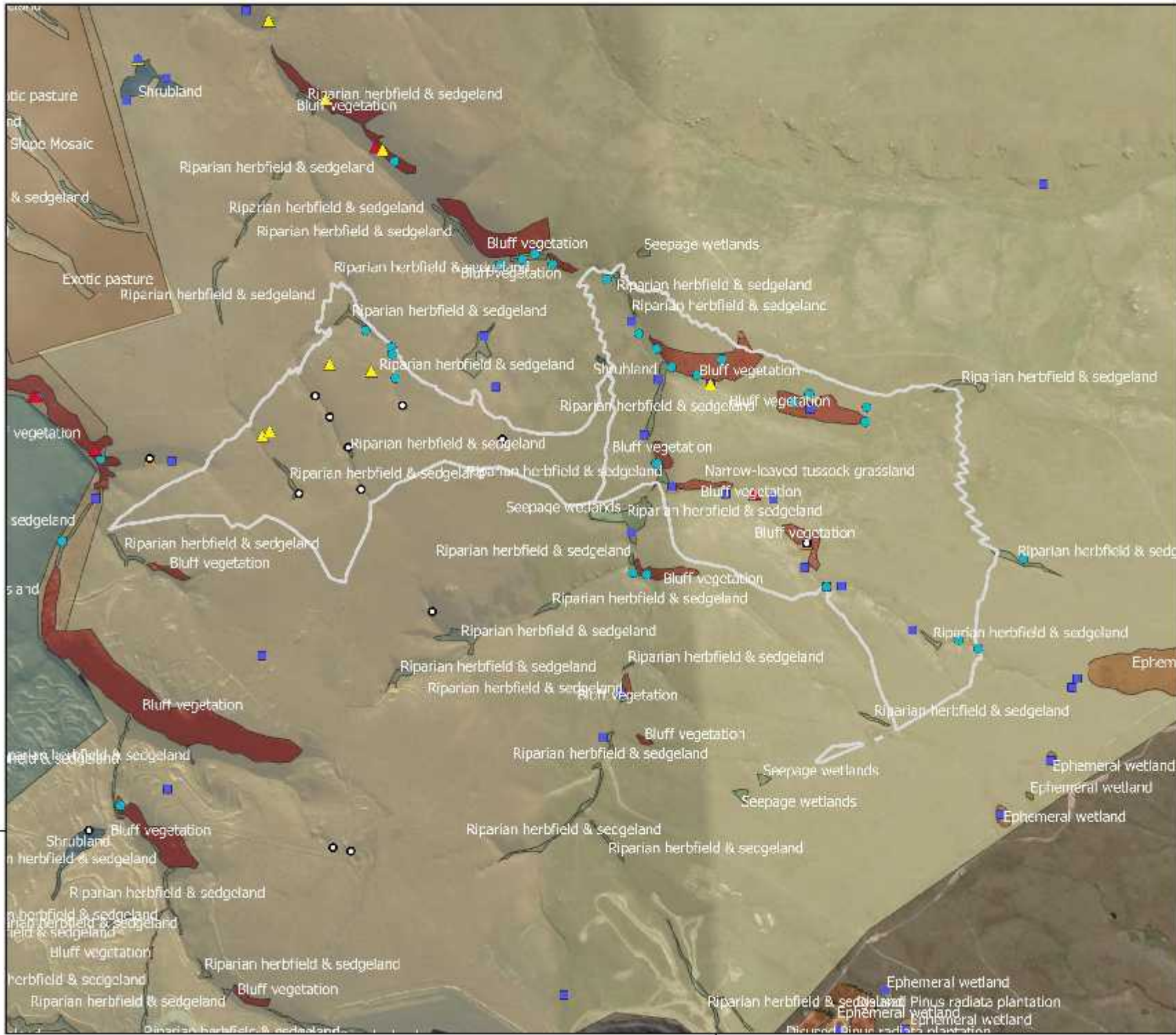
Coronation North 4255 Give-Up Area

Plant Species of Interest

- Nationally Critical
- Nationally Endangered
- Nationally Vulnerable
- Declining
- Nationally Uncommon
- Locally Significant

Vegetation

- Bluff vegetation
- Disused Pinus radiata plantation
- Ephemeral wetland
- Exotic pasture
- Gully Slope Mosaic
- Narrow-leaved tussock grassland
- Fern
- Riparian herbfield & sedgeland
- Seepage wetlands
- Shrubland
- Shrubland

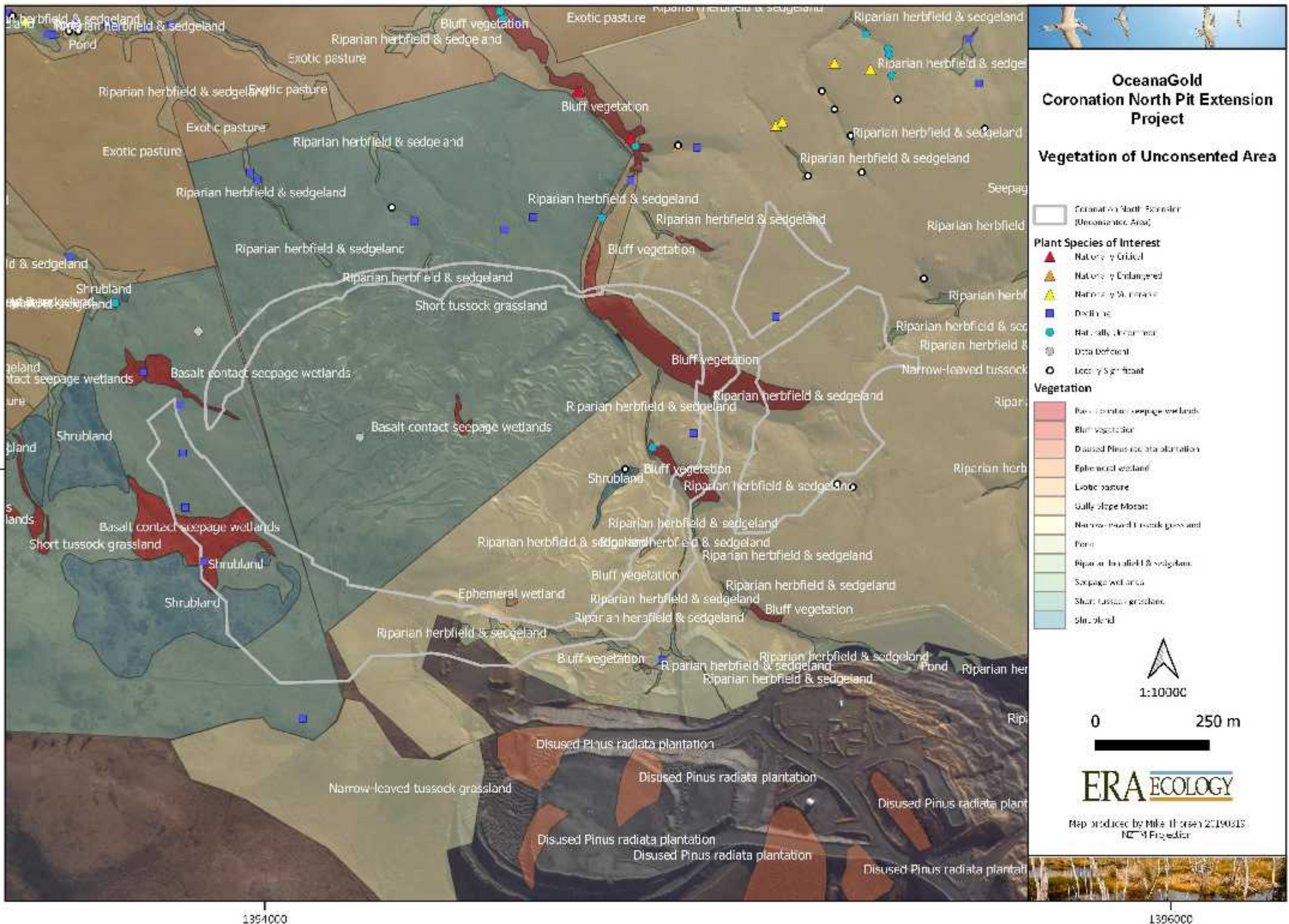


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Map produced by Mike Hooten 2/19/2015
NORM FROEDER





**OceanaGold
Coronation North Pit Extension
Project**

Vegetation of Unconsented Area

Coronation North Extension
Unconsented Area

Plant Species of Interest

- Naturally Critical
- Naturally Endangered
- Naturally Mammals
- Declining
- Naturally Uncommon
- Data Deficient
- Locally Significant

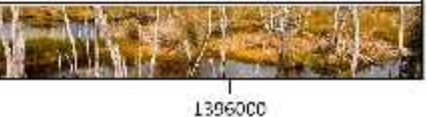
Vegetation

- Basalt contact seepage wetlands
- Bluff vegetation
- Disused *Pinus radiata* plantation
- Ephemeral wetland
- Exotic pasture
- Gully Slope Mosaic
- Narrow-leaved tussock grassland
- Pond
- Riparian herbfield & sedgeland
- Seepage wetland
- Short tussock grassland
- Shrubland

0 250 m

ERA ECOLOGY

Map produced by Mike Hooten 21/03/15
NFM Predator



1354000

1396000

4978000

Appendix IV
Noise Monitoring Results

Data Point	Time	LAeq	Lmax(dB)	L10(dB)	L95(dB)	L50(dB)	Weather Conditions	Comments
Howard Property	20/03/2019		34.1	22.4	22.1	21.7	Very still, humid	
	01/08/2018 00:07	33.4	52	34	28	30	Clear, light wind	
	31/07/2018 22:04	64	80.8	67.5	50	59.5	Clear & windy	
	29/07/2018 03:25	41.1	56	44	35.5	40	Light breeze	
	27/07/2018 21:00	58.2	71.6	61	51.5	56.5	Windy, 10m/s	
	27/07/2018 04:02	37.7	57.2	51.5	41	45.5	High SW Wind	
	26/07/2018 00:40	42.5	71	44.5	34.5	40.5	Calm	
	26/07/2018 04:30	44	57.6	47	38.5	4.5	Calm	
	26/07/2018 21:10	37.3	64.1	40	32	35	Light wind	
	25/07/2018 03:25	29.3					Frosty, still	Sheep in the paddock mostly quite
	24/07/2018 22:30	47.5					Fog	Sheep in the paddock.
	19/07/2018	46.8	64.8	49	33.5	41	No wind	Sheep in the paddock
	16/07/2018 22:15	46	72.7				Wind in the trees, 5.8m/s	
	16/07/2018 22:35	43	64.9				Wind noise, 8m/s	.
	2/04/2018 3:25	0	0	0	0	0	Heavy fog to ground level	Sheep in paddock bleeting
	2/04/2019 12:07	33.4	52	34	28	30	East, Clear, Light Wind	
	1/08/2018 0:00	33.4	52	34	28	30	Clear, light wind	
	31/07/2018 22:00	64	80.8	67.5	50	59.5	Clear & windy	
	2/04/2019 3:25	41.1	56	44	35.5	40	SW, Light breeze	
	29/07/2018 3:30	41.1	56	44	35.5	40	Light breeze	
	27/07/2018 21:00	58.2	71.6	61	51.5	56.5	Windy	
	2/04/2018 4:02	37.7	57.2	51.5	41	45.5	SW, High South westerly wind	
	2/04/2018 9:00	58.2	71.6	61	51.5	56.5	SW, Strong Winds, 10m/s	
27/07/2018 21:00	37.7	57.2	51.5	41	45.5	High wind		

	26/07/2018 21:00	37.3	64.1	40	32	35		
	26/07/2018 4:30	44	57.6	47	38.5	42.5		
	26/07/2018 0:30	42.5	71	44.5	34.5	40.5		
	25/07/2018 10:00	47.5	68	50	38	45	Calm clear night.	
	25/07/2018 3:30	29.3					Frosty	
	24/07/2018 22:30	47.5					Fog	
	2/04/2019 10:01	46.8	67.4	49	33.5	41	Northerly wind 0%	Sheep in paddock. No wind so drone from the trucks does seem louder than normal but with the amount of sheep in the paddock this is not an accurate reading.
	19/07/2018 10:00	46.8	67.4	49	33.5	41	Sheep in paddock. No wind.	
	2/04/2019 10:35	43	67.9	0	0	0	Clear, 8m/s	Wind noise
	2/04/2019 10:15	46	72.7				NW, 58 Knots	Wind noise in trees
	16/07/2018 10:30	46	72.7				Wind noise in trees	
	16/07/2018 10:00	43	64.9				Wind noise	
	18/06/2018 13:56	35.5	49				0% cloud 0 wind	Light road noise
	4/06/2018 15:40	42.8	62.1	45	33	38		
	4/06/2018 11:36	41.1	68.5	43	31.5	37.5		
	2/04/2018 9:10	37.3	64.1	40	32	35	Light Southerly Wind	
	27/03/2018 10:30	44.2	59.2					
	22/03/2018 20:51		34.1	22.4	22.1	21.7	Very still, Humid, No Fog & Rain	Clear visability. Little bit of sheep movement. Recorded by CBoyt
	31/01/2018 11:02	56.8	76.2				5% cloud	Medium wind noise in trees
	30/01/2018 12:00	52.5	73.8				5% cloud	Trucks running to plant. Some wind noise. Trucks not very noisy.
	19/09/2017 15:05	41.9	54.4	44.5	36.5	40.5	90% cloud NE 5 km/h	
	17/08/2017 15:53	42.8	56.6	46	33.5	41	5% Cloud W 4m/s	Some tree noise

	25/07/2017 11:03	69.9	70.3	43	31	37	10% cloud W 2 m/s	
	21/04/2017 0:00	38.4	74.8	35.5	27.5	31	Clear, Clam, warm, 1 m/s	Paused for vehicles, Mining noise audible - trucks hauling, duck noise from dredge pond

Data Point	Time	LAeq	Lmax(dB)	L10(dB)	L95(dB)	L50(dB)	Weather Conditions	Comments
O'Neill Property	8/03/2018 0:17		49.5				Slight fog	One frog & one sheep making noise
	8/03/2018 0:38		55.7				Slight fog	One frog & one sheep making noise
	18/04/2018 10:18	41.3	61.1				80% cloud N 6 kmh	Windy. Dogs barking
	22/03/2019 23:13	29.3	54.2	25	21	21.5	Overcast, Nil Wind Speed, Overcast	Odd Sheep, Pretty quiet - Recorded by Ryan Biard
	22/03/2019 22:43	40	68	33	22.5	24.5	Nil Wind, Overcast, Still	Bull and Electric fence inaudible but minimal other than 3-4 horn blasts. Electric fence clicking in shed 30m. Recorded by Ryan Biard.
Peddie Property	17/05/2017 11:03	39.7	64.8	43.5	25	33	20% cloud NW 3m/s	Tested at DG22
	25/07/2017 11:59	71.8	60.2	46	30	38	15% cloud NW 5 m/s	
	17/07/2017 12:17	30.6	51.6	33	23	26	0% cloud SW 2m/s	Night monitoring
	22/03/2019 22:43	40	68	33	22.5	24.5	Overcast, Still, Nil Wind	Bull in paddock and clicking electric fence. Recorded by Ryan Biard.

Data Point	Time	LAeq	Lmax(dB)	L10(dB)	L95(dB)	L50(dB)	Weather Conditions	Comments	
O'Connell Property	12/05/2017 12:50	39	55.3	41.5	34.5	38	40% cloud wind 1 m/s		
	17/05/2017 12:03	37.2	56.1	39.5	31.5	35.5	40% cloud SW 4m/s	2 vehicles drove past. lots of noise from school	
	17/07/2017 23:05	29.3	50.7	31.5	23	25	0% cloud 0 wind	Digger moving up Frasers Ramp	
	17/08/2017 15:42	38	55.1	42	27	33	90% cloud S 3m/s	minor tree noise. Vehicle drove past	
	19/09/2017 15:30	42.9	53.3	45.5	38	42	90% cloud NE 5km/h	Some road noise, some wind noise	
	19/09/2017 23:52	30.4	43.3	32	27	29.5	10% cloud N 1 km/h	paradise ducks making noise	
	24/10/2017 16:10	38.7	62.9				80% cloud		
	19/01/2018 15:37	40.3	70.8	42	35	38.5	NE wind, 4 m/s, 30 % Cloud		
	8/02/2018 11:47	40.3	49.1				0% cloud		
	13/04/2018 15:34	49.8	75.2				30% cloud 0 wind	light traffic through township	
	18/04/2018 11:36	38.1	65				100% cloud WNW 2 kph	Wind in trees making noise	
	18/06/2018 14:27	29.9	50.7				0% cloud 0 wind		
	18/06/2018 23:22	37.5	57				50% cloud 0 wind	Ag vehicle drove past	
	3/07/2018 14:36	29.7	55.8				0% cloud 0 wind		
	2/04/2019 23:21		58.7	32.5	25.5	28.5	0% Wind 0% Wind speed	0% Cloud Conditions	
	24/08/2018 14:36	40.9	63.8				99% cloud SW 3 m/s	used old meter	
	2/04/2019 12:17		0	0	0	0	SE, 2m/s, Slight Fog	Hot seat change over. 1 Frog 1 Sheep	
	22/03/2019 21:55			86.3	61.5	36.4	22.2	Still, No Visibility	Still, a little noise from Ducks. This was on the other side of Parky's house. Recorded by CBoyt
	22/03/2019 4:15			39.5	22.5	21.1	21.1	Still, No rain or wind	Very still, could hear trucks hauling in distance. Horses started being restless and making a little noise. Recorded by CBoyt

Data Point	Time	LAeq	Lmax(dB)	L10(dB)	L95(dB)	L50(dB)	Weather Conditions	Comments
School House	10/05/2017 15:47	45.4	71.5	45	35	39	calm, clear	mining noise audible, bird noise
	10/05/2017 15:20	45.8	73.1	41	31.5	35.5	calm, clear warm wind 1m/s	paused for vehicle, vehicle went past, mining noise audible
	12/05/2017 12:22	37.2	56.1	39.5	31.5	35.5	40% cloud, SW 4m/s	Vehicle drove past, wind noise from trees, Voices from school
	25/07/2017 11:23	42.9	62.9	45	29	37	15% cloud NW 4m/s	Some noise from trees
	17/08/2017 15:27	37.7	54.7	42	28.5	33	5% cloud W 3m/s	Some tree noise
	19/09/2017 15:50	42.1	49.7	45	37	41	NE 5 km/h	some road noise
	31/01/2018 11:28	63.5	71.6				5% cloud	Lots of wind noise through trees
	8/02/2018 12:05	8.4	57.1				0% cloud no wind	school children at school making noise
22/03/2019 10:30		44.4	23.5	22.5	22.5	Cool, Nil wind or rain, Low fog	Still and very quiet. Couple of ducks quacking away and our camper in the background.	

Appendix V
Noise Monitoring Reports

File Ref: AC18364 – 02 – R2

5 March 2019

Mr G. Lee
OceanaGold Corporation
Golden Point Road
RD3
Macraes Flat 9483
EAST OTAGO

Email: Gavin.Lee@oceanagold.com

Dear Gavin,

**Re: Oceana Gold Corporation, Macraes Flat, Otago
Response to MDA peer review queries**

Acoustic Engineering Services (AES) have been asked to provide additional information regarding the expected noise levels at the Howard dwelling as a result of the activity on the Macraes Flat gold mine.

We understand that the mining activity on the site currently is at the Coronation North pit, on the opposite side of the hill to the north of the Howard dwelling, and the associated haul road connecting the pit to the processing plant.

1.0 CURRENT NOISE LEVELS (A-WEIGHTED AND SPECTRAL) AT THE NOTIONAL BOUNDARY OF THE HOWARD'S PROPERTY, EITHER MEASURED OR PREDICTED UNDER LIGHT DOWNWIND CONDITIONS IN ACCORDANCE WITH NZS6801/6802/ISO9613-2

A long-term noise monitoring station has been installed approximately 20 metres from the Howard dwelling. The data from this unit has been analysed for the night-time period (2100 to 0700 hours) for a selected six-week period in August and September 2018, after a bund was installed along the haul road. As this six-week period occurred during the colder months of the year, we expect it to be representative (or over-representative) of the relevant weather conditions in the area which enhance the propagation of sound. We understand that it is during the night-time period that the noise from the mine is more disturbing to the Howards. It is also the period when the surrounding ambient noise is generally low and the noise from the mine is able to be isolated.

Measurements were disregarded from the analysis when the wind speed at the local weather monitoring station was recorded above 5 m/s, as well as when the audio files confirmed that the dominant noise source was obviously not from the mine (such as wind noise in trees).

Based on this analysis, the following noise levels have been recorded at the Howard dwelling:

Noise from the Coronation North mine

- Under typical weather conditions and mining activity (with no hauling) noise levels during the night-time period are in the range of 25 – 35 dB LAeq (15 mins).
- On some infrequent occasions the noise levels increased to a maximum of 42 dB LAeq (15 mins) due to unusual meteorological conditions, and equipment undertaking non-typical activity on the mining site

or the haul road (for example a bulldozer travelling along the haul road). Unusual meteorological conditions may sometimes still be within the meteorological window outlined in NZS6802:2008, but occur very infrequently. These periods may not therefore be necessarily considered 'representative' as per section A1.3 of NZS6802:2008

Noise from the Haul Road

- Noise from a single haul truck on the haul road under neutral conditions measured 37 dB L_{Aeq} (15 mins) at the Howard dwelling. This may be increased (by 1 – 3 dB) if it happened to occur at a time of enhanced propagation which still fell within the 'meteorological window' outlined in NZS 6802:2008.
- We understand that up to eight trucks may use the haul road during a single 15-minute period during the night-time. Therefore, considering enhanced propagation (+ 3 dB) noise levels of up to 49 dB L_{Aeq} (15 mins) may be received at the Howard dwelling if this was to occur.

We note that the sound insulation analysis outlined in our report titled *Oceana Gold Corporation, Macraes Flat, Otago: Proposed upgrades to Howard dwelling* (AES file reference: AC18364 – 01 – R2, dated the 19th of November 2019), was based on the C_{tr} adaption term outlined in ISO 717.1:2000 *Acoustics – Rating of sound insulation in buildings and of building elements Part 1: Airborne sound insulation*, rather than a specific measured noise spectrum.

Attended noise monitoring was undertaken in the proximity of the Howard dwelling as the haul trucks travelled along the haul road, and in close proximity to the haul trucks. The close proximity measurements of the trucks were used to determine the overall sound power of the trucks. SoundPlan computational noise modelling software, based on ISO 9613 *Acoustics – Attenuation of sound outdoors – Part 2: General method of calculation* has been used to calculate the propagation of noise from the trucks, taking into account the topography of the area, and the sound power level of the trucks.

Based on a 49 dB L_{Aeq} overall noise level at the notional boundary of the Howard dwelling, the possible frequency content of the noise suggested by each method is as follows:

Frequency		63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz
dBA	C_{tr}	-	35	39	42	45	43	38
	Measured at Howard dwelling	25	37	37	46	43	37	21
	Predicted at Howard dwelling based on close proximity measurements	27	35	28	45	45	38	4

2.0 CURRENT CONSENT CONDITIONS APPLYING TO NOISE AT THE HOWARD DWELLING

We understand that the current noise related conditions of consent are as follows:

1. *The consent holder shall ensure that all construction and operation activities associated with the mining operation are designed and conducted so that the following noise limits are not exceeded at the locations specified in Condition 8.2*
 - (a) *On any day between 7am and 9pm (daytime): 50 dB L_{Aeq} ; and*
 - (b) *On any day between 9pm and 7am the following day (night-time): 40 dB L_{Aeq} ; and/or 70 dB L_{Amax}*

Measurement Locations

2. *Noise measurements shall be taken at any point within Macraes Village; or at, the notional boundary of any dwelling not owned by the consent holder in the Rural Scenic Zone.*

Note: The notional boundary is defined as a line 20 metres from the exterior wall of any rural dwelling or the legal boundary where this is closer to the dwelling.

Measurement and Assessment

3. *All noise measurements referred to in Conditions 8.1 and 8.2 above shall be measured in accordance with the provisions of NZS 6801:2008 Acoustics: Measurement of Environmental Sound, and shall be assessed in accordance with the provisions of NZS 6802:2008 Acoustics: Environmental Noise.*
4. *Prior to the commencement of mining, the consent holder shall install double glazing at 406 Horse Flat Road owned by C A and E M Howard. The glazing shall include one layer of 6 mm laminated glass for noise reduction purposes. A mechanical ventilation system shall also be installed in the dwelling that will supply supplementary fresh air ducted from outside to bedrooms and living spaces.*

3.0 MITIGATION STRATEGY THAT OCEANIA IS OR COULD CONSIDER TO REDUCE THE NOISE LEVELS TO A COMPLIANT LEVEL

As stated in section 1.0, the dominant noise received at the Howard dwelling is due to the use of the haul road. In order to reduce noise levels from this source, we understand that OceanaGold have completed the following:

- Installed 4-metre-high bunds along portions of the haul road identified by AES between the Coronation North pit and the Howard dwelling. Based on the unattended monitoring this has reduced the noise levels at the Howard dwelling by more than 5 dB.
- Implemented a no hauling at night policy until an agreement with can be reached with the Howards.
- Upgraded the glazing and installed a mechanical ventilation system at the Howard dwelling, as required by the Condition of Consent.
- Installed the long-term monitoring station at the Howard dwelling to provide greater understanding of the current noise levels experienced.

As outlined in our report titled *Oceana Gold Corporation, Macraes Flat, Otago: Proposed upgrades to Howard dwelling* (AES file reference: AC18364 – 01 – R2, dated the 19th of November 2019), Oceana Gold have also offered to undertake further upgrades of the Howard dwelling.

Further to the above, we understand that the following is also being investigated with regard to practicality and effectiveness:

- Increasing the height and / or extent of the bund further, as there is still currently line of sight between the trucks and the Howard dwelling in some locations. We understand that this is currently being investigated in regard to wind and slope stability.
- Limitations on the number of truck movements in a 15-minute period.
- Additional close proximity screening for the Howard dwelling.

4.0 PREDICTED NOISE CONTOURS ACROSS THE HOWARD'S PROPERTY FOR FUTURE STAGES OF ALREADY CONSENTED OR POSSIBLE FUTURE UN-CONSENTED PROJECTS (A-WEIGHTED AND SPECTRAL DATA)

As discussed above, the main noise received at the Howard dwelling is from the haul trucks on the haul road. SoundPlan computational noise modelling software, based on ISO 9613 *Acoustics – Attenuation of sound outdoors – Part 2: General method of calculation* has been used to calculate the propagation of noise from the trucks, taking into account the topography of the area, and the sound power level of the trucks.

We note that we have modelled the haul trucks as a line source on the haul road, calibrated to the worst-case expected 15-minute noise level at the Howard dwelling. The associated contour for one truck on the haul road is shown in figure 4.1 below, with the worst-case eight trucks in a 15-minute period shown in figure 4.2.

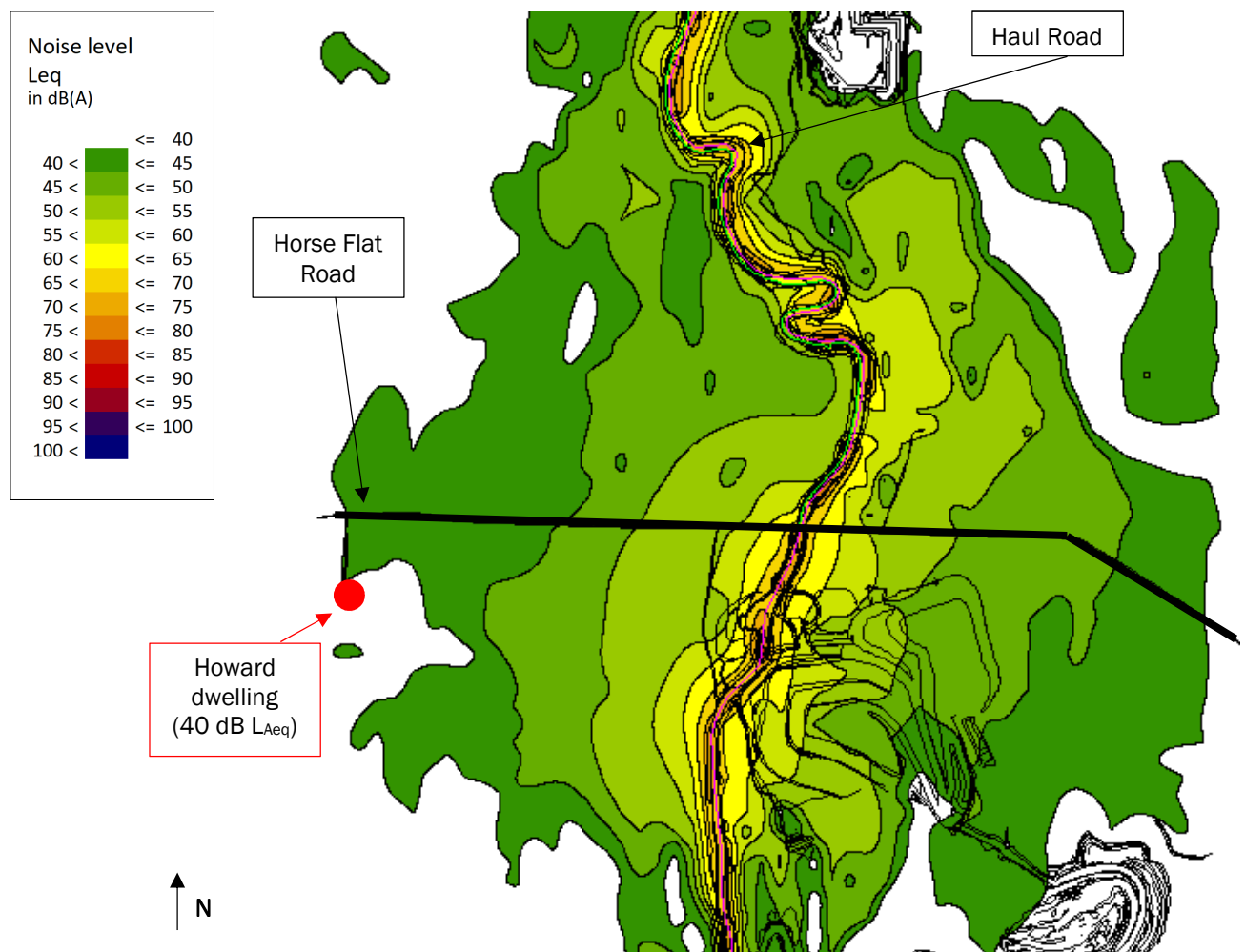


Figure 4.1 – Noise contour from one truck in a 15-minute period on the haul road

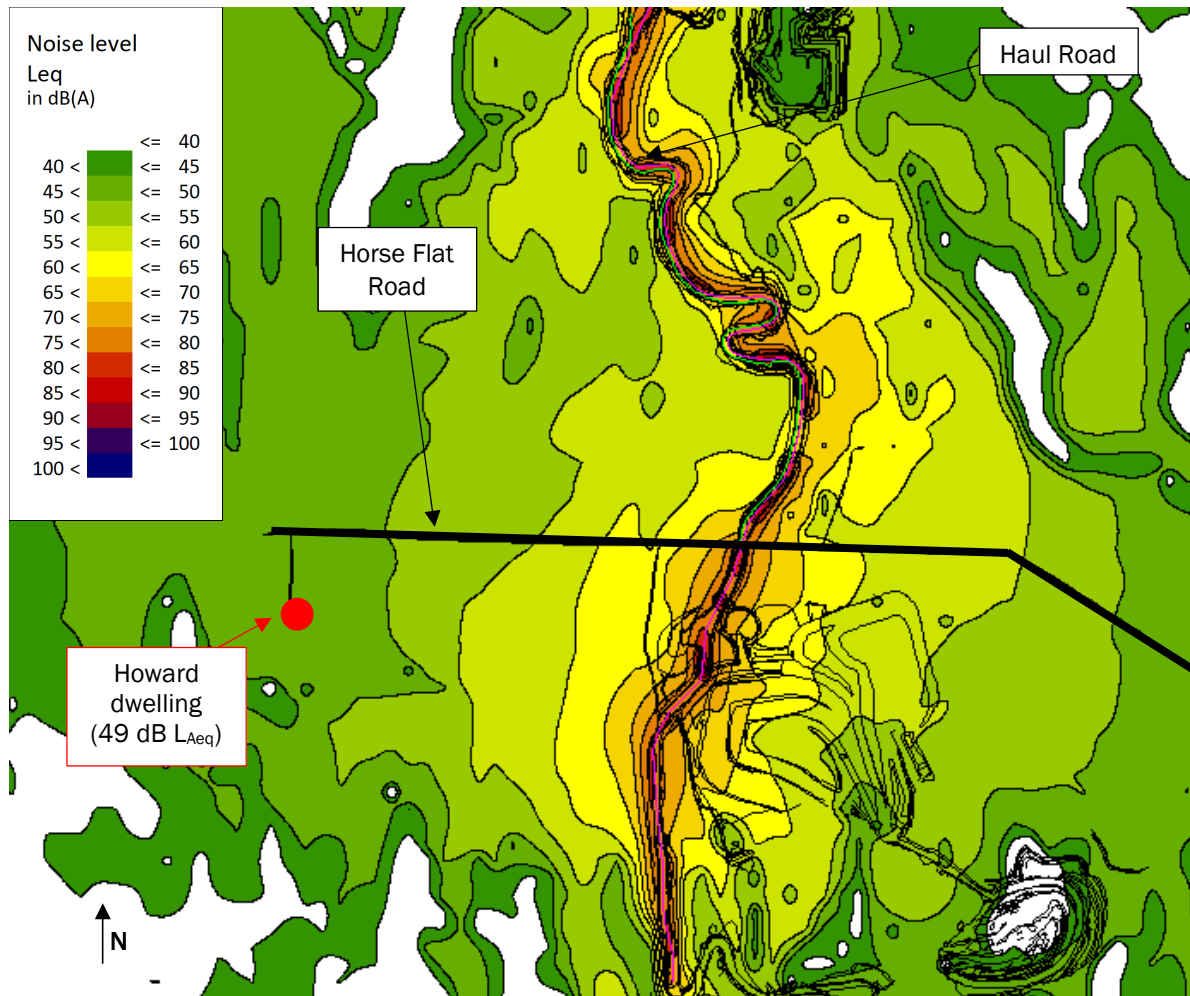


Figure 4.2 – Noise contour from eight trucks in 15-minute period on the haul road

Please do not hesitate to contact us to discuss further as required.

Kind regards

Clare Dykes
MBSc, MASNZ
Senior Acoustic Engineer
Acoustic Engineering Services Ltd

Appendix VI
Coronation North Extension Noise Modelling

File Ref: AC19058 – 01 – R2

21 March 2019

Mr G. Lee
OceanaGold Corporation
RD3, Macraes Flat 9483
East Otago

Email: Gavin.Lee@oceanagold.com

Dear Gavin,

**Re: OceanaGold Coronation North mine, Macraes Flat, Otago
Current noise emissions**

Acoustic Engineering Services (AES) have been engaged to model the noise emissions from the current Coronation North mining activity at the OceanaGold Macraes Flat gold mine.

AES have undertaken previous noise measurements at a neighbouring dwelling in order to determine the noise levels from the Coronation Noise mine. An unattended monitoring station has also been set-up at the site. The levels recorded for a six-week period were analysed and the results outlined in a report titled *Oceana Gold Mining activity, Macraes Flat – Review of unattended noise monitoring data* (AES file reference: AC17347 – 12 – R2) and dated the 21st of November 2018.

1.0 SITE AND SURROUNDING ENVIRONMENT

The site is located within both the Dunedin City District and the Waitaki District. It is within the Macraes Mineral Mining Zone and Rural Scenic Zone as defined in the Waitaki District Plan, and the Rural High Country Zone as defined in the Dunedin City Plan.

We understand that the activity occurs in two main pit areas, with the haul road connecting the pits to the processing plant. These areas are shown in figure 1.1 below.

There are a number of residential neighbours in relatively close proximity to the site. These are as follows:

- O'Neill – 540 Four Mile Road (Dunedin City District, Rural High Country Zone)
- Peddie – 482 Longdale Road (Dunedin City District, Rural High Country Zone) – owned by OceanaGold
- Howard – Horse Flat Road (Waitaki District, Rural General Zone)

The unattended monitoring discussed above was undertaken at the Howard dwelling.

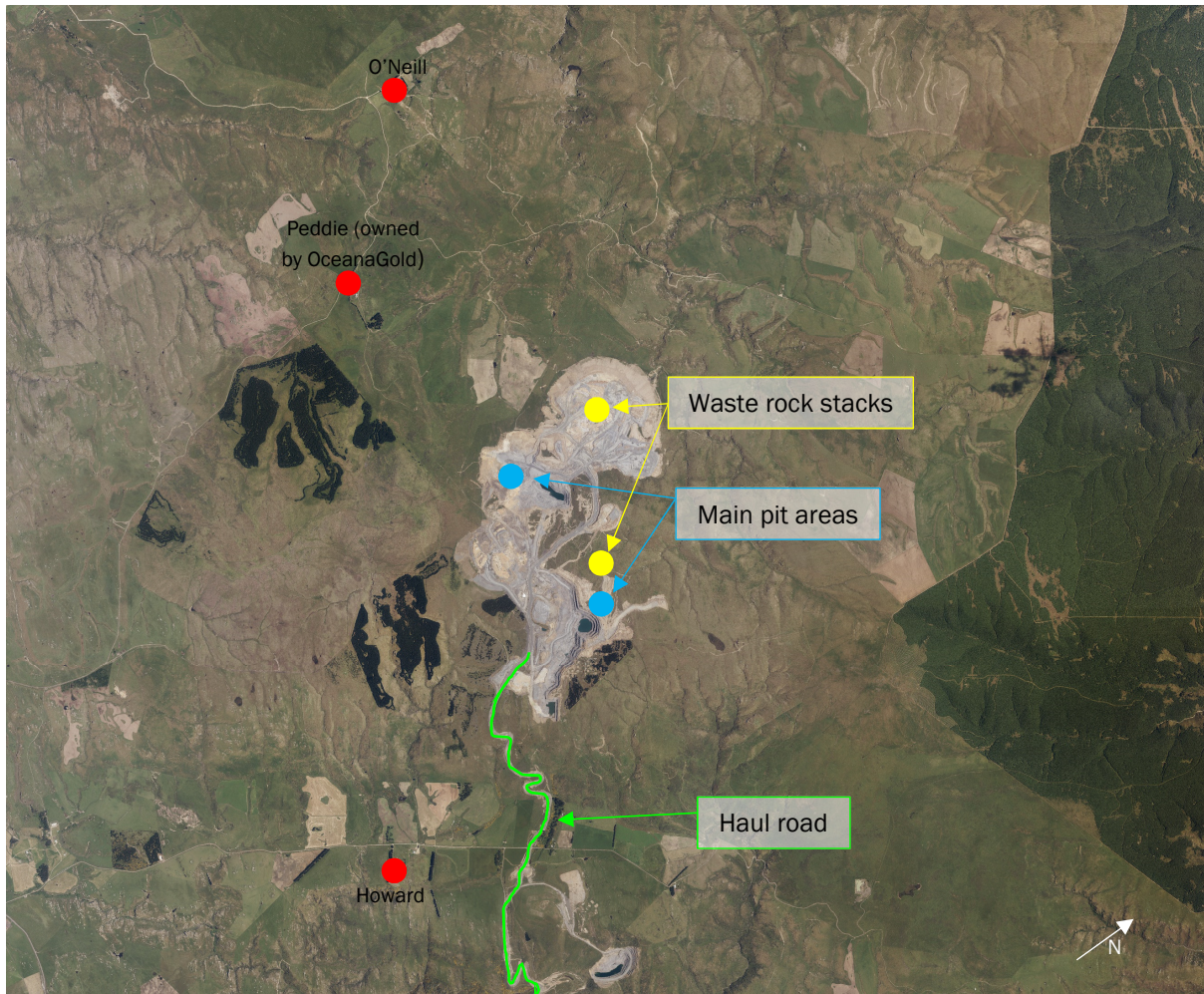


Figure 1.1 – Site and surrounding area

2.0 CONDITIONS OF CONSENT

Through the previous Resource Consent process, several conditions of consent were approved, which included noise limits for the site. The noise related conditions of consent are as follows:

1. *The consent holder shall ensure that all construction and operation activities associated with the mining operation are designed and conducted so that the following noise limits are not exceeded at the locations specified in Condition 8.2*
 - (a) *On any day between 7am and 9pm (daytime): 50 dB L_{Aeq} ; and*
 - (b) *On any day between 9pm and 7am the following day (night-time): 40 dB L_{Aeq} ; and/or 70 dB L_{Amax}*

Measurement Locations

2. *Noise measurements shall be taken at the notional boundary of any dwelling not owned by the consent holder.*

Note: The notional boundary is defined as a line 20 metres from the exterior wall of any rural dwelling or the legal boundary where this is closer to the dwelling.

Measurement and Assessment

3. All noise measurements referred to in Conditions 8.1 and 8.2 above shall be measured in accordance with the provisions of NZS 6801:2008 *Acoustics: Measurement of Environmental Sound*, and shall be assessed in accordance with the provisions of NZS 6802:2008 *Acoustics: Environmental Noise*.

3.0 NOISE FROM MINING OPERATION

SoundPlan computational noise modelling based on ISO 9613 *Acoustics – Attenuation of sound outdoors – Part 2: General method of calculation* has been used to calculate the propagation of noise from the site, taking into account the topography of the area, and sound power levels for each of the noise sources.

This modelling considers enhanced propagation representative of either moderate downwind conditions (up to 5 m/s) in every direction (which would not occur in reality), or moderate ground-based temperature inversions to represent what can occur on a clear, calm night. Noise levels predicted under these conditions are taken as being at the upper limit of the ‘meteorological window’ described in NZS 6801:2008 and NZS 6802:2008 where valid compliance assessments are possible.

3.1 Sound power of equipment

Clare Dykes of AES conducted a series of noise measurements on mining plant, equipment and heavy machinery operating at the existing Coronation North Pit, between 1300 and 1600 hours on the 8th of February 2018. Measurements were made in general accordance with NZS 6801:2008 *Acoustics – Measurement of environmental sound*.

The purpose of these measurements was to acquire data which could be used for predicting the expected noise levels at the notional boundaries of the neighbouring residential properties, for a given worst-case scenario in each of the mining areas.

In addition, as discussed above attended and unattended noise monitoring has been carried out at the Howard’s dwelling to determine the noise levels associated with trucks using the Haul Road.

3.1.1 Main quarrying equipment

We note that it was not possible to obtain measurements of all the specific equipment on the site – as it was not operating at the time of the measurements. However, a representative sample of equipment was obtained and the measured noise levels are in line with the reference levels provided in the relevant standards. Based on these measurements and analysis, the assumed worst-case sound power levels of the noise generating equipment which is associated with the operation are shown in table 3.1 below. This data has been used to calculate the noise expected at the nearest neighbouring dwellings due to the machinery operating.

Table 3.1 – Equipment sound power levels

Equipment or Machinery	Sound level dB L _{WA}	Notes
Drill	119	1.
Excavator	115	2.
Dozer / Loader	116	2.
Grader	115	2.
Water truck / Service truck	115	2.

1. Worst-case assumption based on measurements undertaken of larger exploration drill on site.

2. Measured typical levels on site and referenced against the British Standard BS 5228-1:2009 *Code of practice for noise and vibration control on construction and open sites – Part 1: Noise*.

3.1.2 Trucks

The noise level emitted by the haul trucks is more difficult to determine as the noise output of the truck varies with load, terrain and operation.

Given the changing gradient of the haul road the trucks emit varying levels of noise as they travel up / down the road. To determine the relative noise source level of the trucks as they travel on the haul road, we have calibrated our model using the results from our unattended noise monitoring at the notional boundary of the Howard dwelling. Noise from a single haul truck on the haul road under neutral weather conditions measured 37 dB $L_{Aeq (15 mins)}$ at the Howard dwelling. This may be increased (by 1 – 3 dB) if it happened to occur at a time during enhanced propagation which still fell within the meteorological window outlined in NZS 6802:2008.

We understand that up to eight trucks may use the haul road during a single 15-minute period. Therefore, considering enhanced propagation (+3 dB) noise levels of up to 49 dB $L_{Aeq (15 mins)}$ may be received at the Howard dwelling if this was to occur.

We have therefore considered eight trucks as a line source along the haul road, scaled to achieve a noise level of 49 dB L_{Aeq} at the Howard dwelling.

3.2 Predicted noise levels

3.2.1 Daytime activity (0700 to 2100 hours)

Based on discussions with the Client, we have based our model on the following worst-case level of activity between 0700 and 2100 hours:

- Western Pit – 2 excavators, 2 drills, 3 dozers, 1 grader, 1 service truck
- Eastern Pit – 2 excavators, 2 drills, 3 dozers, 1 grader, 1 service truck, 1 loader
- 10 trucks travelling between the western pit and the western waste rock stack
- 10 trucks travelling between the eastern pit and the eastern waste rock stack
- Eight trucks travelling from both of the pits down the haul road to the processing plant

There is also one water truck, and one grader on the roads between the two pits, and a water truck at the closest point to the Howard's on the haul road.

The resultant predicted daytime noise levels are shown in figure 3.1 below.

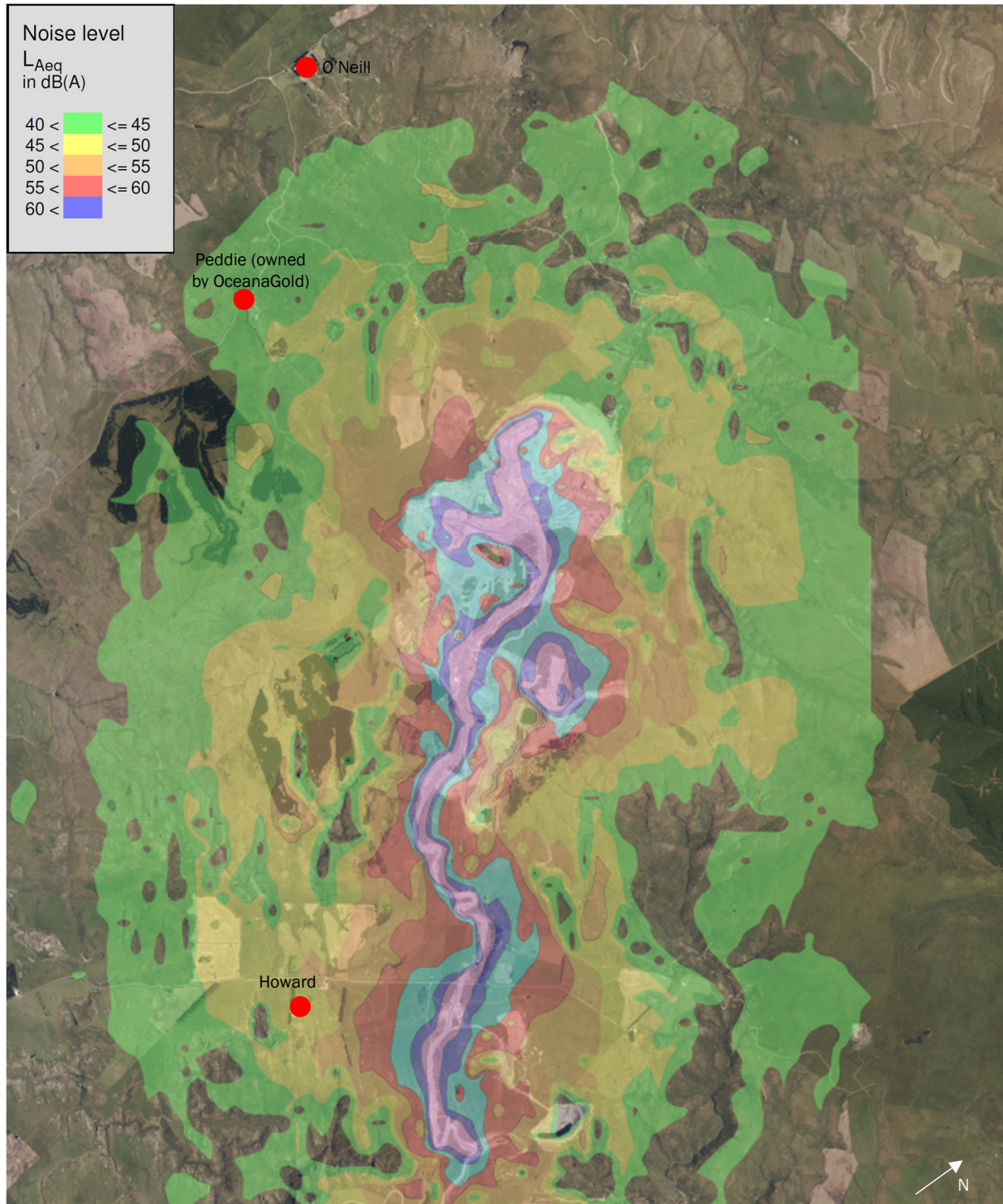


Figure 3.1 – Predicted daytime noise levels

Based on this modelling, the following noise levels are likely to currently be expected at the notional boundaries of the nearest neighbouring dwellings:

- O'Neill – 36 dB L_{Aeq}
- Peddie – 44 dB L_{Aeq}

- Howard – 49 dB L_{Aeq}

3.2.2 Night-time activity (2100 to 0700 hours)

We understand that OceanaGold have currently implemented a no hauling at night policy until they can come to an agreement with the Howards. The remaining activity on the site will continue at the same level, including the trucks travelling between the pits and waste rock stacks. Therefore, we have considered a scenario with all of the equipment stated in section 3.2.1 above in the same locations, but without any haul trucks travelling from the pits to the processing plant. The resultant predicted noise levels without the trucks on the haul road during the night-time period are shown below in figure 3.2.

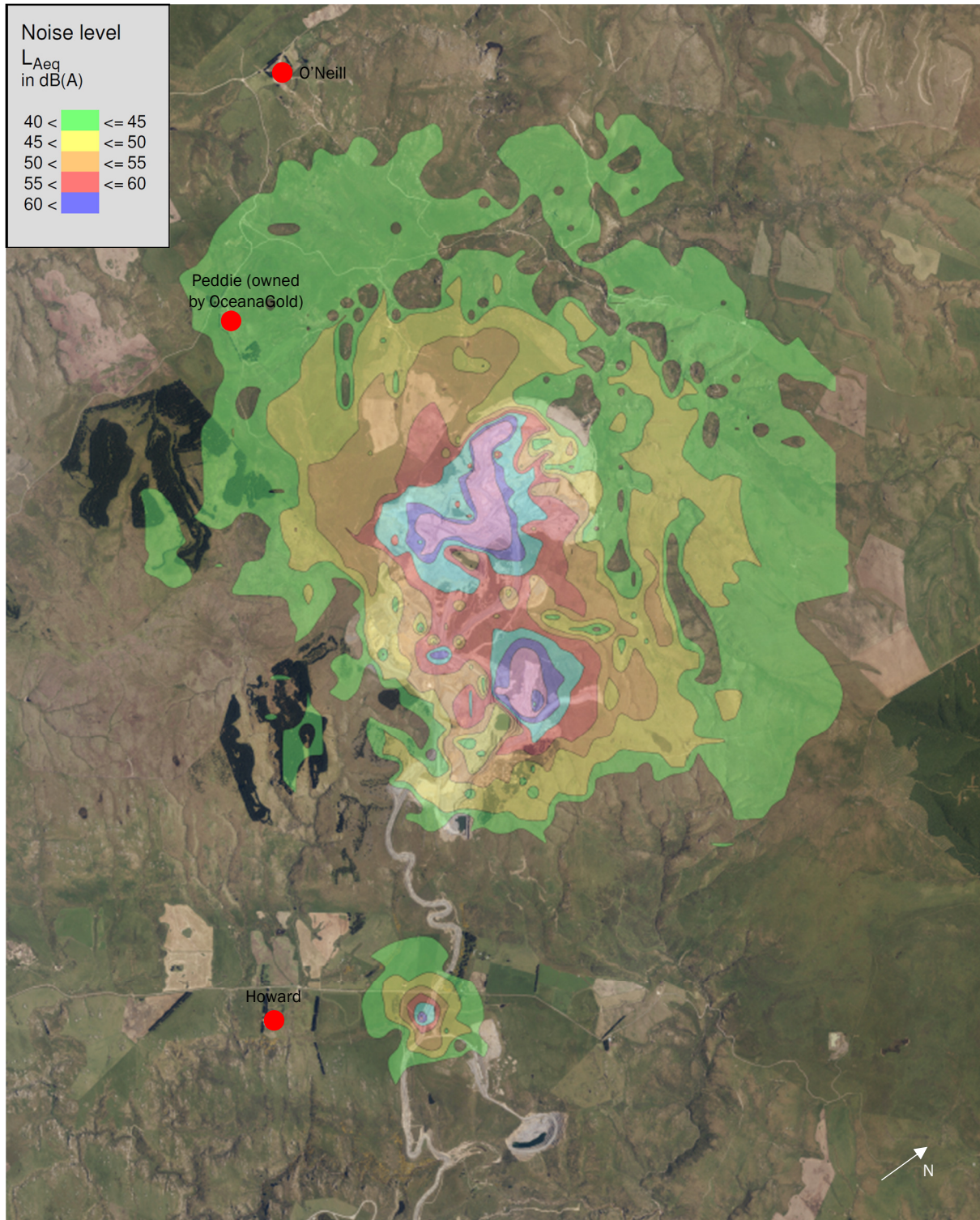


Figure 3.2 – Predicted night-time noise levels

Based on this modelling, the following noise levels are likely to be expected at the notional boundaries of the nearest neighbouring dwellings:

- O'Neill – 32 dB L_{Aeq}

- Peddie – 42 dB L_{Aeq}
- Howard – 34 dB L_{Aeq}

Please do not hesitate to contact us to discuss further as required.

Kind Regards,



Clare Dykes
MBSc, MASNZ
Senior Acoustic Engineer
Acoustic Engineering Services Ltd