NI 43-101 Technical Report Macraes Gold Mine Otago, New Zealand

Effective Date: June 30, 2020
Report Date: September 25, 2020

Report Prepared for

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TECHNICAL REPORT CERTIFICATION

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Forward-Looking Information

This report contains forward-looking statements. All statements, other than statements of historical fact regarding OceanaGold Corporation or Macraes Operations, are forward- looking statements. The words "believe", "expect", "anticipate", "contemplate", "target", "plan", "intend", "project", "continue", "budget", "estimate", "potential", "may", "will", "can", "could" and similar expressions identify forward-looking statements. In particular, this report contains forward-looking statements with respect to cash flow forecasts, projected capital, operating and exploration expenditure, targeted cost reductions, mine life and production rates, potential mineralisation and metal or mineral recoveries, and information pertaining to potential improvements to financial and operating performance and mine life at the Macraes Operations that may result from. All forward-looking statements in this report are necessarily based on opinions and estimates made as of the date such statements are made and are subject to important risk factors and uncertainties, many of which cannot be controlled or predicted. Material assumptions regarding forward-looking statements are discussed in this report, where applicable. In addition to such assumptions, the forward-looking statements are inherently subject to significant business, economic and competitive uncertainties, and contingencies. Known and unknown factors could cause actual results to differ materially from those projected in the forward-looking statements. Such factors include, but are not limited to: fluctuations in the spot and forward price of commodities (including gold, diesel fuel, natural gas and electricity); the speculative nature of mineral exploration and development; changes in mineral production performance, exploitation and exploration successes; risks associated with the fact that the Macraes Operations is still in the early stages of evaluation and additional engineering and other analysis is required to fully assess their impact; diminishing quantities or grades of reserves; increased costs, delays, suspensions, and technical challenges associated with the construction of capital projects; operating or technical difficulties in connection with mining or development activities, including disruptions in the maintenance or provision of required infrastructure and information technology systems; damage to OceanaGold Corporation's or Macraes Operations reputation due to the actual or perceived occurrence of any number of events, including negative publicity with respect to the handling of environmental matters or dealings with community groups, whether true or not; risk of loss due to acts of war, terrorism, sabotage and civil disturbances; uncertainty whether the Macraes Operation's will meet OceanaGold Corporation's capital allocation objectives; the impact of global liquidity and credit availability on the timing of cash flows and the values of assets and liabilities based on projected future cash flows; the impact of inflation; fluctuations in the currency markets; changes in interest rates; changes in national and local government legislation, taxation, controls or regulations and/or changes in the administration of laws, policies and practices, expropriation or nationalisation of property and political or economic developments in Canada; failure to comply with environmental and health and safety laws and regulations; timing of receipt of, or failure to comply with, necessary permits and approvals; litigation; contests over title to properties or over access to water, power and other required infrastructure; increased costs and physical risks including extreme weather events and resource shortages, related to climate change; and availability and increased costs associated with mining inputs and labour. In addition, there are risks and hazards associated with the business of mineral exploration, development, and mining, including environmental hazards, industrial accidents, unusual or unexpected formations, pressures, cave-ins, flooding and gold bullion, copper cathode or gold or copper concentrate losses (and the risk of inadequate insurance, or inability to obtain insurance, to cover these risks).

Many of these uncertainties and contingencies can affect OceanaGold Corporation's actual results and could cause actual results to differ materially from those expressed or implied in any forward- looking statements made by, or on behalf of, OceanaGold Corporation. All of the forward-looking statements made in this report are qualified by these cautionary statements and OceanaGold Corporation and the Qualified Persons who authored this report undertake no obligation to update publicly or otherwise revise any forward-looking statements whether as a result of new information or future events or otherwise, except as may be required by law.

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1 Summary

1.1 Overview

OceanaGold Corporation (OGC) / OceanaGold (New Zealand) Limited (OGL) has prepared this Technical Report on the Macraes Gold Mine (Macraes or the Project) as at the 30 June 2020.

The Project includes both open pit and underground mining, ore processing and a single economic analysis based on combined open pit and underground mineral reserves.

The Project is controlled by OceanaGold Corporation through its wholly owned subsidiary OceanaGold (New Zealand) Limited ("Oceana"). OceanaGold is listed on the Toronto and Australian stock exchanges under the code "OGC" and is the Issuer of this Technical Report.

The areas included in the Project comprise the following:

- Coronation North, Coronation, Deepdell, Round Hill, Innes Mills, Frasers West and Frasers Gay Tan open pits;
- Frasers Underground mine and a new underground mine at Golden Point;
- Processing plant; and
- Tailings Storage Facilities, including a new storage facility that is currently being investigated for storage from 2024.

The purpose of this Technical Report is to disclose the Mineral Resources and Mineral Reserves for use by the general investing community. The Technical Report will be lodged with SEDAR in accordance with TSX requirements.

This Technical Report has been prepared in accordance with the National Instrument 43-101 Standards of Disclosure for Mineral Projects (NI 43-101).

Inferred Mineral Resources are too geologically speculative to have mining and economic considerations applied to them to be categorised as Mineral Reserves.

OceanaGold is undertaking exploration drilling for the purpose of identifying potential further discoveries and resource conversion to increase mining inventories and extend mine plans.

1.2 Property Description and Ownership

The Project is located approximately 30 kilometres (km) to the northwest of Palmerston in the Otago Region of the South Island, New Zealand (NZ). The mining operation occurs 1-2km to the east of the Macraes Flat township and is predominantly surrounded by farmland.

The Macraes mining and exploration permits cover a contiguous area of 14,576 hectares.

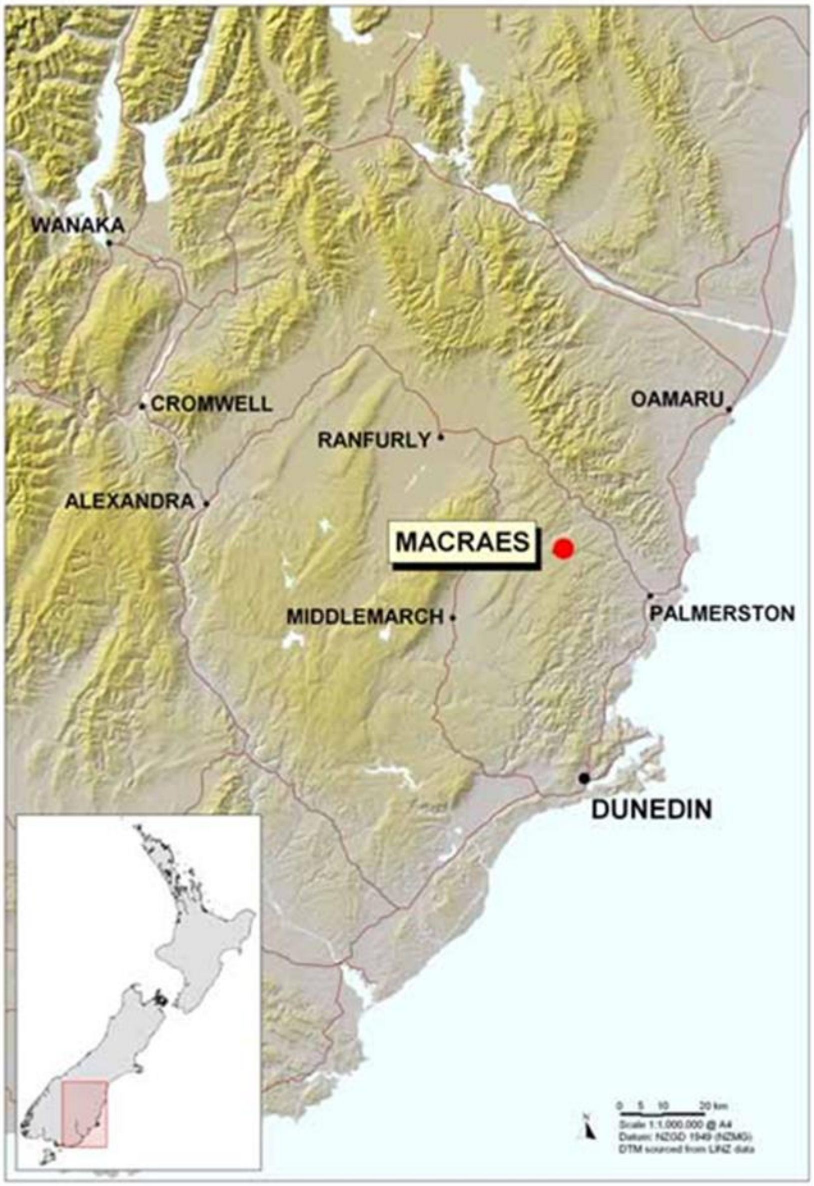

Figure 1-1: General Location of the Macraes Project

1.3 Geology and Mineralisation

The Macraes gold deposits are located within a low-angle (~15-20°) shear zone, the Hyde Macraes Shear Zone (HMSZ). Mining has centred on mineralisation developed along this regionally continuous structure that has been traced for over 30 km along strike.

Mineralisation within the HMSZ is hosted within lower greenschist facies metamorphosed, pelitic to psammitic sediments that are variably altered, deformed, and mineralized. This schist package, known as the Intrashear Schist, is bounded above by the Hangingwall Shear, and below by the Footwall Fault, and can be up to 150m thick. The thickest parts of the HMSZ comprise multiple, stacked shears and associated quartz vein arrays. The shears have ductile deformation textures overprinted by cataclasis (Craw et al., 1999). The Hangingwall shear, which is the most continuous and intensely mineralised structure, can be up to 25m thick and is commonly darker coloured due to fine grained graphite and sheared sulphide minerals (McKeag et al., 1989).

There is a strong empirical correlation between gold, arsenic, scheelite, silicification and deformation intensity within the HMSZ. Gold-scheelite-pyrite-arsenopyrite mineralisation is associated with replacement and fissure quartz veins within D4 post-metamorphic shear zones. Shear parallel quartz veins and cataclastic shears contain the highest gold and scheelite grades (Lee et al. 1989).

The following four types of mineralisation occur within the HMSZ at Macraes (Mitchell et al., 2006):

- Mineralized schist. This style of mineralisation involved hydrothermal replacement of schist minerals with sulphides and microcrystalline quartz. Mineralisation was accompanied by only minor deformation;
- Black sheared schist. This type of schist is pervaded by cm to mm scale anastamosing fine graphite and sulphide bearing micro shears. This type of mineralisation is typically proximal to the Hangingwall Shear. Scheelite mineralisation occurs in the silicified cataclastic shears;
- Shear-parallel quartz veins. These veins lie within and/or adjacent to the black sheared schist and have generally been deformed with the associated shears. The veins locally crosscut the foliation in the host schist at low to moderate angles. Veins are mainly massive quartz, with some internal lamination and localized brecciation. Sulphide minerals are scattered through the quartz, aligned along laminae and stylolitic seams. These veins range from 1cm to > 2m. Scheelite mineralisation is associated with quartz veining in some areas; and
- Stockworks (aka quartz vein arrays). These veins occur in localized swarms that are confined to the Intrashear Schist. Individual swarms range from c. 100 to 2000m2 in area and consist of numerous (10 – 100) subparallel veins. Most of these veins formed sub-perpendicular to the shallow east dipping shear fabric of the Intrashear Schist. Stockwork veins are typically traceable for 1-5m vertically with most filling fractures that are 5 – 10cm thick but can be up to 1m thick. Swarms of stockwork veins within the Intrashear Schist were lithologically controlled by the dimensions and locations of more competent pods of Intrashear Schist.

Gold is associated with pyrite and arsenopyrite in all the above styles of mineralisation. Rarely free gold up to 300µm occurs in quartz veins, but most gold occurs as 1-10µm scale blebs hosted in and near sulphide grains (Angus, 1993).

Tungsten as scheelite is found predominantly within mineralised quartz veins, although a subordinate phase of disseminated scheelite and a remobilised phase are also observed (Farmer, 2016). The main phase of tungsten mineralisation occurred early in the development of the deposit and typically occur in the same lode and vein structures as gold mineralisation. However, tungsten mineralisation is not genetically related to gold mineralisation. MacKenzie (2015) recognised 5 types of scheelite. Types 1,3,4,5 are fine grained and disseminated varieties. Type 2 scheelite is the coarse grained to massive creamy coloured scheelite that was mined historically.

1.4 Drilling and Sampling

Overall, the drill hole and sampling data quality is acceptable for resource estimation purposes. The quality control database is however incomplete for some of the earlier campaigns of drilling (1980's) prior to OceanaGold's ownership. OceanaGold has successfully mined for two decades through areas affected by these early drilling campaigns and considers the residual risk associated with this early drilling to be low. Much of the resource based upon these earlier drilling campaigns has now been mined out.

Prior to 1998 some of the reverse circulation (RC) drill holes were sampled under wet drilling conditions leading to the potential for sampling bias and contamination. Much of the legacy risk associated with wet RC sampling has been mitigated by subsequent replacement of wet RC drill holes by diamond twins. Where however, wet RC drill holes have not been replaced, RC sample grades have been factored, based on relationships between twinned RC versus diamond core sample grades. This approach has been applied by OceanaGold for several pits at Macraes and has resulted in acceptable resource estimate to mine reconciliations. The relatively low proportions of remaining wet RC samples, and previous mining history indicate are the basis for OceanaGold considering the residual risk to the resource estimates to be low.

1.5 Exploration

The Macraes area is a mature exploration province and much of the strike potential has been tested near surface. There remains good potential for discovery both down dip of previously mined open cuts and underground operations and along strike to the north and south. The 2015 discovery of the Coronation North deposit in an area previously thought to have low prospectivity, highlights the potential of the belt. From 2015 -2018 OceanaGold spent NZD5-8M per annum on exploration/resource definition, with NZD8.6 million spent in 2019 and has committed NZD10 million in 2020

The immediate focus is on drilling out extensions to known mineralisation at Coronation, Deepdell, Golden Point, Round Hill, Innes Mills, Frasers and Golden Bar to support the current life of mine plan. Over the longer-term, focus will shift to more distant areas, between the Coronation North and Nunns deposits and the many small deposits in the Stoneburn area to the south.

There is a large inventory of mineral resources classed as Inferred. Infill drilling to convert these resources to Measured and Indicated and subsequently into reserves is on-going and will add to the life of the project.

At NZD2,394 gold price, OceanaGold’s assumed gold price for resource reporting, the majority of the Macraes open pit optimisations become drilling-limited, representing a significant opportunity to increase the resource base and extend mine life.

1.6 Mineral Processing and Metallurgical Testing

Over the last twenty-nine years OceanaGold has developed considerable experience in development and operation of the complex ore processing technology required to optimise gold recovery from the Macraes refractory ores.

Emphasis is placed on the control of costs. The relatively high tonnage processed, the simple flotation reagent regime and economies resulting from concentration of the gold into a flotation product comprising between 1.5% and 3% of the ore mass treated reduce operating cost. Labour costs are also lower than in most comparable developed countries. The operating cost of the core sulphide process is due to low comminution costs (contributed to by the coarse grind, and relatively soft ore).

Plant utilisation has been maintained at about 95% which is at the high end of typical industry benchmarks. Gold recovery on open pit ore and underground combined, for 2019 averaged 83.4%. Overall, recoveries are considered reasonable given the refractory nature of the ores.

The Processing Plant has the capacity to treat up 5.9 Mt of ore per annum. However forecast mill throughput drops to 4.1 Mt from 2025-2026 as mine production reduces due to the conclusion of underground mining. Possibilities for covering this shortfall include expanding GPUG, increasing open pit prestrip by mobilising additional resources or feeding low grade stockpiles.

1.7 Mineral Resource Estimate

The grade estimates have been constrained within suitable geological frameworks which are well established and validated by decades of acceptable resource estimate to mine reconciliations. OceanaGold's mineral resource estimation process is well established and is maintained by a process of internal peer review.

At Macraes the resource estimates tend to underpredict contained gold. Over the last 5.5 years, the open pits have realized 9%, 2% and 11% more tonnes, grade and contained gold respectively than predicted. Over the last 2.5 years, the Frasers Underground has realized 7%, 0% and 7% more tonnes, grade and contained gold respectively than predicted.

The mine to mill reconciliation averages -2.5% over the past 5.5 years.

The reported Mineral Resources were derived via three-dimensional geological interpretation and grade estimation for each deposit. Technique selection was based on the mineralisation style, drill hole spacing, population statistics and end use of the estimate. Estimation involved the application of Ordinary Kriging for underground estimates as well as for satellite, non-producing open pits. All other open pit deposits use Large Panel Recoverable estimation using Multiple Indicator Kriging.

Table 1.1 represents the Macraes Project Mineral Resource Statement as at June 30, 2020 reported in accordance with the Canadian National Instrument 43-101, Standards of Disclosure for Mineral Projects of June 2011 (the Instrument) and the classifications adopted by Canadian Institute of Mining, Metallurgy and Petroleum (CIM) Council in December 2011. Furthermore, the resource classification is also consistent with the Australasian Code for the Reporting of Mineral Resources and Ore Reserves of December 2012 (the Code) as prepared by the Joint Ore Reserves Committee (JORC) of the Australasian Institute of Mining and Metallurgy, Australian Institute of Geoscientists and Mineral Council of Australia. A detailed description of these resources by deposit, geology and by the applicable cut-off grade is provided in Section 14 of this report.

Table 1.1: Macraes Project Mineral Resource Statement as at June 30, 2020

Resource Cut-off (g/t Au)	Resource Area	Measured		Indicated		Measured & Indicated			Inferred Resource		
		Mt	Au g/t	Mt	Au g/t	Mt	Au g/t	Au Moz	Mt	Au g/t	Au Moz
0.4	Nunns	-	-	0.23	0.83	0.23	0.83	0.01	0.64	0.92	0.02
0.3	Coronation North	1.30	1.26	4.32	0.75	5.61	0.87	0.16	2.82	0.65	0.06
0.3	Coronation	-	-	2.43	1.06	2.43	1.06	0.08	1.67	0.74	0.04
0.3	Deepdell	2.25	1.06	1.81	0.96	4.06	1.02	0.13	2.09	0.54	0.04
0.3	Round Hill	8.72	1.25	44.2	0.82	53.0	0.89	1.51	11.6	0.65	0.24
1.34	Golden Point Underground	0.15	2.97	2.86	2.68	3.00	2.69	0.26	0.95	2.54	0.08
0.3	Innes Mills	2.53	1.07	17.2	0.72	19.7	0.76	0.48	9.61	0.52	0.16
0.3	Frasers West	2.47	1.04	8.21	0.70	10.7	0.78	0.27	3.76	0.56	0.07
0.3	Gay-Tan	2.98	0.57	10.8	0.54	13.8	0.55	0.24	1.04	0.65	0.02
1.20	Frasers Underground	1.48	2.90	1.71	2.16	3.18	2.50	0.26	0.32	2.14	0.02
0.4	Ounce	-	-	-	-	-	-	-	0.76	0.75	0.02
0.4	Golden Bar	0.09	1.54	1.21	1.35	1.30	1.37	0.06	4.31	1.33	0.18
0.4	Taylors	-	-	0.23	0.84	0.23	0.84	0.01	0.43	0.76	0.01
0.4	Stoneburn	-	-	-	-	-	-	-	1.44	0.72	0.03
0.3	Stockpiles	4.36	0.55	-	-	4.36	0.55	0.08	-	-	-
Totals		**26.3**	**1.11**	**95.2**	**0.85**	**121.5**	**0.91**	**3.54**	**41.5**	**0.74**	**0.99**

Notes: Cut-off grades are based upon a gold price of NZD2,394/oz (US$1,700/oz @ USD:NZD 0.71).
Open pit resources are reported within shells optimized using a gold price of NZD2,394/oz (US$1,700/oz @ USD:NZD 0.71).
Mineral Resources reported are included in the Mineral Reserves reported for the same deposit.
There is no certainty that Mineral Resources that are not Mineral Reserves will be converted to Mineral Reserves.
No dilution is included in the reported figures and no allowances have been made for mining recoveries or processing losses.
The tabulated resources are estimates of metal contained as troy ounces of gold.

Total Macraes Measured and Indicated Resources and Inferred Resources have increased net of mining depletion by 90 koz and 70 koz respectively since 31 December 2019.

These increases are primarily a result of:

- The first-time reporting of the Golden Point underground resource. Approximately half of the Golden Point underground resource is captured within the Round Hill open pit design. This component of the Golden Point underground resource has been excised from the reported open pit resource; and
- The Frasers open pit resource being reported within an open pit shell based on a NZD2,394/oz gold price (previously NZD2,083/oz). Note that some of the open pit resources are data limited at the NZD2,394/oz gold price and require step-out to fully test their potential.

These increases have partially been offset by:

- First half 2020 open pit and underground mining depletion;
- The removal of some pillar resources following the completion of a study on recoverable pillar resources within the Frasers Underground; and

- Operational resource updates.

1.8 Development and Operations

The physical and financial projections presented in this report are based upon a Life of Mine Plan developed in July 2020. The topography used was as at June 30, 2020.

The Macraes Project is the largest gold producing operation in NZ and has been in operation since 1990. To June 30, 2020, over 5 million ounces of gold have been produced. The Project consists of large-scale open pit mining, underground mining and an adjacent process plant inclusive of an autoclave for pressure oxidation of the ore. From 2007 to 2016, flotation concentrate from the Reefton mine was transported by rail and road to utilise surplus autoclave capacity at Macraes.

The Coronation North Stages 3 and 4, Coronation Stage 5 and Gay Tan Stage 1 were the only open pit stages mined in 2019, and supplied approximately 5.5 Mt of ore, while the Frasers Underground (FRUG) mine supplied a further 1.0 Mt of ore. Stockpiles provided supplementary feed when required. The combined Macraes production for the twelve months, ended December 31, 2019 was 172.5 koz.

Mining of Coronation Stage 5 is expected to be completed in 2020. Mining of Coronation North and Gay Tan Stage 2 is expected to be completed in 2021. Mining of FRUG is expected to be completed in 2022. New open pits coming online in 2020 include Deepdell, Frasers West Gay Tan Stage 2 and Innes Mills followed by Round Hill in 2023 and underground mining to commence at Golden Point underground (GPUG), to replace FRUG.

The Macraes process plant can treat approximately 5.9 Mtpa of ore and incorporates a semi-autogenous grinding (SAG) mill, flotation circuit, autoclave for pressure oxidation of the concentrate, CIL plant and smelting facilities

The current combined open pit, stockpile and underground reserves of 1.35 Moz support a mine life at Macraes extending to 2028. The combined open pit and underground schedule from 30 June 2020 is shown in Table 1.2.

Table 1.2: Combined open pit and underground ore processing schedule

	Units	2020	2021	2022	2023	2024	2025	2026	2027	2028	LoM
Open Pit Schedule											
Total Ore Milled Quantity	Mt	2.67	5.23	5.22	5.19	5.24	3.50	4.21	5.90	0.71	**37.87**
Total Milled Gold Grade	g/t Au	0.81	0.99	0.76	0.61	1.08	0.87	0.83	1.28	0.59	**0.92**
Total Milled Contained Gold	Koz	70	167	128	102	183	98	113	243	13	**1,116**
Underground Schedule											
Total Ore Milled Quantity	Mt	0.39	0.63	0.68	0.71	0.68	0.57	-	-	-	**3.65**
Total Milled Gold Grade	g/t Au	1.92	1.93	1.99	2.37	1.90	1.98	-	-	-	**2.03**
Total Milled Contained Gold	Koz	24	39	43	54	42	36	-	-	-	**238**
Combined Open Pit and Underground											
Total Ore Milled Quantity	Mt	3.06	5.86	5.90	5.90	5.92	4.07	4.21	5.90	0.71	**41.53**
Total Milled Gold Grade	g/t Au	0.95	1.09	0.90	0.82	1.18	1.03	0.83	1.28	0.59	**1.01**
Total Milled Contained Gold	koz	93	206	171	156	224	134	113	243	13	**1,354**

1.9 Mineral Reserve Estimate

The Mineral Reserves reported by category using a 0.4 g/t Au cut-off for open pits, a 1.36 g/t Au cut-off for Frasers underground and 1.61 g/t Au for Golden Point underground are presented in Table 1.3. These Mineral Reserves are a subset of the Mineral Resources tabulated in Table 1.1.

Table 1.3: Macraes Mineral Reserve Estimate as at June 30, 2020

Area	Proven		Probable		Total		
	Mt	Au g/t	Mt	Au g/t	Mt	Au g/t	Au Moz
Coro North	0.98	1.39	1.23	0.92	2.21	1.13	0.08
Coronation			0.22	1.10	0.22	1.10	0.01
Deepdell	1.67	1.06	1.29	0.98	2.96	1.03	0.10
Round Hill	3.89	1.32	8.21	1.00	12.1	1.10	0.43
Innes Mills	1.73	1.26	5.81	0.84	7.54	0.94	0.23
Frasers	1.52	0.69	6.89	0.71	8.41	0.71	0.19
Stockpiles	4.36	0.55			4.36	0.55	0.08
Subtotal - Open Pit	**14.1**	**0.98**	**23.6**	**0.87**	**37.8**	**0.91**	**1.11**
Frasers Underground	0.69	2.11	0.58	1.47	1.28	1.82	0.07
Golden Point Underground	0.12	2.39	2.26	2.12	2.34	2.13	0.16
Subtotal - Underground	**0.81**	**2.15**	**2.84**	**1.99**	**3.62**	**2.02**	**0.23**
Total Macraes	**14.0**	**1.04**	**26.5**	**0.99**	**41.4**	**1.01**	**1.34**

Notes: All figure are rounded to reflect the relative accuracy of the estimates. Totals may not sum due to rounding.
Mineral reserves are reported based on CoG based on metal price assumptions, exchange rates and mining, processing, general and administrative costs. Gold Price assumptions include USD1,300/oz for Open Pit and USD1,500/oz for underground and NZD:USD 0.71.
The Macraes processing plant recovery varies based on ore source and feed grade – an average 82% recovery is achieved.
Open pit dilution and recovery estimates are built into the underlying Resource models and no further adjustments are made.
Underground Insitu Recovery, Mining Recovery and Dilution modifying factors have been applied that result in an average underground mining recovery of 98% of the designed tonnage and 89% of the designed grade.
Mineral reserves have been estimated based on mine designs and plans consolidated into a Life of Mine Schedule.
Pieter Doelman, Technical Services & Projects Manager at Macraes is the Qualified Person for the Open Pit Mineral Reserve Estimate.
Tom Cooney, General Manager Studies based in Brisbane Australia is the Qualified Person for the Underground Mineral Reserve Estimate.

1.10 Mining Methods

OceanaGold has prepared life of mine production plans from reserves only which cover 2020-2027 for Macraes. This schedule sees a new open pit at Frasers West and the re-opening of the Deepdell North open pit starting in 2020 and the re-opening of Innes Mills pit in stages from 2020 to 2024. Re-opening of the Round Hill pit occurs later in schedule in 2023. Underground production from FRUG ceases in 2022. Initial development of the Golden Point underground commences at the end of 2020 and will be in full production in 2022. The production rates forecast is consistent with recent performance and the anticipated grades. The mine production plans are considered reasonable for the purpose of long-term scheduling.

The open pit fleet is held to a consistent size from 2020 to 2026. The fleet includes three Hitachi EX3600 excavators and one Hitachi EX2500 to load twenty to twenty-two Caterpillar 789C/D haul trucks. Multiple equipment replacements are scheduled for the 2020-2026 period as equipment reaches the end of its' economic life. OceanaGold is satisfied that there are enough working areas for the excavators to operate.

The current underground fleet will be maintained in 2020. Some of this fleet will transition to GPUG but several units will be replaced as they have reached the end of their economic life. GPUG will essentially have the same fleet configuration as FRUG but load-haul-dump units will standardize at the 17t class and fewer trucks are required due to the decreased depth compared with FRUG.

The underground ore is dumped at an in-pit stockpile for periodic re-handling by the open pit fleet to the process plant's run of mine stockpile. OceanaGold is satisfied with the accuracy of the dilution factors, ore loss factors and constraints placed upon the mining schedule, which are supported by extensive operating experience.

Macraes is mined by a combination of conventional open pit and underground retreat uphole stope methods along the line of strike.

The open pit mining operation utilises hydraulic excavators and rear dump diesel trucks to extract both overburden and ore. Blasting requires relatively light powder factors compared with some other operations due to the comparatively weak and fractured rock mass. Ore is blasted in 7.5m high benches and excavated in three, nominally 2.5m high flitches. Waste is blasted in 15m benches and excavated in four flitches.

The underground retreat uphole stope mining operation utilises electro-hydraulic development jumbos, diesel load-haul-dump units, diesel haul trucks and longhole drill rigs to extract both waste and ore. The uphole retreat stope voids are not backfilled and the mine design utilises yielding pillars between adjacent extracted stopes to gradually deform over a time.

The open pit and underground operations are owner-operated by OceanaGold with support from a range of contracts supporting the mining operations.

OceanaGold's performance at Macraes has shown that the mining equipment and mining methods are suited to the required mining rates and deposit geometry. Open pit and underground mine design procedures are appropriate and have been conducted in accordance with established industry standards and with input from appropriately qualified geotechnical specialists, hydrological specialists and consultants.

Mining at Round Hill is predicted to reactivate movement on the footwall fault. Geotechnical modelling has predicted this movement to be modest and controllable however the process plant overlies the failure plane so the consequences of a significant slope failure could be very significant.

Historical productivity and safety records are generally in line with or better than industry standards.

The open pit and underground life of mine plan schedule has been prepared to 2027. The schedules rely only on reserves, and are considered appropriate and reasonable

The mining and ore processing schedules have factors applied to account for poor weather, public holidays, equipment availability, equipment utilisation, historically justified limitations on mine production and historically justified limitations on mill throughput.

The mining schedules contain several ore sources that are not currently in production. The Round Hill open pit is fully permitted and consented. The Frasers West, Deepdell open pits and the Golden Point underground are under resource consent application as at the Effective Date.

There is one study underway which has the potential to enhance the production schedule from 2022 onwards:

- Round Hill Gold-Tungsten Project. This is a continuation of studies which commenced in 2015 to unlock over 1 Mozs of gold that is currently compromised due to the proximity to the Processing Plant and Tailings Storage Facilities. The potential extraction of tungsten as a by-product is included in the study. This project alone has the potential to add 10 or more years mine life to Macraes in addition to what has already been identified.

There is an additional opportunity to lower the open pit cut-off grade with recent strengthening of the gold price providing this lower grade material can be successfully recovered in the process plant. Currently low grade (0.3-0.4 g/t Au) material is being stockpiled. This low grade in-situ material and stockpiles are not included in the Mineral Reserves.

1.11 Infrastructure

OceanaGold continues to maintain appropriate infrastructure at Macraes, including road access, power, water supplies and administration facilities.

Environmental management and mitigation measures are maintained at Macraes, including ongoing monitoring to ensure compliance with resource consent conditions and permit requirements. These consents and permits are issued by the Ministry of Economic Development (MOED), the Otago Regional Council (ORC) and the Waitaki District Council (WDC). Tailings and waste rock disposal facilities are maintained and managed on an ongoing basis. Progressive rehabilitation is ongoing.

There is enough tailings storage capacity in the present consented facilities to store tailings until mid-2021. An extension to the current facility is in the process of being designed and permitted which will extend the life of this facility until 2024. The final site selection, detailed design and resource consenting of an additional storage facility is scheduled for 2021.

The project reserves, plant site, tailings dams and waste dumps are located on land that is covered by mining permits, and which OceanaGold owns or has access to mine. All material tenements and landholder agreements are in good standing.

1.12 Environmental Studies and Permitting

The Project is fully consented for current operations, with actual and potential environmental effects regularly monitored and reported to the relevant agencies.

The project reserves, plant site, tailings dams and waste dumps are located on land that is covered by mining permits, and which OceanaGold owns or has access to mine. All material permits and landholder agreements are in good standing.

The mineral permits are in good standing and there is one mineral permit application underway in 2020, an application for the extension of MP 52 738 for a further 20 years to allow future mining of the resource within this permit. Based on experience, OceanaGold has every confidence that this application will be successful.

The site is achieving environmental compliance, with good internal reporting of environmental issues and performance. The site environmental documentation is appropriate and follows Environment Management Strategy (EMS) principles, although a full EMS is not in place. Documentation is reviewed and updated regularly.

Resource Consent applications have been lodged for the Deepdell North and Frasers West open pits and for the Golden Point underground. Resource consent application will need to be lodged in 2020 for the planned Top Tipperary Tailing Storage Facility extension and in 2021 for the next Tailings Storage Facility.

A contingency closure plan has been developed for Macraes and a detailed Closure Plan will be completed during 2020/21.

There are no material compliance issues relating to the principal mining and processing operations. OceanaGold is in partnership with Otago Fish and Game, a semi-government organisation, to manage a Trout Hatchery on the Macraes mine site.

Overall, no material environmental issues have been identified to limit the ongoing operation of the mine within the planned schedule.

1.13 Capital and Operating Costs

Capital and operating costs are well known from the 30 years of operations and have been appropriately applied to develop cut-off grades and inputs into economic analysis.

There is no material expansion of the current production at Macraes based on the reported Mineral Reserves. The production schedule is being implemented through to completion of the open pits and underground operations.

Plant operating cost estimates for Macraes are generally considered reasonable and consistent with recent experience and trends and are regarded as accurate to ±15%.

Capital cost estimation and forecasting are considered reasonable and consistent with proposed development programmes and ongoing requirements. Capital expenditures over the period will vary against the forecast due to unforeseen problems, modifications, upgrades and introduction of new technology.

Total capital costs are provided by area in Table 1.4 and by year in Figure 1-2, and the total operating costs are provided by area in Table 1.5, and by year in Figure 1-3.

Table 1.4: Capital Cost Summary

Capital Expenditure	LoM Total (NZD M)	LoM Total (USD M)
Pre Strip	199.3	129.5
Tailings	62.5	39.8
Tailings Remining	30.1	19.5
Mining Rehab	29.6	19.3
Underground Decline	59.2	38.5
Processing	13.0	8.4
Exploration	17.7	11.5
General Capital	28.0	18.2
Asset Sales	-27.6	-17.9
Total Capital Expenditure	**410.6**	**246.6**
Leased Vehicles		
Open Pit Mining Equipment	28.9	18.8
Underground Mining Equipment	14.9	9.7
Total Leased Mobile Equipment	**46.9**	**28.4**

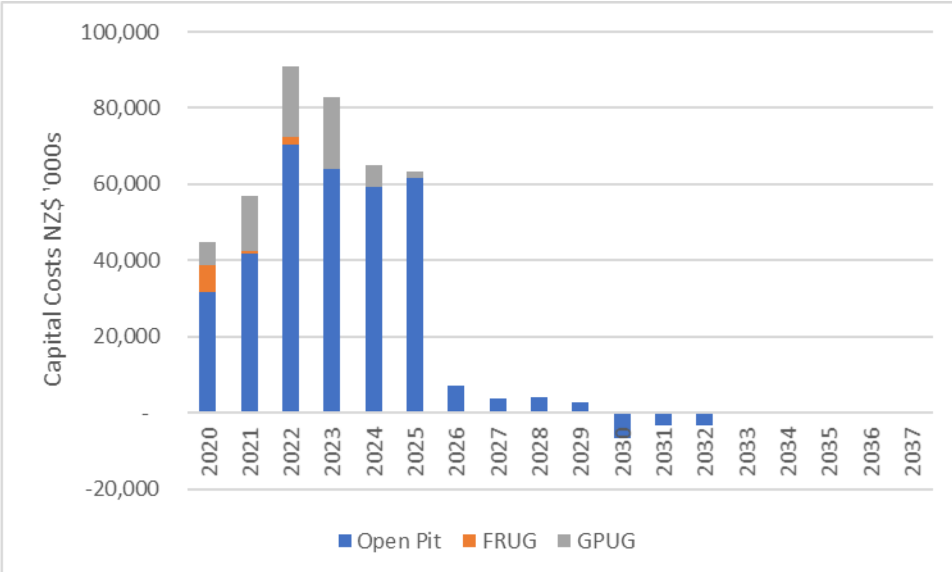

Figure 1-2: Capital Costs for LoM

Table 1.5: Operating Cost Summary

Operating Expenditure	NZD		USD	
	Total $M	$/t	Total $M	$/t
Open Pit Mining	486.9	1.96	316.5	1.27
FRUG Underground Mining	86.5	67.12	56.2	43.63
GPUG Underground Mining	120.7	56.99	78.5	37.04
Processing Costs	457.0	11.02	297.0	7.16
General and Administration Costs	125.5	3.02	81.6	1.96
Total Direct Costs	**1,276.7**		**829.8**	

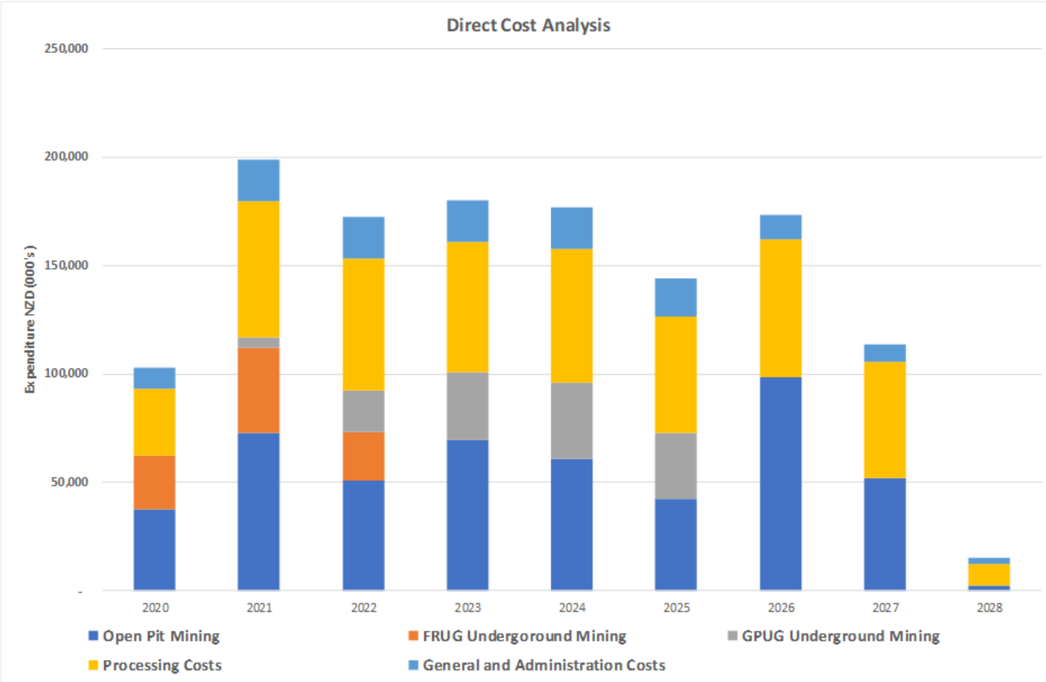

Figure 1-3: LoM Direct Operating Costs

1.14 Economic Analysis

1.14.1 Assumptions

- Open pit mining rates have been scheduled at a maximum rate of 57 Mtpa;
- Processing plant production rate of a maximum 5.9 Mtpa has been scheduled;
- Gold Price Assumptions as shown in Table 1.6;
- Metallurgical recovery assumptions ranging from 80% to 83% have been used;
- Revenue is recognised at the time of production;
- Royalty payments included are based on the New Zealand Government Royalties which are either 1 % of sales revenue or 5% of accounting profits whichever is the higher. In addition to the New Zealand Government royalty there is a small parcel of land for which a private group has a revenue royalty entitlement; and
- The operating cost estimates are considered reasonable and consistent with demonstrated costs.

Table 1.6: Gold Price Assumptions

	2020	2021	2022	2023	Long Term
Gold Price (USD)	1700	1600	1550	1550	1500
NZD / USD	0.65	0.65	0.65	0.65	0.65
Gold Price (NZD)	2,615	2,462	2,385	2,385	2,308

1.14.2 Cash Flow Analysis

A pre-tax Cash Flow Projection has been generated from the life-of-mine (LOM) production schedule and capital and operating cost estimates. The cash flow is based on a 9-year LOM. A Summary of the Project economics are presented in Table 1.7.

Table 1.7: Project Economics

	Unit	NZD	USD
Average Gold Price	$/oz	2,396	1,541
Free Cashflow (pre-tax)	$M	854	555
NPV (5% discount rate, pre-tax)	$M	663	431
Free Cashflow (after-tax)	$M	649	422
NPV (5% discount rate, after-tax)	$M	499	324

1.15 Conclusions

The following conclusion have been drawn from this Technical Report:

- The Mineral Resources have been estimated in accordance with the Canadian Institute of Mining, Metallurgy and Petroleum Standard Definitions for Mineral Resources and Mineral Reserves dated May 10, 2014 (CIM definitions);
- While the geological setting and mineralisation styles are well understood the current limit on expansions to known resources is the extent of drilling. The nature of the mineralisation at Macraes means there is a significant alignment to the gold price as the price increases more resource becomes an economic mining target. In many of the current or previously mined areas the resource estimates have reached the limits of the drill data. There is significant opportunity with further drilling in targeted areas to increase the potentially minable resources and thereby the mine life both short and long term; and
- The economic result is based on a conservative gold price assumption and a cost base that is representative of known costs.

1.16 Recommendations

Based on the conclusions of the Technical Report, the following actions are recommended:

- Continue exploration and the Resource conversion drilling program;
- Complete test work on metal recoveries for low grade (0.3-0.4 g/t Au) material so these low-grade stockpiles can be included in future production schedules;
- Continue with the Round Hill Gold-Tungsten project which has the potential to add 10 or more years to mine life with tungsten as a by-product. Complete study by end 2021;
- Include low grade stockpiles (0.3-0.4 g/t Au) in the production schedule once the metallurgical test work is completed to fill in production shortfalls;
- Confirm the next tailing storage facility and proceed with appropriate consenting processes; and
- Obtain the necessary resource consents in a timely manner to allow the project to stay on schedule.

2 Introduction

2.1 Terms of Reference and Purpose of the Report

This report has been prepared at the request of OceanaGold Corporation and OceanaGold (New Zealand) Limited (Oceana). OceanaGold Corporation is the ultimate holding company in which OceanaGold (New Zealand) Limited is a subsidiary. OceanaGold Corporation is the reporting issuer in Canada.

References in this report to OceanaGold include OceanaGold (New Zealand Limited, OceanaGold Corporation and their subsidiaries.

The cut-off date for data to be included in this report is June 30, 2020. Permit boundaries are as at the June 30, 2020.

2.1.1 Purpose of the Report

This report was prepared as a National Instrument 43-101 (NI 43-101) Technical Report for OceanaGold by internal qualified persons employed by OceanaGold to provide updated technical information relating to the Coronation, Coronation North, Deepdell, Round Hill, Innes Mills, Frasers Gay Tan and Frasers West open pit resources and reserves, and the Frasers and Golden Point Underground resources and reserves.

Progress of the Macraes Gold-Tungsten project and the evaluation of the potential tungsten resource is discussed but is not included in the Mineral reserves or economic assessment.

This report includes an economic analysis of open pit and underground mining and ore processing based on open pit and underground reserves.

This report updates the previous NI43-101 Technical Report on Macraes dated 12th February 2010 (Redden & Moore, 2010) which covers the period up to the end of 2009. References to this earlier document will be made throughout this report where appropriate to avoid repetition and the reader should refer to this document if more details on sections are required.

2.1.2 Reporting Standards

The report has been prepared in accordance with Canadian National Instrument 43-101 for the 'Standards of Disclosure for Mineral Projects' of June 2011 (the Instrument) and the resource and reserve classifications adopted by CIM Council. This report complies with disclosure and reporting requirements set forth in the Instrument, Companion Policy 43-101CP, and Form 43-101F1.

This report has also been prepared in accordance with the 'Code for the Technical Assessment and Valuation of Mineral and Petroleum Assets and Securities for Independent Expert Reports' of 2015 (the "Valmin Code") as adopted by the Australasian Institute of Mining and Metallurgy (AusIMM), and is consistent with the 'Australasian Code for Reporting of Mineral Resources and Ore Reserves' of 2012 (the "JORC Code"), as prepared by the Joint Ore Reserves Committee of the Australasian Institute of Mining and Metallurgy, Australian Institute of Geoscientists and Minerals Council of Australia (JORC). The satisfaction of requirements under both the JORC and Valmin Codes is binding upon the authors as Members of the AusIMM.

2.2 Authors of the Report

This technical report has been prepared by or under the supervision of the following authors, who are all employees of OceanaGold:

- Peter Edwards, as Senior Project Geologist at Macraes;
- Sean Doyle, as Principal Resource Geologist; at Macraes;
- Pieter Doelman, as Technical Services & Projects Manager at Macraes;
- Tom Cooney as General Manager, Studies in Brisbane, Australia; and
- David Carr as Chief Metallurgist in Brisbane, Australia.

2.3 Qualifications and Experience of Qualified Persons

The persons preparing this technical report are specialists in the fields of geology, exploration, Mineral Resource and Mineral Reserve estimation and classification, underground mining, geotechnical, environmental, permitting, metallurgical testing, mineral processing, processing design, capital and operating cost estimation, and mineral economics.

The following individuals, by virtue of their education, experience and professional association, are considered Qualified Persons (QP) as defined in the NI 43-101 standard and are members in good standing of appropriate professional institutions. QP certificates of authors are provided in Appendix A.

The QP's are responsible for specific sections as follows:

- Sean Doyle, BSc (Hons) Geology, MAIG, MAusIMM CP (Geo), (OceanaGold Principal Resource Geologist, Macraes) is the QP responsible for Section 14 of this Technical Report;
- Peter Edwards, MSc (Hons) Geology, GradDip Business, GradDip Computing, MAIG, MAusIMM (OceanaGold Senior Project Geologist, Macraes) is the QP responsible for Sections 4, 5, 6, 7, 8, 9, 10, 11, 12 and portions of Section 14 of this Technical Report;
- Pieter Doelman, BEng (Hons) Mining MAusIMM CP(Min) (Technical Services & Projects Manager, Macraes) is the QP responsible for Sections 1, 2, 3, 18, 19, 20, 21, 22, 23, 24, 25, 26 and the open pit portions of Sections 15 and 16 of this Technical Report;
- Tom Cooney BEng (Hons) Mining, Mman Mining MAusIMM CP (Min) (OceanaGold General Manager Studies & Project Development, Brisbane) is the QP responsible for the underground portions of Section 15 and 16 of this Technical Report; and
- David Carr BEng (Hons) Metallurgical MAusIMM CP (Met), (OceanaGold Chief Metallurgist, Brisbane) is the QP responsible for Sections 13, 17 and portions of Sections 25 and 26 of this Technical Report.

2.4 Site Inspections

Pieter Doelman, Sean Doyle and Peter Edwards are based at Macraes. Tom Cooney and David Carr are based in Brisbane and visit the Macraes mine site regularly.

2.5 Sources of Information

The authors of this technical report have not relied upon other experts in its preparation, other than obtaining input from persons employed within OceanaGold who have provided information concerning legal, environmental or other matters relevant to this report.

The information used to prepare all sections relating to Mineral Resources and Reserves was furnished by OceanaGold.

OceanaGold furnished all data, modelling, test work and financial analysis to verify the information relating to Mineral Resources and Reserves and the conclusions regarding the resource and reserve estimates.

In so far as other persons have had input into the preparation of this report, the authors have conducted appropriate due diligence and consider such reliance to be reasonable.

A list of the publications and internal reports that were used in the preparation of this report, and to which specific reference is made in the body of this report, appears in section 27.

2.6 Effective Date

The effective date of this report is June 30, 2020.

2.7 Units of Measure

The Metric System for weights and units has been used throughout this report. Tonnes are reported in metric tonnes of 1,000 kg. All currency is in NZ. Dollars (NZD) unless otherwise stated.

3 Reliance on Other Experts

3.1 General

This report has been written entirely by OceanaGold personnel and no external Experts were directly relied on. Contributions of OceanaGold's Macraes personnel to specific parts of the report are listed below.

- Gavin Lee, OceanaGold Environment & Community Manager, Macraes:
  - Chapter 4, section 4.7; and
  - Chapter 20.
- Paul Whelan, OceanaGold Commercial & Finance Manager, Macraes:
  - Chapters 19, 21 and 22.
- Geua Mola, OceanaGold Metallurgical Superintendent, Macraes:
  - Chapters 13 and 17.

The Authors used their experience to determine if the information from previous reports was suitable for inclusion in this technical report and adjusted information that required amending. This report includes technical information, which required subsequent calculations to derive subtotals, totals and weighted averages. Such calculations inherently involve a degree of rounding and consequently introduce a margin of error. Where these occur, the Authors do not consider them to be material.

These items have not been independently reviewed by OceanaGold and OceanaGold did not seek an independent legal opinion of these items.

4 Property Description and Location

4.1 Property Location

The Macraes Project is located approximately 60km north of Dunedin in eastern Otago and is situated about 2km northeast of the small township of Macraes Flat (Figure 4-1).

The current activity is mining from the Frasers Open Pit, Coronation, Coronation North and the Frasers Underground (FRUG) mine within Mining Permit (MP) 41 064. The process plant, several waste rock stacks, and tailings impoundments are located within MP52 738.

The Project is located at, -45.36°S, 170.43°E (Latitude/Longitude – World Geodetic System 1984) or at 5,535,600mN, 2,308,500mE New Zealand Map Grid (New Zealand Geodetic Datum 1949) or at 4,973,945mN, 1,398,635mE New Zealand Transverse Mercator (New Zealand Geodetic Datum 2000).

A local grid has also been established for the Macraes Project. This grid is rotated 45° west of true north, parallel with the local trend of the mineralised structures.

The Macraes Project has a total area of 14,576.3 hectares.

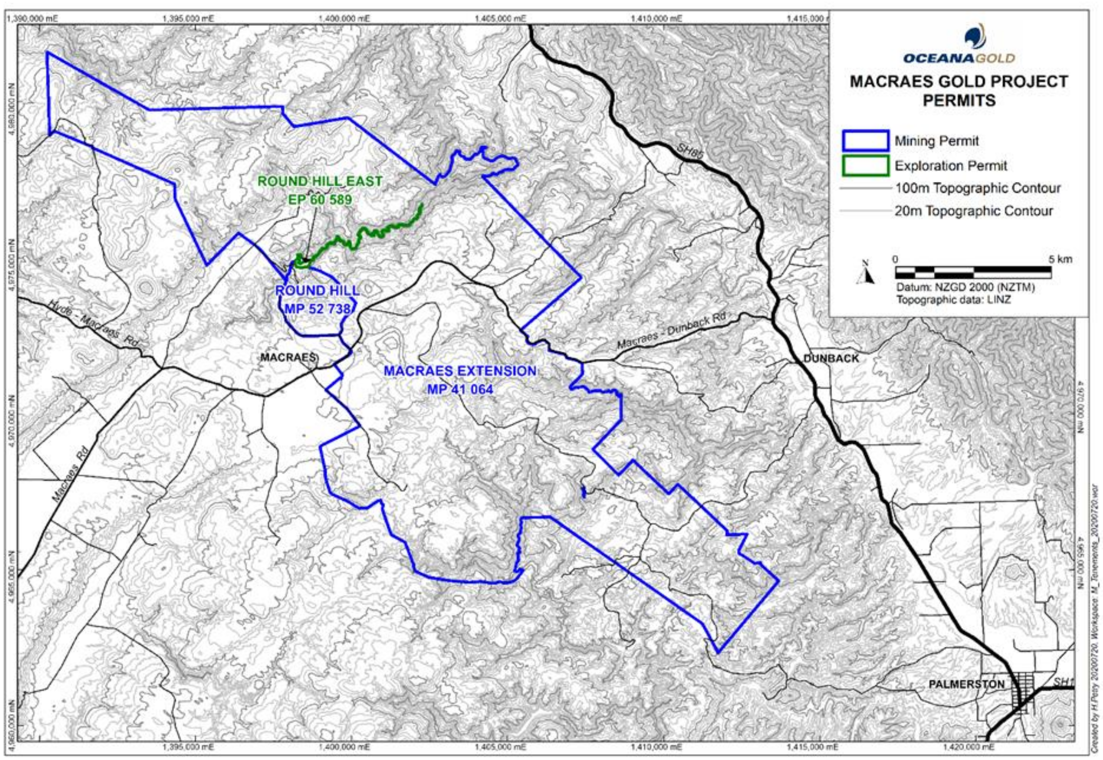

Figure 4-1: Macraes, project location map

Macraes is predominantly surrounded by farmland (tussock and grassland for high country grazing) as shown in Figure 4-2.

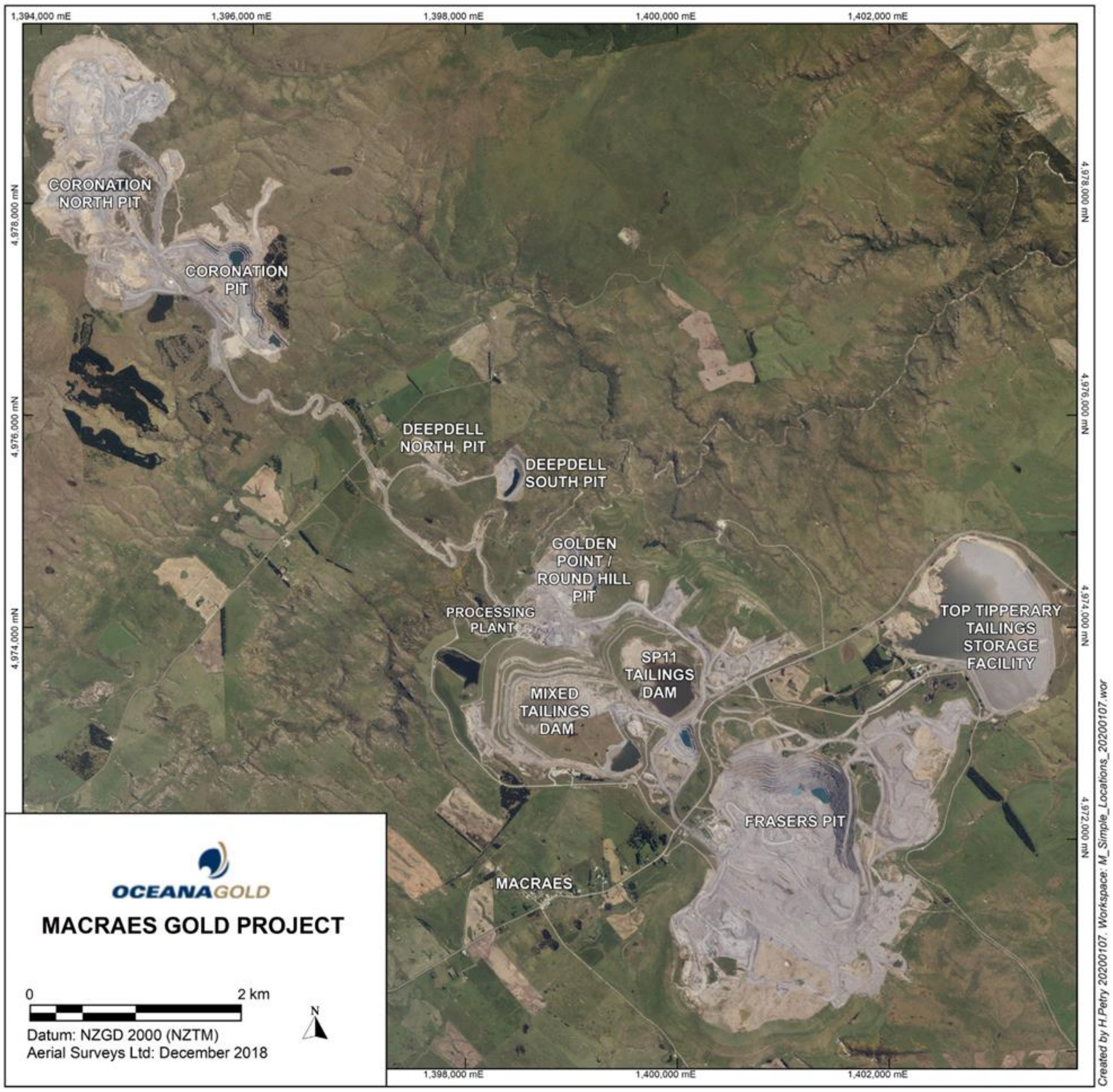

Figure 4-2: Macraes, aerial image of project

4.2 Ownership

Land in the immediate vicinity of the OceanaGold mining operations, and most of the land in permits MP52 738 and MP41 064, is owned by OceanaGold. Land not used for active mining activities is leased at a market rental to local farmers. OceanaGold land ownership extends beyond those two permits as shown in Figure 4-3. Land outside the mining permits is currently owned by a variety of landowners.

In general, OceanaGold property boundaries follow existing cadastral boundaries. Where OceanaGold boundaries have departed from these, the boundaries have been surveyed by registered surveyors.

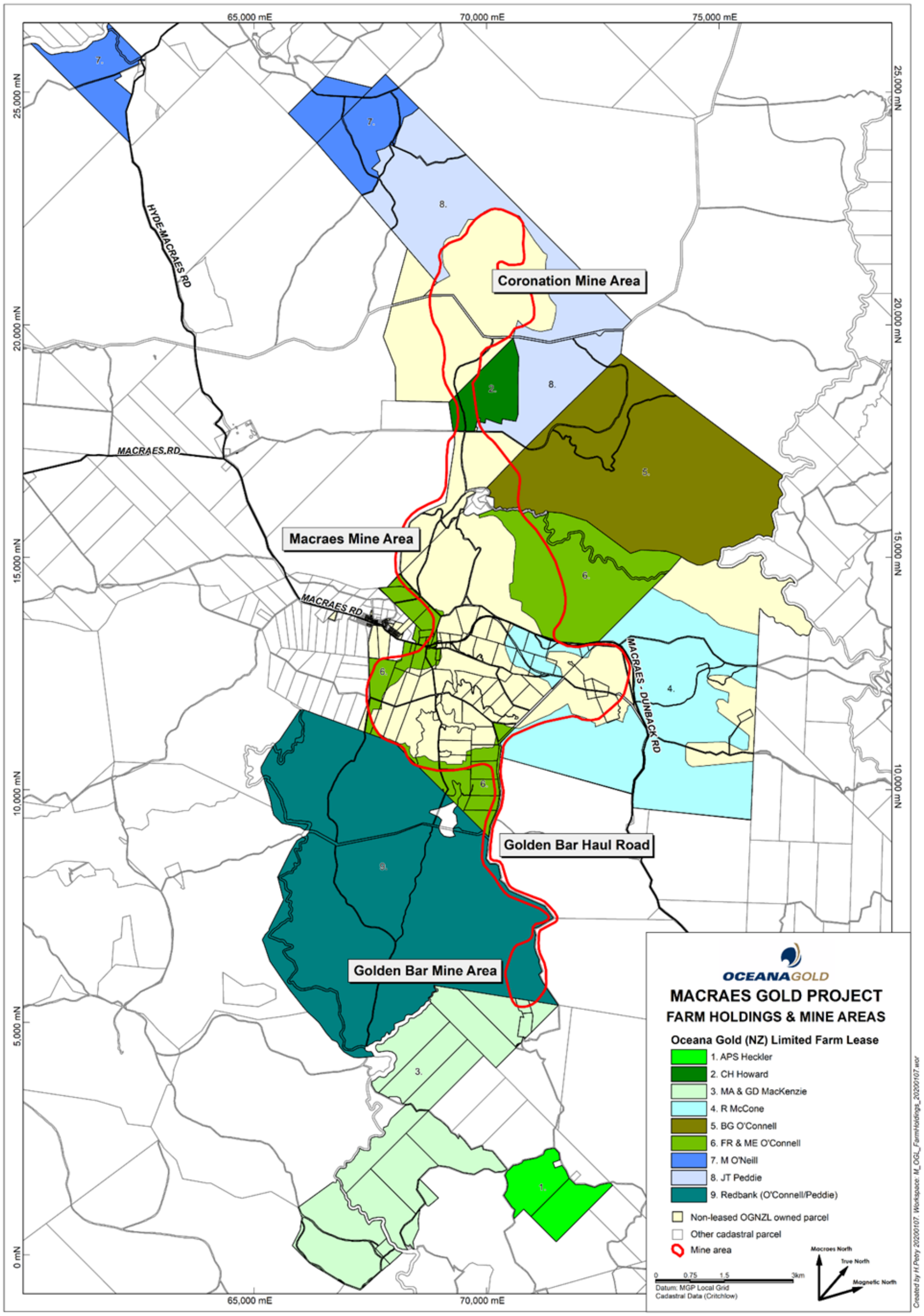

Figure 4-3: Macraes project farm holdings and mine areas

4.3 Mineral Titles

OceanaGold holds a contiguous group of permits to the north-west and south-east of Round Hill, covering approximately 27km of strike along the mineralized Hyde Macraes Shear Zone (HMSZ) as shown in Figure 4-1 and detailed in Table 4.1.

The permits comprise two Mining Permits (MP) and an Exploration Permit (EP) granted under the Mining Act 1971 or the Crown Minerals Act 1991.

An exploration permit can have an initial term of five years with the right of extension of term, over 50% of the area (in one contiguous piece), for a further term of up to five years but not exceeding 10 years. An exploration permit can be converted into an appraisal permit for further terms exceeding the initial 10 years. The Crown Minerals Act 1991 allows for extensions of the permit areas subject to certain conditions for compliance.

Table 4.1: Macraes project permits

Permit No.	Licensee	Location Name	Date Commenced	Term/ Expires	Area (Hectares)	Interest in Permit
MP52 738	OceanaGold	Round Hill	31.10.2010	10 yrs 30.10.2020	395.4	100%
MP41 064	OceanaGold	Macraes Extension	01.02.1994	31 yrs 31.01.2030	14,157.182	100%
EP60 589	OceanaGold	Round Hill East	14.07.2020	5yrs 13.07.2025	23.72	100%

In May 2020 OceanaGold applied to New Zealand Petroleum and Minerals (NZPAM) for a 20-year extension of duration to MP52 738. OceanaGold is not aware of any reason as to why this extension of duration should not be granted.

The area held under title or under application totals 14,576.3 hectares compared to the 27,492 hectares previously held (Redden & Moore, 2010). All the previously held exploration permits have been dropped or absorbed into mining permit MP41 064 which has grown from 9,610 hectares to 14,157.182 hectares, the last to be absorbed being EP 40 524 “Dunback” in 2020.

4.4 Nature and Extent of Title

Land in the immediate vicinity of the OceanaGold mining operations, and most of the land in permits MP52 738 and MP41 064, is owned by OceanaGold. Land not used for active mining activities is leased at a market rental to local farmers. OceanaGold land ownership also extends beyond those two permits as shown in Figure 4-3. Land outside the mining permits is currently owned by a variety of landowners.

The granting of a mineral permit does not confer a right of access to land subject to the permit. A permit holder must arrange land access with the owner and occupier of the land before beginning any prospecting, exploration or mining for minerals on or in land (other than minimum impact activity as defined in the Crown Minerals Act 1991). Access arrangements are binding on successors in title provided they are registered against affected land titles where the term is longer than six months.

OceanaGold currently has no access agreements for land covered by mineral permits it does not own and is not currently negotiating any land access agreements, However, in the future Oceana may need negotiate access agreements to the properties that cover the Nunn's, down dip of Golden Bar and Stoneburn resources. Oceana has a strong track record of negotiating land access agreements and is confident it can negotiate land access on reasonable terms and conditions.

Any activity carried out below the surface of any land subject to a permit will not be considered, for the purposes of the Crown Minerals Act, to be prospecting, exploration or mining on or in the land and consequently not require an access arrangement, if the activity will not or is not likely to:

- cause any damage to the surface of the land or any loss or damage to the owner and/or occupier of the land;
- have any prejudicial effect regarding the use and enjoyment of the land by the owner and/or occupier; and
- have any prejudicial effect regarding any possible future use of the surface of the land.

4.5 Location of Mineral Resources

Mineralised zones at Macraes are located along the surface trace of the HMSZ, a major northwest- southeast trending structure (see section 7.3). All previous mining production and current resources are located along this zone. Figure 4-4 shows the location of mineral resources within OceanaGold's Macraes permits. Local grid coordinates for the limits of the resource areas at Macraes areas are given in Table 4.2.

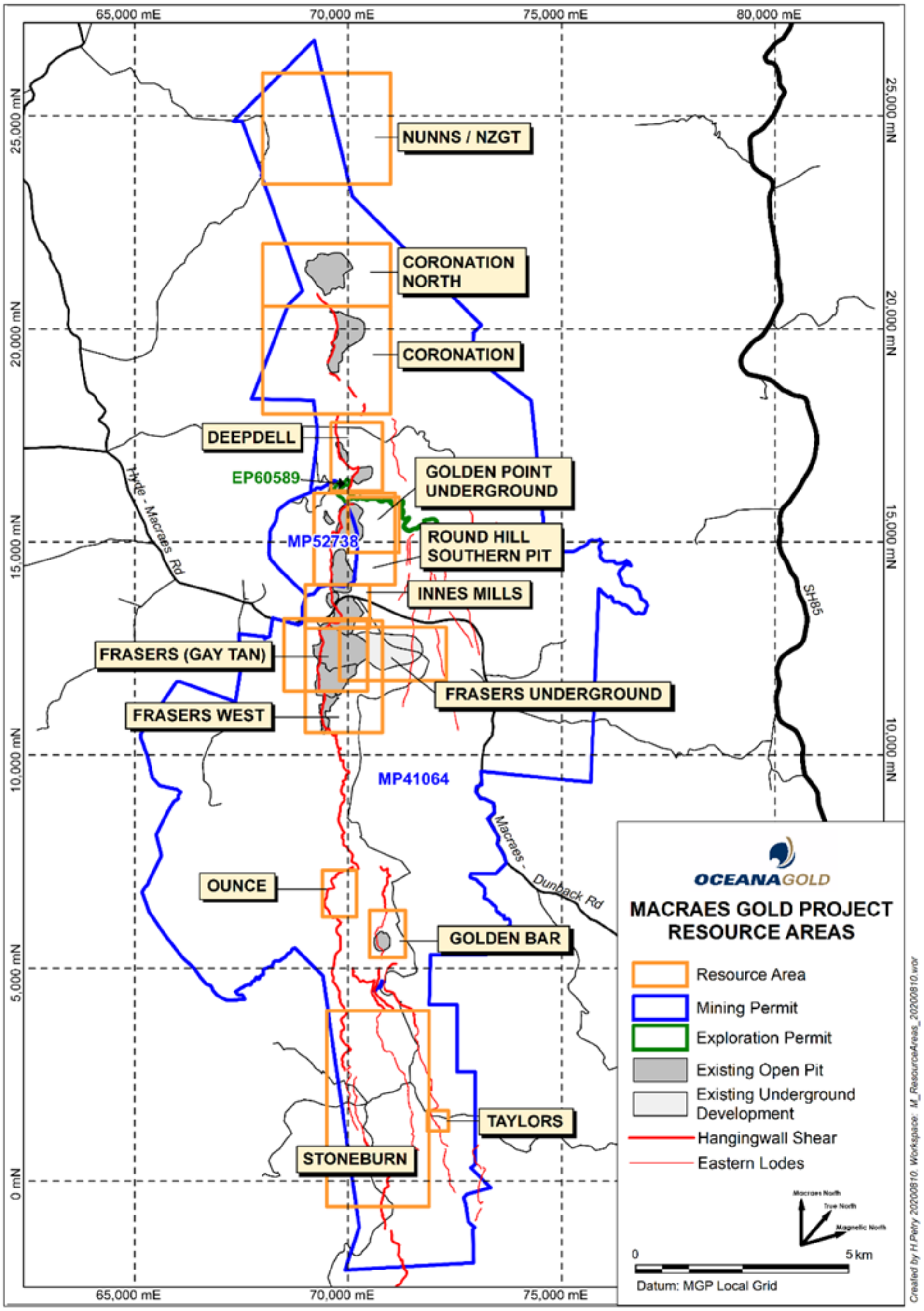

Figure 4-4: Macraes project resource locations

Table 4.2: Macraes resource area boundaries

Resource Area	Northing (Local Grind)		Easting (Local Grind)	
	From	To	From	To
Nunns/NZGT	23,400	26,000	68,000	71,000
Coronation North	20,525	22,000	68,000	71,000
Coronation	18,000	20,525	68,000	71,000
Deepdell	16,200	17,800	69,600	70,800
Golden Point UG	14,750	16,050	70,000	71,200
Round Hill/Sthn Pit	14,000	16,150	69,200	71,100
Innes Mills	12,975	14,000	69,000	70,500
Frasers West	10,525	13,150	69,000	70,800
Frasers – Gay Tan	11,500	13,200	68,500	70,450
Frasers UG	11,750	13,000	69,800	72,300
Ounce	6,200	7,300	69,400	70,200
Golden Bar	5,250	6,350	70,500	71,350
Stoneburn	-600	4,000	69,500	71,900
Taylors	1,175	1,650	71,850	72,350

4.6 Royalties, Agreements and Encumbrances

Under the Mining Act 1971 no royalty on gold is payable to the Crown on MP52 738. A royalty of 2% of the gross proceeds from scheelite concentrate sold (if any) is payable to the Crown. The MP is covered under a Royalty Agreement between OW Hopgood and OceanaGold, where OceanaGold pays Hopgood a royalty 5% of revenue if recovered by open pit mining and 3% if recovered by underground mining) on any gold, scheelite or other minerals recovered from the area which was formerly PL31 595 and ML32 3047.

Under the Crown Minerals Act 1991 which applies to MP41 064 royalties are payable to the Crown annually in respect of all gold, silver and scheelite that are recovered from the land pursuant to the mining permit. Royalties are calculated based on net sales revenue or accounting profits whichever is the greater. Royalties are generally calculated and payable at the following rates:

- no royalty is payable if net sales revenue from the permit is less than NZD100,000 for an annual reporting period or averages less than NZD8,333 per month if the annual reporting period for the permit is less than 12 months. Where the permit is part of a production unit, the thresholds will apply to net sales revenues from all permits in the production unit;
- a royalty of 1% Ad Valorem is payable if net sales revenue from a permit is between NZD100,000 and NZD1,000,000; and
- a royalty of either 1% Ad Valorem or 5% of the accounting profits, whichever is greater, if the net sales revenue from a permit is more than NZD1,000,000.

4.7 Environmental Permitting & Compliance

4.7.1 Overview

This report provides an overview of the principal environmental statutes that OceanaGold operates under in order to understand the extent of OceanaGold’s environmental liabilities and how these liabilities arise.

There are three principal agencies that oversee OceanaGold's mining activities together with several secondary agencies. The three principal agencies are:

- Otago Regional Council;
- Waitaki District Council; and
- Dunedin City Council.

In order to undertake mining of Crown owned minerals (such as gold) there are three key consents and permits required:

- access arrangements with the owner of the land;
- a mining permit under the Crown Minerals Act 1991; and
- Resource Consents to use land, water, and air.

As OceanaGold is a significant landholder in the district and the area covered under the mining permits covers most of the foreseeable mining target, the key approval process is related to Resource Consents.

Resource Consents Description

Territorial authorities and regional councils have primary responsibility for administering the Resource Management Act 1991 (RMA). Their functions are defined within the RMA (sections 30 and 31 RMA) but in simple terms, relevant to OceanaGold's activities, territorial authorities manage the effects of land use change and noise, whilst regional councils manage effects associated with:

- water quality (surface, ground and coastal water);
- taking, damming, diversion of water;
- discharges of contaminants into or onto land, air, or water, and discharges of water into water; and
- the bed of any water body, and the planting of any plant in, on, or under that land.

In managing the effects of activities on the matters above, both territorial authorities and regional councils seek to give effect to the purpose of the RMA (section 5 RMA), which is "to promote the sustainable management of natural and physical resources". Sustainable management is defined by the RMA to mean managing the use, development, and protection of natural and physical resources in a way, or at a rate, which enable people and communities to provide for their social, economic, and cultural wellbeing and for their health and safety while:

- sustaining the potential of natural and physical resources (excluding minerals) to meet the reasonably foreseeable needs of future generations;
- safeguarding the life-supporting capacity of air, water, soil, and ecosystems;
- avoiding, remedying, or mitigating any adverse effects of activities on the environment;
- Supporting the purpose of the RMA are several principles that persons exercising functions; and
- powers under the RMA, in relation to managing the use, development, and protection of natural and physical resources, shall recognise and provide for (section 6 RMA), have particular regard to (section 7 RMA), and take into account (section 8 RMA).

The term "effect" includes (section 3 RMA):

- any positive or adverse effect;
- any temporary or permanent effect;
- any past, present, or future effect;

- any cumulative effect which arises over time or in combination with other effects – regardless of the scale, intensity, duration, or frequency of the effect, and includes;
- any potential effect of high probability; and
- any potential effect of low probability which has a high potential impact.

The RMA places restrictions on the use of land (section 9 RMA), the subdivision of land (section 11 RMA), the use of the coastal marine area (Section 12 RMA), on certain uses of beds of lakes and rivers (section 13 RMA), water (section 14 RMA), and the discharge of contaminants into the environment (section 15 RMA). Activities that 'use' land, water, and air cannot legally occur unless they are permitted by a rule in a district or regional plan or have a resource consent granted.

A resource consent is therefore permission from a territorial authority or regional council to undertake an activity that would otherwise contravene a statutory plan prepared under the RMA (or sections 9, 11, 12, 13, 14, or 15 RMA).

Applications for resource consents are typically processed in one of two ways. Non-notified applications (no general public submissions allowed) may occur when the environmental effects of the activity to be consented are no greater than minor and written approvals have been obtained from any deemed affected parties. Notified applications occur when the environmental effects of the activity to be consented may be greater than minor and provide an opportunity for any person in New Zealand to make a submission supporting or opposing the application.

Consents are granted subject to conditions such as the requirement for an environmental bond to be paid by the consent holder, conditions to avoid, remedy, or mitigate significant adverse effects on the environment and provide for the monitoring of these effects. Failure to meet the conditions of consent may lead to prosecution, payment of fines, and in severe circumstances the cancellation of the consent. The maximum penalties available under the RMA are imprisonment for a term not exceeding 2 years, or a fine not exceeding NZD600,000. If the offence is a continuing one, an additional fine may be imposed not exceeding NZD10,000 for every day or part of a day during which the offence continues.

OceanaGold has been deemed, in obtaining the consents to license activities with environmental effects for this project, to have met the purpose and requirements of the RMA, which establishes a not insignificant threshold for the granting of such consents.

OceanaGold holds all required resource consents for the activities it undertakes. Compliance with the conditions of resource consents is discussed below.

Although expectations over how effects from activities are assessed and the level of mitigation required for managing those effects has changed overtime, OceanaGold has a robust understanding of the Resource Consenting process, engages competent specialists (many of whom have a long-standing relationship with the Macraes Mine) to undertake assessments, and has solid relationships with the territorial and regional councils.

Mining Permits / Crown Minerals Act 1991

Mining licenses and permits for the Macraes Operation have been issued under the Mining Act 1971 and the Crown Minerals Act 1991 for life of mine mining requirements, and no material environmental liabilities emerged.

The allocation of rights to prospect, explore or mine for minerals owned by the Crown is carried out by the issuing of permits under the Crown Minerals Act 1991 (CMA)."Crown owned" minerals include all naturally occurring gold and silver and some coal and other metallic and non-metallic minerals and aggregates. The CMA contains transitional provisions that allow mining licenses granted under the Mining Act 1971 (such as MP52 738) to remain in force.

4.7.2 Access Arrangements

Access Arrangements are agreements sort with landowners to allow for exploration activities to be conducted. At the time of entering an access arrangement general terms and conditions include an option to purchase should exploration results prove favourable.

OceanaGold currently owns approximately 13,540ha of land in the immediate vicinity of the Macraes Operation. The current exploration forecast suggests that the only access arrangement that may be required is associated with Crown Land associated with Golden Point Reserve, currently being managed by the Department of Conservation. If exploration drilling is required on this land, negotiations with the Department of Conservation will be undertaken, to determine the conditions of the access arrangements. The land is within tenements MP52 738 and MP41 064.

4.7.3 Compliance

Management of compliance by the regulating authorities is undertaken through several mechanisms:

- submission of and in some cases presentation of annual plans;
- compliance audits and inspections, undertaken; and
- self-reporting of incidents which result in or have the potential to result in non-compliance with obligations.

The primary agencies involved in the submission of annual plans are New Zealand Petroleum and Minerals (in the case of the Mineral Permits) and the territorial and regional authorities in the case of resource consents.

Audits are conducted by the Councils either on an annual basis or on a consent or topic specific basis, whilst inspections are ad-hoc. In some cases, the Councils will work with other related government institutions such as the Department of Conservation, on topic specific audits.

Progress against corrective actions identified in audits and inspection are tracked in the Corporate Database, InControl.

5 Accessibility, Climate, Local Resources, Infrastructure and Physiography

5.1 Accessibility

Access to the mine is by sealed highway from Dunedin, and then via sealed roads from Middlemarch and Palmerston. There is good access along mine roads and farm tracks throughout the project area.

The Macraes mine is within short driving distance to several populated centres.

- The Macraes plant site is approximately 6km from the Macraes Flat village. The village and surrounding farming community comprises approximately 40 families;
- Dunedin, a university city with a population of 130,000, is 90km away by road;
- Oamaru with a population of 14,000 is 105km by road; and
- Palmerston, with a population of 800, is 37km by road.

Transport to the site is typically by vehicle. OceanaGold provides bus services from Oamaru and Dunedin with many pick-up points enroute. A domestic and international airport is in Dunedin, which also has an operating seaport. A national trunk railway line from Christchurch to Dunedin passes through Palmerston.

5.2 Physiography

The project area is situated on an elevated (approximately 490m above sea level) plateau drained by a trellis pattern of north-westerly and north-easterly trending streams. Parts of the plateau are deeply dissected. Elevations range from 200 metres to 820 metres above sea level.

Vegetation is comprised of a combination of improved pasture and tussock grassland, while streams and gullies are choked by matagouri, gorse, thistles and wild rose. The predominant land use is stock grazing, with small areas covered by pine plantations.

5.3 Climate

Average daily temperatures are about 15 degrees C in summer and 5 degrees C in winter, with daily maximums ranging up to just over 30 degrees C in summer with winter minimums down to -7 degrees C. Snow regularly falls during the winter months but rarely enough to severely restrict access.

Rainfall averages 650 millimetres per year but can vary by about 80 millimetres per year depending on topography. There is little seasonal variation in rainfall, but monthly totals can be quite variable, and the area is susceptible to long dry periods. Droughts, which last two or three years, have been recorded in the east Otago region every 10 to 20 years.

Climatic influence translates to approximately 500 hours of lost open pit mining time per year due to rainfall, snow or fog. Underground mining and processing plant operations are unaffected by weather.

5.4 Land Resources and Infrastructure

5.4.1 Sufficiency of Surface Rights

OceanaGold has all necessary rights and mining permits for current mining operations at the Macraes Project. Planned mining operations at Deepdell, Golden Point Underground and Frasers West require additional resource consents, and these are under application at the time of writing. Future discoveries may require new consents and conversion of ground currently held as an exploration permit to a subsequent mining permit prior to the commencement of mining.

5.4.2 Power

Macraes is connected to the local power grid, which provides a reliable electrical power supply. The power line has adequate capacity to supply the mine at full operating limits.

5.4.3 Water

Water is drawn from the Taieri River and pumped to the site. Through storage and active recycling, an adequate reservoir of process and potable water is maintained to enable continuous operation, even in times of drought conditions.

5.4.4 Communications

Macraes is connected to the New Zealand ultrafast broadband fibre network, providing both voice and internet access. The mine site utilises a local area network for computer connections.

A multi-channel radio network is utilised for operations communication in the mine and process plant.

5.4.5 Mining Infrastructure

The Macraes Project area is sufficient to contain the current open pit mines and underground, process plant, haulage roads, tailings storage areas and waste rock storage areas. Furthermore, sufficient surface area is available within Macraes project area for the construction of any infrastructure necessary for the potential development and mining of other deposits under consideration.

5.4.6 Labour

Mining, processing and support staff are drawn from the local region, with all living in the nearby towns or commuting from Dunedin. Recruitment of suitably skilled and experienced employees for all areas of the operation has been achieved and maintained.

Contract support services are readily available from Palmerston, Oamaru, Waikouaiti and Dunedin.

6 History

6.1 Historic Mining

The earliest alluvial mining in the district commenced at Murphy's Flat in 1862, with Macraes Flat, Deepdell and some parts of Horse Flat being worked soon after (Hamel, 1992). Murphy's Creek was the major early alluvial workings and there is evidence that all of its tributaries were being worked in the 1860's. The Murphy's Creek alluvial workings are reasonably well preserved and are of historic significance (Hamel, 1992).

Lode quartz mining commenced in the 1860's, but the scale of operations was very small. The Golden Point/Round Hill lode system was not discovered until 1889. Development of Golden Point commenced in 1889 and it became established as a significant scheelite and gold producer. From 1890 to 1933, it produced an estimated 13,000 ounces of gold and 800 tons of scheelite (Williamson, 1939). Other areas mined included Maritana, Golden Bell and Deepdell but quantities were small with a total reported of 8,463 tons of crushed ore for 1,630 ounces of gold and 50 tons scheelite (Williamson, 1939). Lodes were worked for either scheelite or gold depending on the price at the time. This was because the fine grinding required to liberate the gold resulted in poor recovery of scheelite.

Areas continued to be mined after 1939 as tungsten was in demand during the Second World War but gold prices were sharply reduced during this time. The scale of operations was small, and work was discontinuous. As a result, records of ore production are poor. Local miners suggest that less than 100 tonnes of scheelite was mined since 1939 but estimates are widely varied. It was a question of economics (due to preferential recoverability of gold or tungsten) not availability that controlled the scheelite industry at Macraes Flat.

The first lode worked in the Macraes field was probably the Duke of Edinburgh, described by Ulrich in 1875 (Williamson, 1939). He also mentions the Golden Bar Reef and the Moonlight Reef, at the head of Macraes Flat, but gives no details about them. In 1888, the Highlay Reef was discovered on the Mareburn, and the lode was soon traced to Golden Point, where it was opened out in 1889. Further prospecting soon resulted in the opening of other mines along the lode, some of them, however, being little more than surface workings.

The mines that have been worked, given in order eastward, are Mount Highlay, New Zealand Gold and Tungsten, Coronation, Golden Bell, Maritana, Deepdell, Golden Point, Round Hill, Innes, Mills, Griffins, Golden Ridge, Ounce and Golden Bar (Williamson, 1939).

Figure 6-1 shows historic mining areas in relation to modern open pit and underground mining zones.

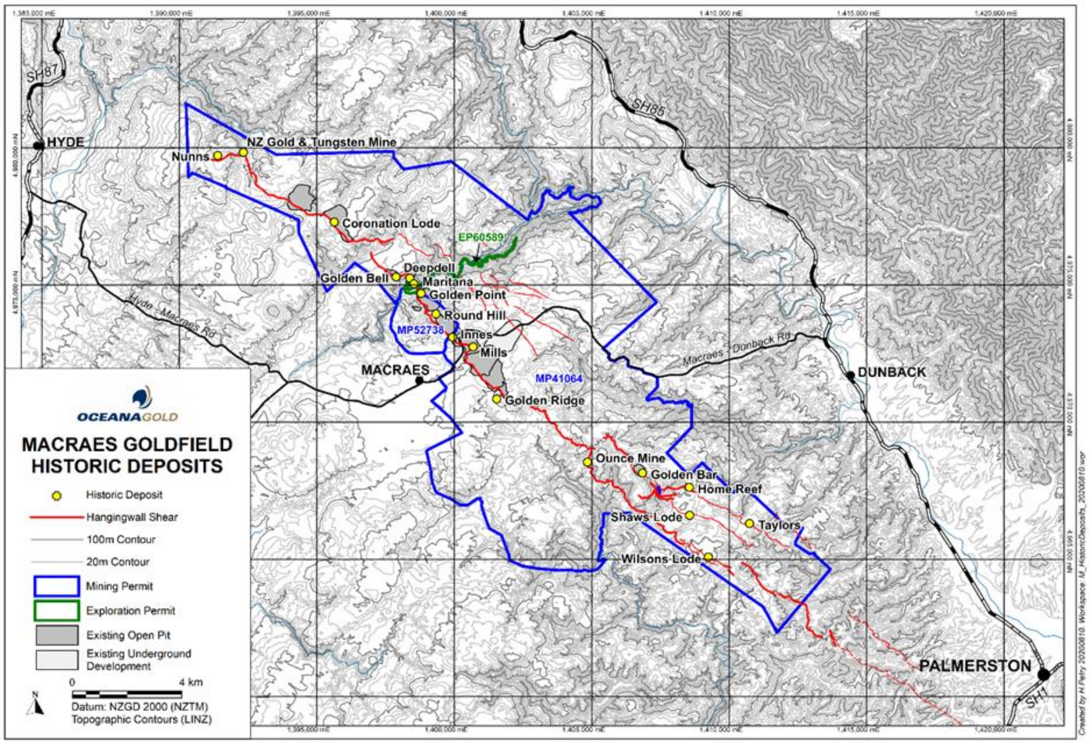

Figure 6-1: Macraes historic deposits

6.2 Prior Ownership

The original permits at Macraes were owned by Golden Point Mining Limited and BHP Gold Mines (New Zealand) Limited, owned by BHP Gold Mines Limited. During December 1989, Macraes Mining Company Limited (MMCL) obtained 100% ownership of these permits. On May 14, 1999, Macraes Mining Company Limited changed its name to Gold and Resource Developments (New Zealand) Limited and again to GRD Macraes Limited on June 30, 2000. Finally, on May 18, 2004, the name was changed to OceanaGold (New Zealand) Limited.

6.3 Previous Work pre 1990

Details on the exploration activities conducted in the Macraes region prior to 1990 when MMCL acquired the Macraes permits are from Redden and Moore (2010). This included approximately 56,000 metres of RAB, RC and diamond drilling in 778 holes.

6.3.1 Geochemistry

Stream Sediment Sampling

During 1987, an orientation stream sediment sampling survey was conducted by BHP Gold Mines (New Zealand) Limited (BHP), in the Round Hill Area. The results from a total of 64 samples taken showed total sediment fine fraction samples (-20# and -80#), gave the best results.

Although the bulk cyanide leach method returned lower-level results, this method was adopted for use on a regional basis due to ease of sample collection.

6.3.2 Geophysics

Two geophysical surveys have been carried using induced potential (IP)/Resistivity; one by Homestake New Zealand Exploration Limited (HNZEL), in April 1985.

The objective of the survey was to test the ability of IP to discriminate between ore grade Au-scheelite- sulphide mineralisation at Round Hill (intersected by diamond drilling) from weakly mineralized parts of the lode shear system south of Round Hill employing dipole-dipole and gradient array IP surveys. The survey lines were orientated both grid east, across the line of lode, and grid north, parallel with the strike of the lode system but across the trend of the Round Hill shoot. A dipole spacing of 50m was used.

Dipole-dipole traverses revealed chargeability responses more or less associated with outcrop of the main lode, however the anomaly was stronger than what would be expected from the sulphide content of the lode system (generally less than 1% total sulphide with maximum of 2-5% in sulfidic zones) and may be related to graphite associated with the shear system. A chargeable source near the centre of line 14900mN was associated with very weak mineralisation intercepted in diamond drill hole (DDH) 5.

The surveys across the Round Hill Shoot failed to clearly discriminate between the shoot and weakly mineralized lode to the south. The gradient array surveys on these lines revealed anomalies in the vicinity of Ferguson’s workings (Southern Pit – 14200-14400mN) in which graphitic rocks are exposed. In summary, IP chargeability anomalies may define a shear system of the Macraes type, especially if sufficient graphite is present, but the variability of sulphide content within the lode system is too low to discriminate between high grade mineralized shoots and low grade or barren parts of the lode system (Robinson, 1986).

In 1986, BP Oil New Zealand Limited (Minerals Division), (BP Oil), carried out a total of 32-line km of dipole-dipole IP/Resistivity surveying at Nunn’s-New Zealand Gold and Tungsten, Frasers (south of the alluvial flats along Macraes Road), Golden Ridge, Golden Bar and Frasers East (Coochey, 1986; Moore,1986). The bulk of this survey, 19-line km, was over Frasers and Golden Ridge. A comparative analysis of the IP survey results with subsequent drilling was not completed, however it appears that the results were like those of HNZEL.

On November 17, 1987, BP Oil undertook a down-hole geophysical survey on drill hole GRRC 14 (Moore,1987). BPB Instrument Limited carried out the demonstration log recording dip-meter analysis, density logs, focused electric and resistivity logs, neutron-neutron and gamma logs. Moore reported that the logs which provided the most information, and which correlated with the down-hole geology were resistivity, focused electric, density, and dip-meter analysis.

During 1987, the Ministry of Works and Development Central Laboratories used portable “OYO” equipment to log 13 holes on the eastern high wall side of the (then proposed) Round Hill pit (Brown,1988). BPB Instruments Limited also logged one of these holes which enabled a comparison between the two contractors. The surveys were reasonably successful with a similarity of results between the two contractors. The results of the survey became very useful allowing for the interpretation of structures required for slope stability analysis.

6.3.3 Drilling

During 1970, Helpet Mining Company Limited drilled 28 holes in the Macraes Flat area exploring for tungsten mineralisation. Core recovery was poor, and mineralisation was found to be sporadic and discontinuous.

Kennecott Exploration (Australia) Pty Ltd also undertook exploration in the area in 1970-71, but their reconnaissance work did not include drilling.

In 1984, Homestake New Zealand Exploration Limited commenced exploration at Round Hill and by the end of 1986 had drilled over 5.5km of strike on the Deepdell, Round Hill and Frasers systems at 100 to 200m drill hole spacings. This drilling defined the Round Hill shoot which was amenable to open cast mining (Lee et al, 1989).

Following HNZEL's success in the Macraes Flat region, BP Oil obtained licences to the north-west and south-east of Macraes along the HMSZ. Between 1986 and 1988, BP Oil carried out drilling at Nunn's, Golden Ridge, Ounce, Golden Bar and Frasers East.

Drilling has continued at Round Hill and adjacent prospects since the purchase of HNZEL by BHP in 1987 and subsequently by MMCL in 1990.

6.4 Historical Estimates

Prior to 2010 there were no relevant historical resource estimates for the Macraes Operation compliant with NI 43-101 rules or CIM guidelines (Redden and Moore 2010). However, the mine had been in production for approximately 19 years to that date and resource estimates for the deposits were routinely updated and refined over time. These estimates had been prepared in accordance with the JORC code (JORC, 2004) and its predecessors.

Since 2010 the estimates have been compliant. The current CIM compliant resource estimates (as of December 31, 2019) are presented in Section 14.

6.5 Previous Production

Historical production from the Macraes Goldfield is poorly recorded. The Golden Point mine produced an estimated 13,000 ounces of gold and 800 tons of scheelite from 1890 to 1933 (Williamson, 1939).

Since the commencement of mining in 1990, the combined Macraes open pits and underground mine have produced more than 5Moz. Since 2006, annual gold production from Macraes has ranged between 150koz and 210koz.

Details of previous exploration and mining activities for the period 1990-end 2009 are covered in Redden & Moore (2010).

7 Geological Setting and Mineralisation

7.1 General

The Macraes gold deposits are in a major, low-angle (~15-20°) structure known as the Hyde Macraes Shear Zone (HMSZ). This regionally continuous, late metamorphic deformation zone cuts greenschist facies metasedimentary rocks of the Otago Schist. The Otago Schist is a moderately high-pressure metamorphic belt (Yardley, 1982) that formed by collisional amalgamation ("Rangitata" Orogeny) of the Caples and Torlesse terranes in the Early-Middle Jurassic (Coombs et al.,1976; Bishop et al., 1985; Little et al., 1999).

The Otago Schist forms part of the more extensive Haast Schist that underlies about 10% of the New Zealand microcontinent (Mortimer, 1993a, b). To the south and west, the Otago Schist grades into mainly volcaniclastic, non-schistose greywacke and argillite of the Caples Terrane (Bishop et al., 1976). Caples Terrane greywackes comprise probable Late Paleozoic-Early Mesozoic, dominantly intraoceanic, magmatic arc lithologies, with lesser proportions of continental derived material (MacKinnon, 1983; Roser et al., 1993). To the north and east, the Otago Schist grades into non-schistose greywacke and argillite of quartzo-feldspathic composition from the Torlesse Terrane (Coombs et al., 1976). Torlesse metasediments were derived from an active continental magmatic arc and granitic gneiss basement in the Permian-Late Triassic. Both terranes contain minor greenschist (metabasite) and quartzite (metachert) layers (MacKinnon, 1983).

7.2 Regional Geology

The basement rocks in the region are quartzo-feldspathic psammitic to pelitic schists of the Rakaia terrane metamorphosed to greenschist facies during the Mesozoic (Mortimer, 1993).

New Zealand underwent a period of extension with associated widespread subsidence during the late Cretaceous to the Oligocene, during which an extensive geomorphologic surface, the Otago Peneplain was developed on the basement rocks (Youngson and Craw, 1996). In the tectonic basins, coarse basin fill (locally auriferous) followed by marine transgressive sequences were deposited. These are locally overlain by fluvial and lacustrine sediments. Sporadic intra-plate volcanic activity occurred during the Eocene/Oligocene, however the bulk of local volcanic activity occurred during the Miocene. Many monogenetic volcanic centres erupted in the Otago province, whereby flow deposits and tuffs capped the eroded Tertiary sediments and schist basement. With the inception of the Australian/Pacific Plate boundary in the late Miocene the tectonic regime changed to one of active deformation and regional uplift. At this time, re-working of earlier quartzose sediments and deposition of regression related sediments such as sandstones and conglomerates occurred. Extensive alluvial gravel (auriferous) and distal glaciofluvial Quaternary sediments mantle the schist, cap ridges and form terraces in North Otago.

Regionally, within the Otago Schist, there is evidence for episodic mineralisation throughout the uplift history. Five phases of deformation, each associated with crosscutting mineral veins, has been observed in the Otago Schist. Two phases occurred before the metamorphic peak, three afterward, determined by structural and physical relations (Craw and Norris, 1991). Within the HMSZ, quartz lode and gold/scheelite mineralisation formed during the uplift of the host schist through the brittle/ductile transition in the Late Jurassic/Early Cretaceous (Craw, 2002).

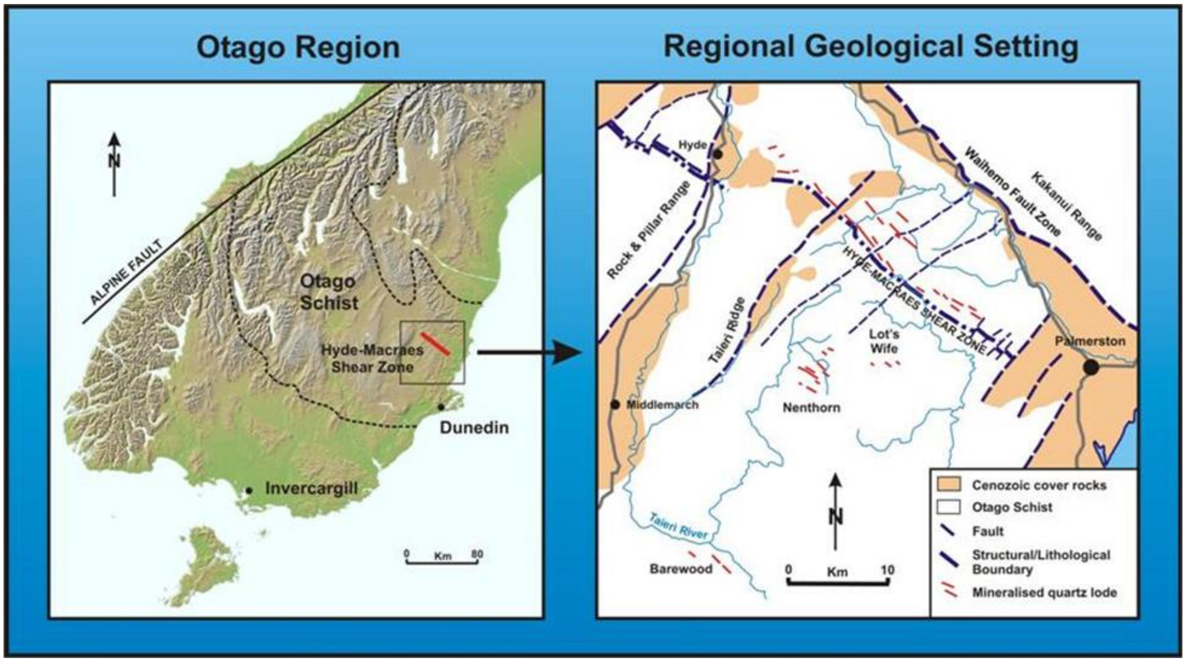

Figure 7-1: Regional Geological setting

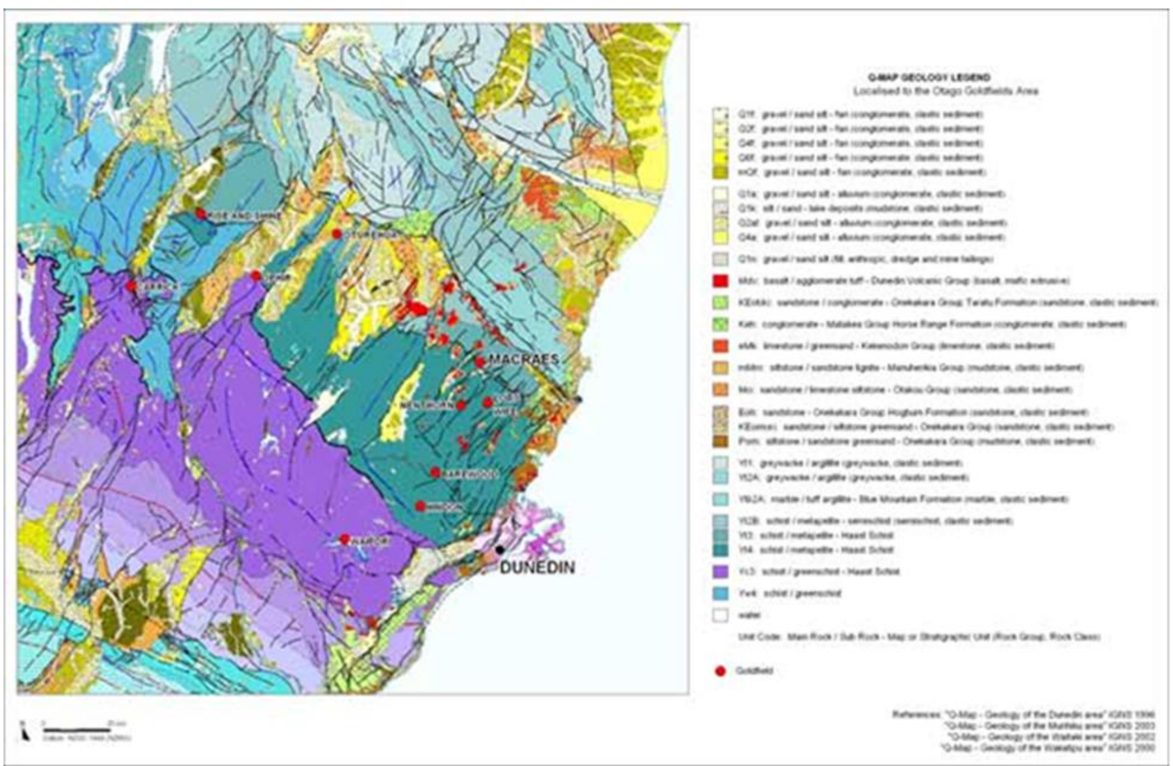

Figure 7-2: Otago Geology map

7.3 Local Geology

The Macraes gold deposits are in a major, low-angle (ca.15-20◦C) structure known as the Hyde Macraes Shear Zone (HMSZ). This regionally continuous, late metamorphic deformation zone cuts greenschist facies metasedimentary rocks of the Otago Schist and is traceable along strike for at least 30km. The HMSZ developed during uplift of the host schist through the brittle/ductile transition in the Late Jurassic (Craw and Angus, 1999).

The HMSZ consists of variably altered, deformed, and mineralised schist up to 150m thick, known as the Intrashear Schist. The thickest part of the shear zone consists of several mineralised zones stacked on metre-thick shears. These shears have ductile deformation textures overprinted by cataclasis (Craw and Angus, 1999). The HMSZ is hosted in lower greenschist facies (chlorite zone) schist and has been juxtaposed against upper greenschist facies schist along a normal fault, the Footwall Fault (Angus et al., 1997). The Footwall Fault is younger than the HMSZ and truncates mineralisation at its base.

The upper boundary between mineralised HMSZ schist (Intrashear Schist) and unmineralised lower greenschist facies schist is commonly a well-defined structure, the Hangingwall Shear. This shear ranges up to 25m thick and is typically black due to the presence of fine-grained graphite and sheared sulphide minerals (pyrite and arsenopyrite) (McKeag et al, 1989; Craw, 2002). The Hangingwall Shear can be traced through the mined pits in the main mining area.

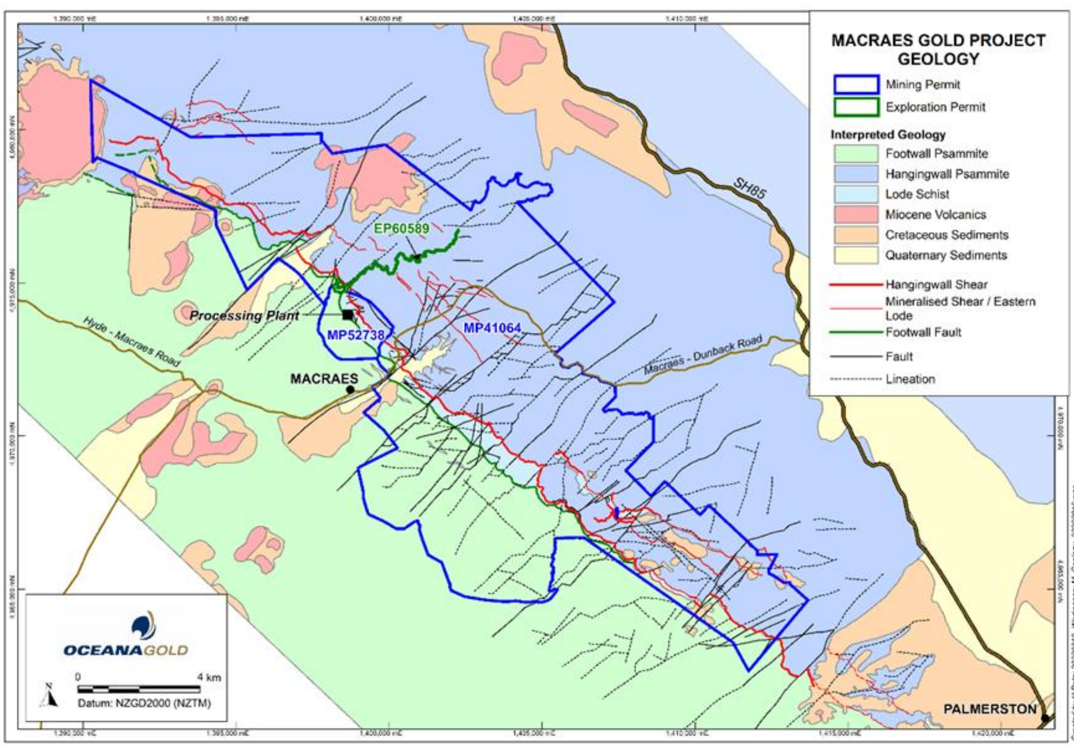

Figure 7-3: Macraes geology map

7.4 Mineralisation

7.4.1 Mineralised Zones

The mineralisation at Macraes is principally developed within the gently northeast dipping HMSZ, though anomalous grades are also recorded in narrow, steeply dipping quartz veins locally occurring in the hanging wall schists, collectively known as the Eastern Lodes (Figure 7-4). Mining to date has occurred along a continuous strike length of 6km in numerous staged open pits, four discrete satellite pits immediately to the north, and at Golden Bar, approximately 7km to the south.

Within the shear zone, mineralisation is generally constrained between the Hangingwall Shear and the Footwall Fault. Schists above the Hangingwall Shear and below the Footwall Fault are generally barren thought there are exceptions to this rule e.g., at Innes Mills and the Eastern Lodes. Economic mineralisation is typically restricted to the upper part of the HMSZ. The Hangingwall Shear, which varies from 1m to >30m in thickness contains the most continuous and consistent mineralisation. This zone is locally underlain by extensive but low grade stockwork zones which may be developed over a width of up to 100m.

Higher grade zones of mineralisation within the shear zone form tabular shoots that may have strike lengths of >300m and extend up to 800m down-dip (i.e. Frasers and Round Hill). In most cases these zones are observed to trend towards the north, oblique to the shear zone dip direction. This orientation is interpreted to be due to the interaction of the HMSZ with folds within the host schist units, creating a preferred lineation direction for mineralisation. The exception to this is the most recently discovered deposit Coronation North where the trend of the mineralisation is south-east.

Mineralisation distribution is broadly consistent along the HMSZ but shows considerable variability in grade, width, continuity and geometry at mine-scale. This variability is attributed to the local development of the HMSZ structure during mineralisation and the influence of host rock lithology, particularly with respect to competency contrasts.

There is a strong empirical correlation between gold, arsenic, scheelite, silicification and strain intensity within the HMSZ. Gold-scheelite-pyrite-arsenopyrite mineralisation is associated with replacement and fissure quartz veins within D4 post-metamorphic shear zones. Shear parallel quartz veins and cataclastic shears contain the highest gold and scheelite grades (Lee et al. 1989).

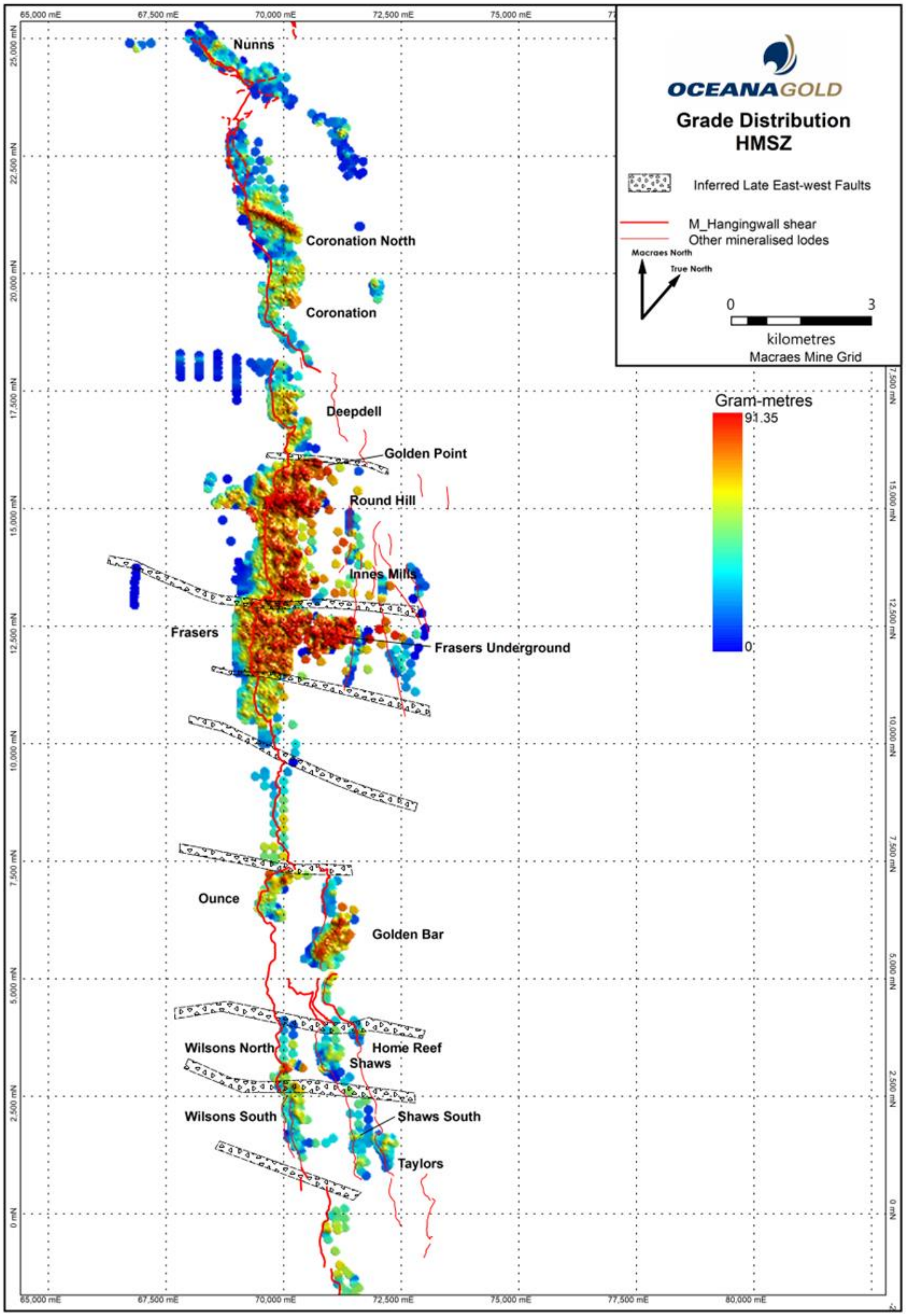

Figure 7-4: Grade distribution along the HMSZ (gram*metre)

7.4.2 Mineralisation Types

The following four types of mineralization occur within the HMSZ at Macraes (Mitchell et al., 2006):

- Mineralised schist. This style of mineralisation involved hydrothermal replacement of schist minerals with sulphides and microcrystalline quartz. Mineralisation was accompanied by only minor deformation;
- Black sheared schist. This type of schist is pervaded by cm to mm scale anastomosing fine graphite and sulphide bearing micro shears. This type of mineralisation is typically proximal to the Hangingwall Shear. Scheelite mineralisation occurs in the silicified cataclastic shears;
- Shear-parallel quartz veins. These veins lie within and/or adjacent to the black sheared schist and have generally been deformed with the associated shears. The veins locally crosscut the foliation in the host schist at low to moderate angles. Veins are mainly massive quartz, with some internal lamination and localized brecciation. Sulphide minerals are scattered through the quartz, aligned along laminae and stylolitic seams. These veins range from 1cm to > 2m. Scheelite mineralisation is associated with quartz veining in some areas; and
- Sheeted veins (laminated veins) locally known as 'stockwork veins'. These veins occur in the Intrashear Schist and can consist of numerous steeply dipping veins. Stockwork veins are typically traceable for 1-5m vertically with most filling fractures that are 5 – 10cm thick but can be up to 1m thick. These veins generally display evidence of incremental opening.

Gold is closely associated with pyrite and arsenopyrite in all the above styles of mineralisation. Rarely free gold up to 300µm occurs in quartz veins, but most gold occurs as 1-10µm scale blebs hosted in and near sulphide grains (Angus, 1993).

Tungsten as scheelite is found predominantly within mineralised quartz veins, although a subordinate phase of disseminated scheelite and a mineralisation phase are also observed (Farmer, 2016). The main phase of tungsten mineralisation occurred early in the development of the deposit and typically occur in the same lode and vein structures as gold mineralisation. However, tungsten mineralisation is not genetically related to gold mineralisation. MacKenzie (2015) recognised 5 types of scheelite. Types 1,3,4,5 are fine grained and disseminated varieties. Type 2 scheelite is the coarse grained to massive creamy coloured scheelite that was mined in the past.

Within the Macraes open-pits, gold mineralisation comprises a combination of Hangingwall, shear-parallel quartz veins ('concordant lodes'), and 'stockwork' veins. However, Hangingwall shear mineralisation accounts for most of the mineralisation within the currently active Coronation pit.

Apart from Coronation, a large amount of irregular mineralisation occurs between the base of the Hangingwall and the Footwall Fault. This is stockwork mineralisation and generally appears in the drilling as clusters of elevated gold grades. Stockwork mineralisation refers to mixtures of steeply dipping narrow quartz veins and concordant lodes, which appear discontinuous at the resource drilling scale. The Footwall Fault lies between 80m and 120m below the Hangingwall Shear and is easily identified in drill holes as a distinctive light-grey fault gouge between 5 and 30cm thick. To date, no economic mineralisation has been located below the Footwall Fault.

A schematic example from Frasers of the stratigraphy and mineralisation is shown in Figure 7-5.

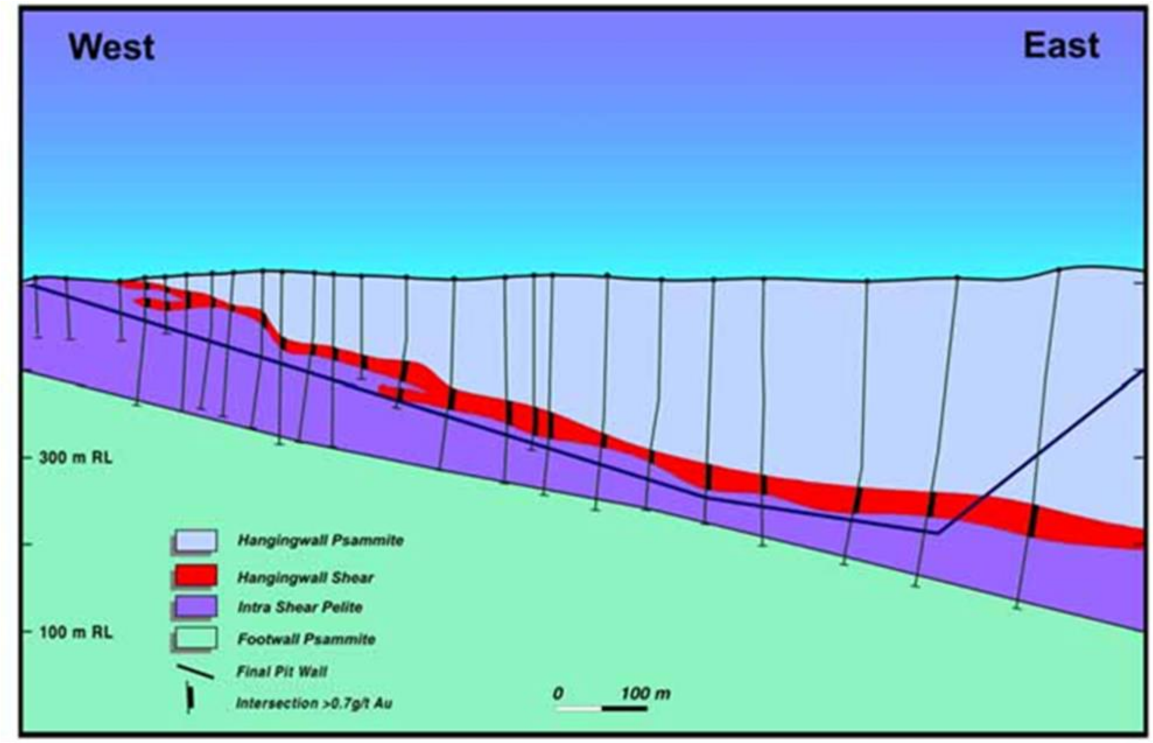

Figure 7-5: Frasers open pit schematic section

7.5 Deposit Geology

At present mining is concentrated in 4 areas: Coronation North, Coronation, Gaytan open pit (within the larger Frasers pit) and FRUG. FRUG is the down dip extension of the open pit mine at Frasers and comprises two zones of mineralisation Panel 1 and Panel 2.

Future mining is planned at Deepdell North, Golden Point, Round Hill, Innes Mills and Golden Bar.

Descriptions of individual deposit geology is included where appropriate in Section 14.

8 Deposit Type

8.1 General

The Macraes deposit is an example of an orogenic style gold deposit. This style of deposit is recognized to be broadly synchronous with deformation, metamorphism, and magmatism during lithospheric-scale continental-margin orogeny (Groves et al., 1998). Most orogenic gold deposits like Macraes occur in greenschist facies rocks. Orogenic deposits typically formed on retrograde portions of pressure- temperature time paths during the last increments of crustal shortening and thus postdate regional metamorphism of the host rocks (Powell et al., 1991 and references therein). Orogenic deposits can be subdivided into epizonal, mesozonal, and hypozonal based on pressure-temperature conditions of ore formation. The Macraes deposit falls into the mesozonal category with mineralisation having occurred near to the brittle-ductile transition at about 300°C.

In orogenic deposits the association between gold and greenschist grade rocks is commonly thought to be related to: 1) the large fluid volume created during the amphibolite and/or greenschist transition and released into the greenschist zone; 2) the structurally favourable brittle-ductile zone that lies just above this transition; 3) fluid focusing and phase separation that are most likely to occur as fluids ascend into the greenschist pressure-temperature regime and/or gold solubility shows a sharp drop under greenschist facies temperatures (Phillips, 1991). Fluid migration along fault-fracture networks was likely to be driven by episodes of major pressure fluctuations during seismic events.

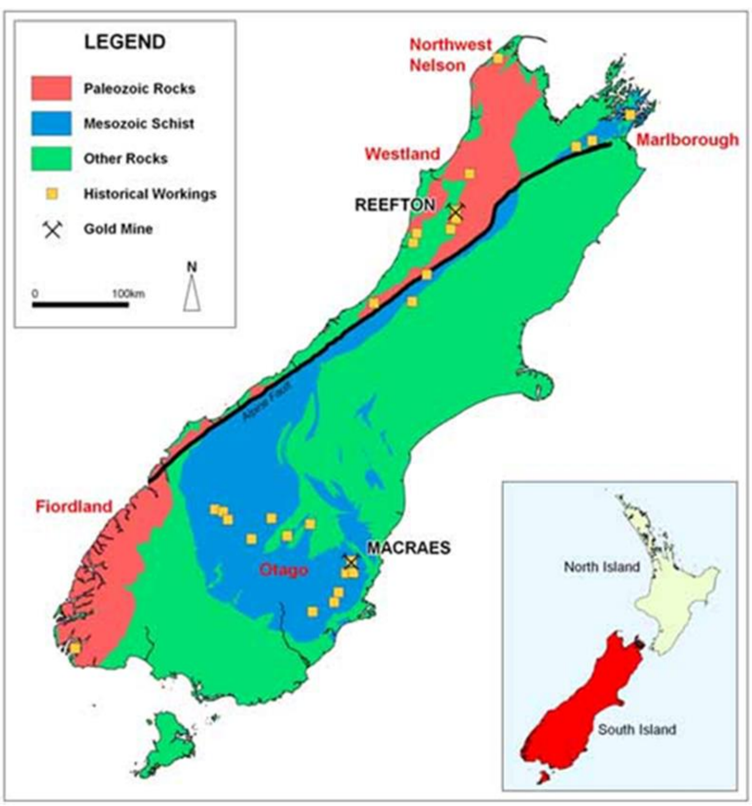

Figure 8-1: Orogenic gold deposits of New Zealand

9 Exploration

9.1 General

Exploration conducted in the Macraes region prior to 1990 when MMCL acquired the Macraes permits is summarized in Section 6.

Exploration by OceanaGold and its predecessor companies from 1990 to the end of 2009 is covered in Redden & Moore (2010).

9.2 Geology

9.2.1 Geological Mapping

Detailed geological mapping has been completed at various times along the strike of the HMSZ. The last major mapping exercise was in Macraes North in 2012, 2015 and 2016 covering the gap between Coronation and Nunns but only interpreted rather than outcrop geology was plotted. Fact and interpreted geology are shown in Figure 9-1.

9.3 Geophysics

No new geophysical surveys have been completed since 2007 apart from re-processing of data from the 2007 Fugro survey.

Between 1990 and 2009 the following surveys completed by OceanaGold and its contractors is listed in Table 9.1.

Table 9.1: Geophysical surveys completed

Date	Survey Type	Contractor
1991	Seismic	Works Consultancy Services
1994	Seismic	Institute of Geological & Earth Sciences (IGNS)
2004	Seismic	Otago University
1994	Electromagnetic (LOTEM, CSAMT, TEM, HEM)	IGNS
1995, 1997	DIGHEM	Geoterrex Ltd
2007	Electromagnetic	Fugro

Results of these surveys are covered in detail in Redden & Moore (2010) and will not be repeated here.

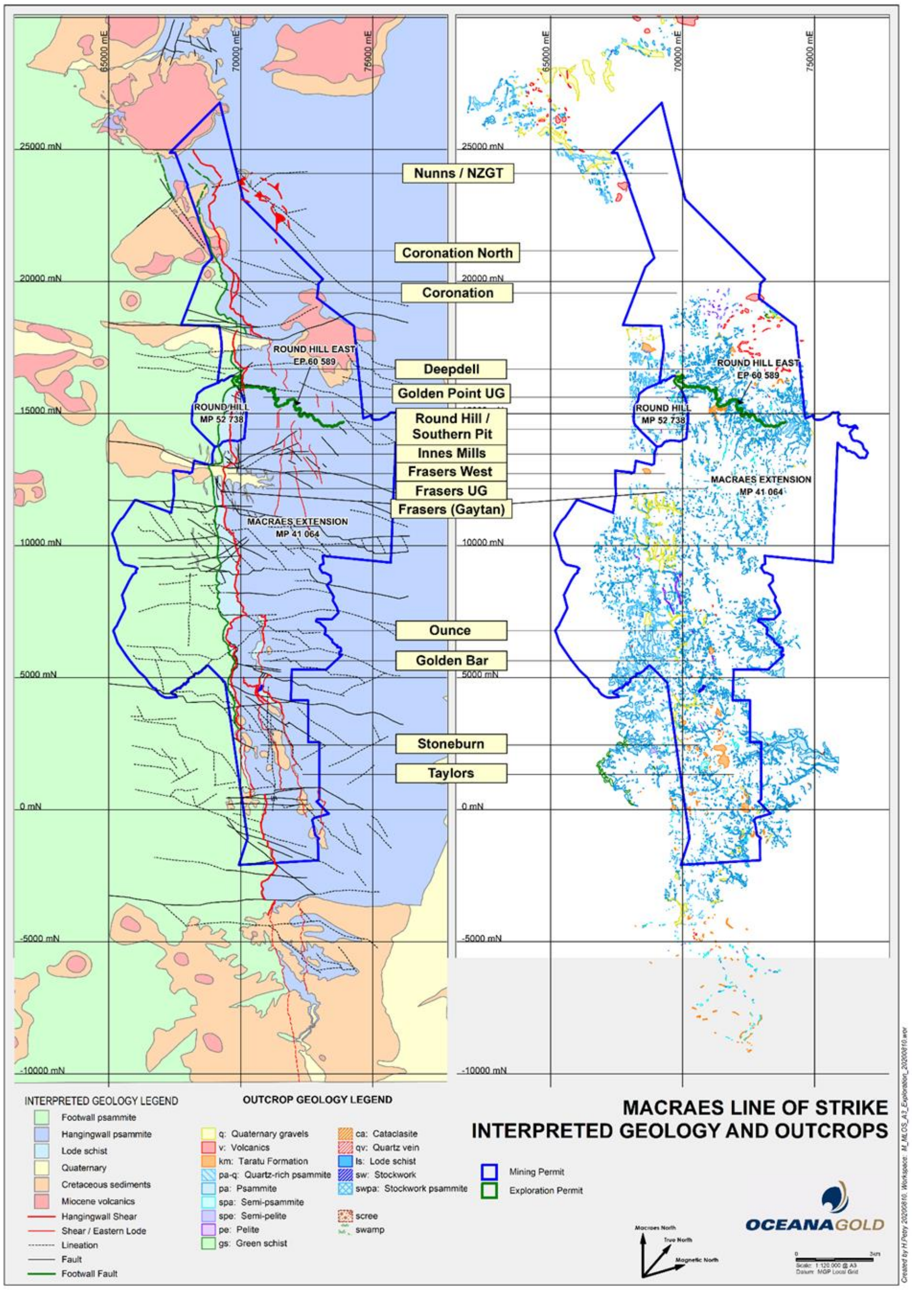

Figure 9-1: Macraes interpreted and outcrop Geology

9.4 Geochemistry

9.4.1 Stream Sediment Sampling

Stream sediment sampling was undertaken in 1991 (Grieve, 1991), in 1994 (Bleakley, 1994) and during 1995. As of June 30, 1997, 803 BLEG (bulk leach extractable gold) stream sediment samples had been collected on the Macraes Project area to complete first pass sampling and infill anomalous catchments. 241 total sediment fine fraction (TSFF) stream sediment samples were also collected. The location of all stream sediment samples collected on the project is shown on Figure 9-2.

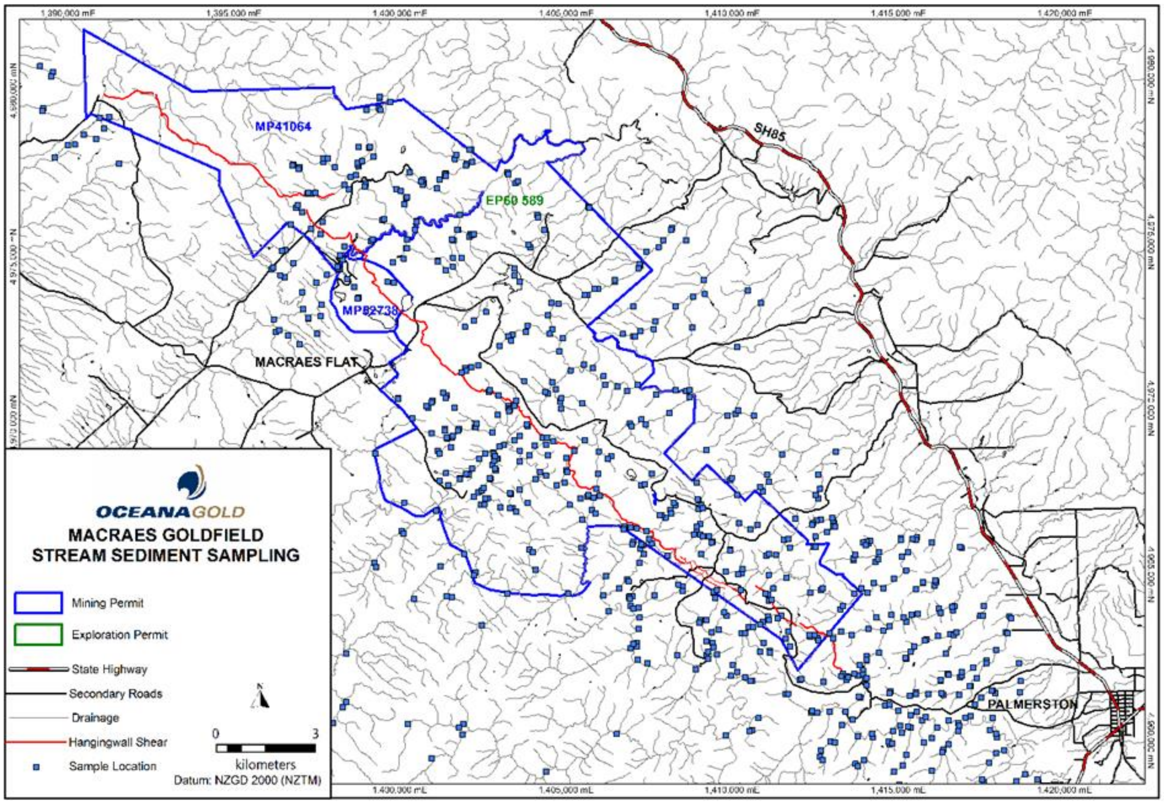

Figure 9-2: Macraes stream sediment sampling

Bulk leach extractable gold (BLEG) samples consisted of approximately 2 to 3kg (dry weight), of -2mm sediment, collected from multiple points ranging from trap sites in active creek channels to over bank fines. Many samples were collected from creeks with low water flow and small active sediment content. Sediment from these creeks consisted of organic-rich fine silts and clays trapped by vegetation. Recent orientation sampling from creeks draining known mineralisation (i.e., the Frasers and Golden Ridge Prospects), produced assays from 78.7 to 3,353ppb gold and 40 to 170ppm arsenic.

Total Sediment Fine Fraction (TSFF) samples were also collected for the first time during early 1997. The samples consisted of 1 to 2kg of -1mm sediment collected from the same trap site as the BLEG samples. These samples were then analysed for a multi-element suite using the Inductively Coupled Plasma (ICP) analytical technique.

9.4.2 Soil Sampling

Soil sampling of B horizon soils using a hand or 64motorised hand auger has been carried out over a large part of the Macraes current and former permit areas. Samples are routinely analysed for arsenic, with some samples also analysed for gold, tungsten and antimony. Arsenic is interpreted as the most reliable path finder element.

In total, approximately 18,000 soil samples have been collected across the Macraes current and former permit areas. The location of all soil samples collected on the project is shown as Figure 9-3.

For conventional sampling, a 2kg un-sieved sample is collected from 0.25 to 1m depth using an auger at each station. Samples usually reached the soil/bedrock interface and consisted of B and C horizon material.

During 1997, two new soil geochemistry techniques were trialled. A two-phase orientation survey testing the Mobile Metal Ion (MMI) technique was conducted, with a total of 604 samples collected. The technique is based on the location of 'blind' mineralisation through the detection of highly mobile ionic species, including gold, which is shed from mineralisation at depth and moves up through the substrate to become weakly bound to soil particles. A very weak solute is used followed by ICP-MS analysis. The results of the orientation were inconclusive, and the programme was suspended.

In addition, considerable work has been conducted on determining whether ICP-OES multi-element suites are more effective at discriminating lithological variations and highlighting mineralisation at the Macraes Project. Work included a 607-sample orientation survey, and an 848 sample follow up survey taken over various areas of the line of strike.

From November 2008 to end 2012, all soil samples have been analysed by ICP-MS at SGS Waihi for Au, As, Sb and W. This has included an extensive soil programme over the eastern parts of the Macraes North and Hyde exploration permits.

In 2015 a soils sampling programme by Hardie Resources on an adjacent permit crossed over into EP40576, then held by OceanaGold. 19 samples were collected and analysed by a portable XRF analyser for a range of elements including arsenic but not gold.

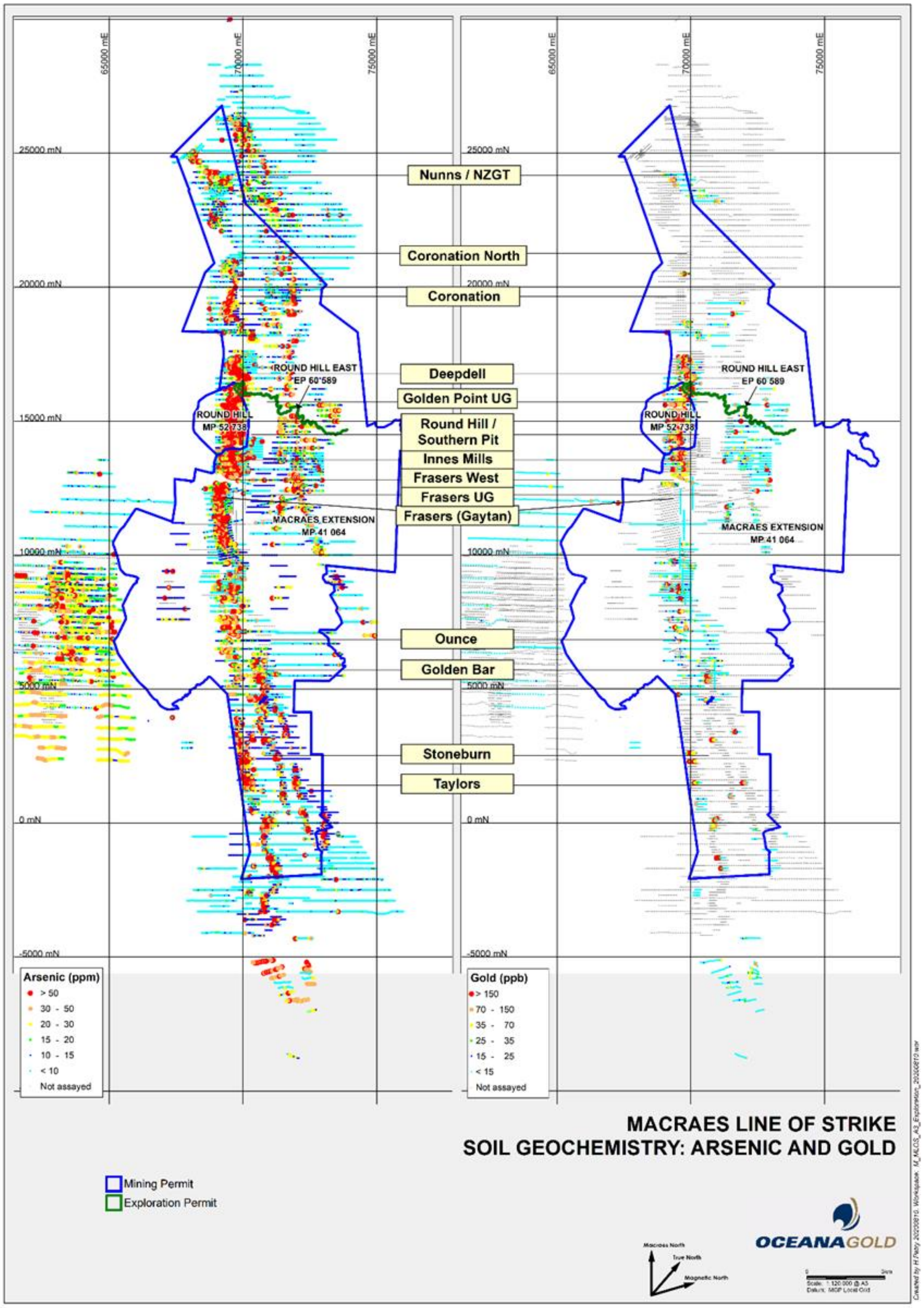

Figure 9-3: Macraes soil

9.5 Trenching

Approximately 17,000m of trenches have been excavated at Macraes, with approximately 5,300 trench rock samples collected.

Trenches are mapped and rock chip sampled, with samples traditionally analysed for gold ± arsenic, ± tungsten ± antimony. In general, the soil profile is shallow in the Macraes area allowing trenching to be undertaken by light (12 tonne), excavators in most areas. Although stream beds and areas of extensive alluvial cover present some difficulties, trenching has proven to be an excellent exploration tool for geological mapping and geochemical sampling.

Trenches are mapped at 1:100 scale with horizontal channel samples collected over geological intervals from 0.5 to 6m. Samples were submitted to the AMDEL laboratory on site for gold, arsenic and tungsten analysis.

9.6 Remote Sensing

In 1994, MMCL purchased a 10m resolution, monochrome 1990 Spot image of the eastern Otago region.

Digital satellite imagery over the Macraes Operation was purchased from Digital Globe Limited in July 2005, March 2006, March 2007, January 2008 and June 2009. The Quickbird satellite imagery is in the visible spectrum, with a resolution of 5m.

9.7 Aerial Photography

Colour aerial photography was flown by New Zealand Aerial Mapping Limited during January 1996. Photography was captured at a nominal scale of 1:30,000. 1:5,000 colour enlargements were produced as an aid to programme planning, geological mapping and interpretation.1:5,000 black and white orthophotographs have been rectified differentially to the Macraes local grid.

Updated colour aerial photography was flown over the Macraes area in March 2005 by Terralink International Limited. Images were supplied as 0.5m resolution digital orthophotographs on the Macraes local grid.

Since 2012 updated colour aerial photography is flown over the Macraes every 1-2 years by Aerial Surveys Ltd. The most recent photography was in December 2018. Images are supplied at a 0.6m resolution.

9.8 Exploration Statement

Exploration surveys and investigations of the Macraes area detailed above have been carried out by OceanaGold, except where a contractor or consultant is named.

10 Drilling

10.1 Summary

By the end of December 2009 approximately 729,000m in about 5,650 exploration/resource infill holes had been drilled in the Macraes Goldfield with most holes (>90%) completed to delineate open pit resources RC percussion drilling, with limited diamond drilling confirmation. (Redden and Moore, 2010). Diamond drilling tails have also been completed where groundwater inflows degraded RC percussion sample quality. Forty-nine air-core holes were drilled to sample the tailings dams to assess the scheelite content.

From 2010 to end of 2019 a further 311,000m in 2,640 exploration/resource infill holes have been drilled, including holes drilled from the underground workings. The proportion of diamond holes has increased to 28% reflecting the deeper drilling required to chase mineralization down dip, the exploration and drill out of the FRUG underground resource and the drill out of the Golden Point underground resource.

This brings the total drilled to 1,040,000m in around 8,290 holes.

The Mineral Resource inventory is based on the results of 972,122 metres of drilling in 7,575 holes used in fourteen resource estimates areas. Four companies, BP Minerals, Homestake, BHP and OceanaGold have drilled the holes but only holes drilled by OceanaGold are used in the resource estimates. The exceptions are the Stoneburn resources which also used the earlier drilling. The FRUG resource estimate also used grade control drill holes and channel cuts. A breakdown of drilling by resource area as at the end of Dec 2019 are summarised in Table 10.1.

In the first half of 2020 a further 92 holes totalling 17,058.5 metres have been drilled at Deepdell, Golden Point, Round Hill and Frasers -Gay Tan. Results from these holes have not been used yet in the current resource estimates.

Table 10.1: Drilling summary by resource area

Resource Area	Holes used in the Current Resource Estimates	
	Holes	Meters
Nunns	144	9,808
Coronation North	494	60,941
Coronation	379	37.945
Deepdell	450	42,108
Golden Point Underground	506	109,969
Round Hill	1,177	100,656
Innes Mills	868	111,141
Frasers West	1,607	190,190
Frasers – Gay Tan	451	24,741
Frasers Underground	836	223,820
Ounce	54	6,530
Golden Bar	277	39,047
Taylors	82	3,479
Stoneburn	223	11,747
Total	**7,575**	**972,122**

Note: 1 Round Hill totals excludes holes also used for Golden Point UG to avoid double counting.
2 For FRUG 1,672 grade control diamond holes (44,312m) and 89 channel cuts (768m) were also used. These are not included in the totals in Table 10.1. Holes in mined out Frasers pit and Gay Tan also not counted.
3 Frasers West holes excludes holes also used in FRUG and Innes Mills to avoid double counting.

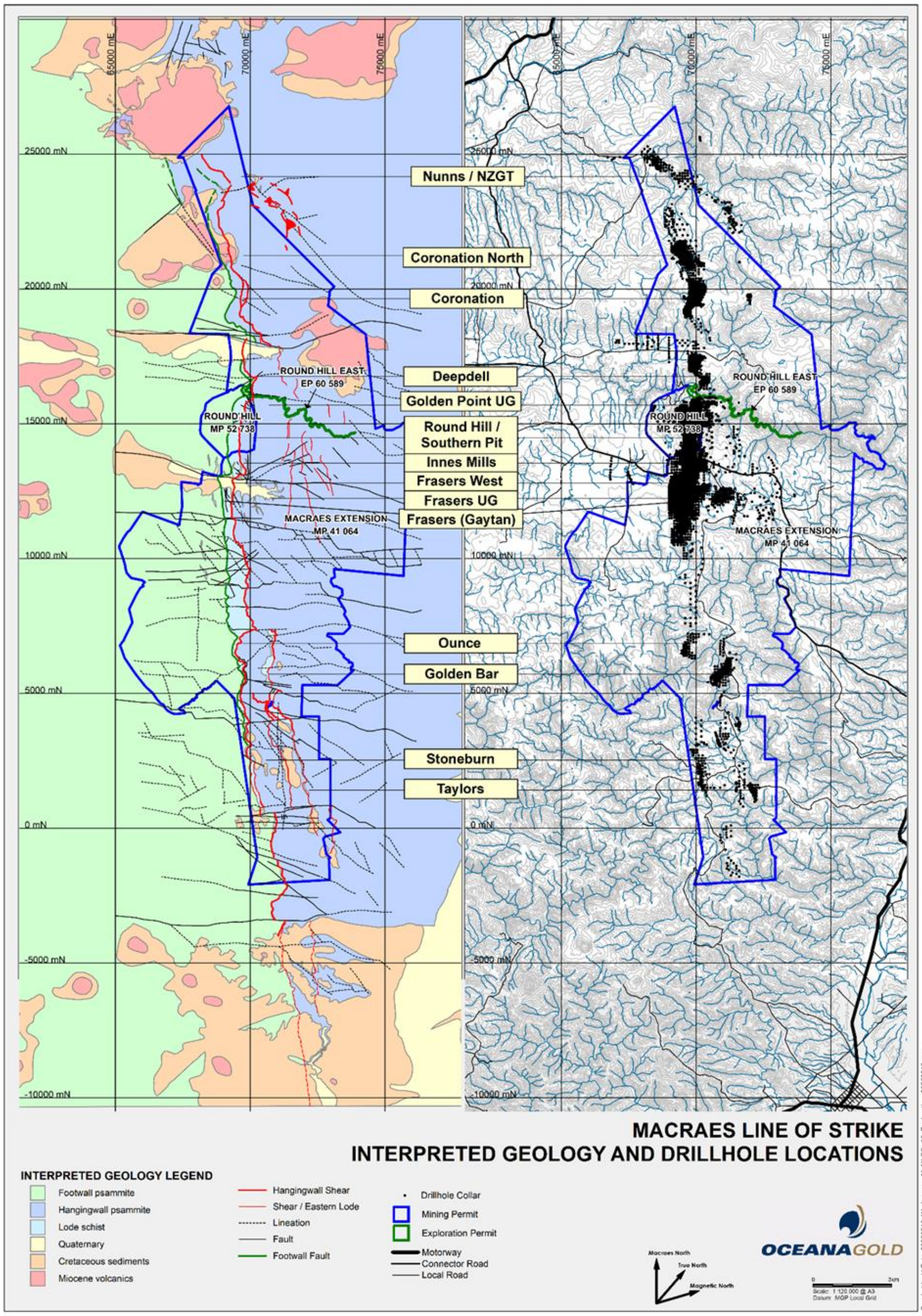

Figure 10-1: Macraes drill hole locations

10.2 Historical Drilling

Limited information is available regarding the specific details of drilling prior to 1990. Drilling was principally completed on the near surface parts of Golden Point, Round Hill, Southern Pit, Innes Mills and Frasers (Figure 10-2). All resources associated with this drilling have been mined.

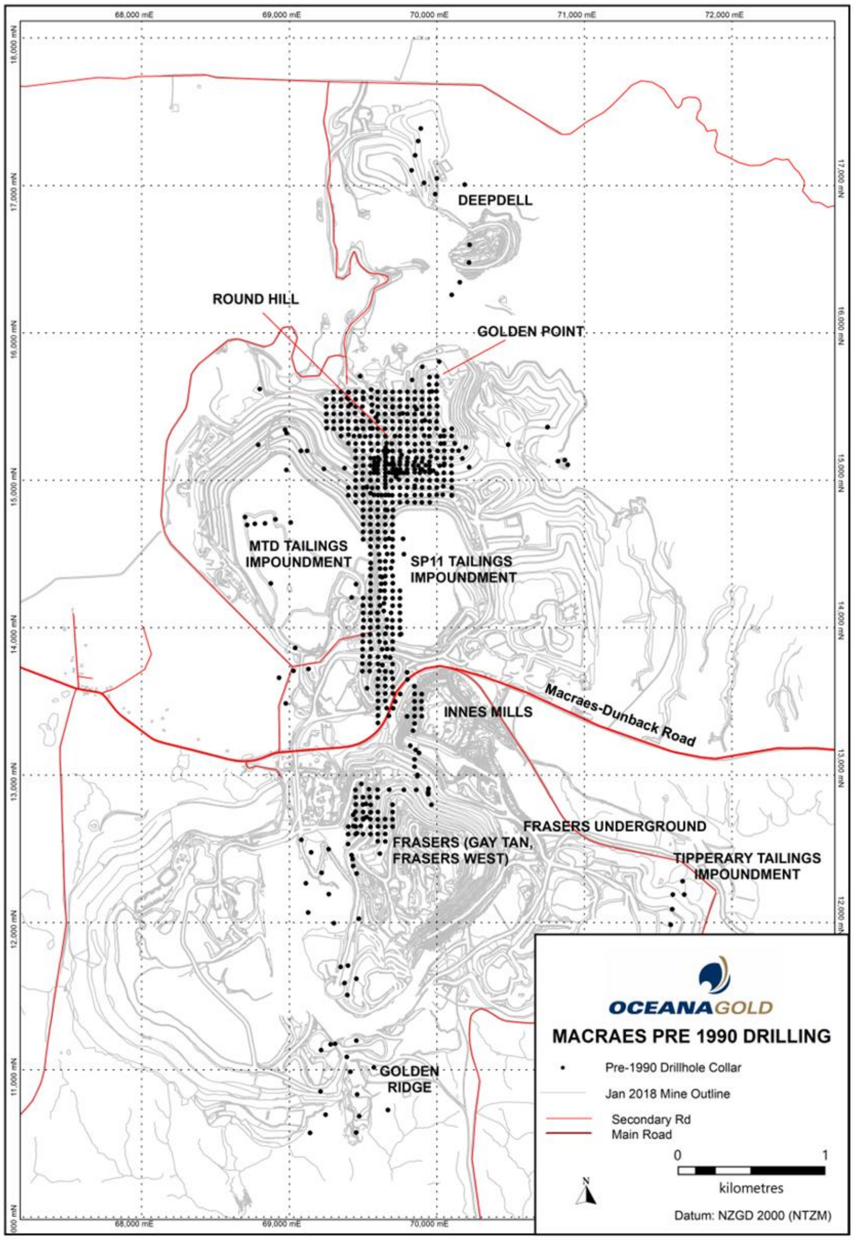

Figure 10-2: Drill hole locations prior to 1990

10.3 OceanaGold Drilling

Details of the drilling completed by OceanaGold post 1990 is shown in Table 10.2. Where known, the details of the drilling method, contractors used to drill holes and the type of drill rigs has been supplied. Historical drilling (pre-1990) completed by Homestake and BHP minerals has been included where available.

Table 10.2: Macraes drilling summary

Year	Hole Type	No. Holes	No. Metres	Contractor	Drill Rig	Prospects
1984	DD	15	2,163	Unknown	Unknown	Round Hill
1985	DD	52	6,687	Unknown	Unknown	Round Hill, Fergussons, Golden point, Deepdell, Frasers, Maritana, Ounce
	RAB	63	3,343	Unknown	Unknown	Round Hill, Fergussons, Deepdell, Innes Mills
1986	DD	9	1,192	Unknown	Unknown	Round Hill, Maritana, Frasers
	RC	36	2,610	Unknown	Unknown	Round Hill, Golden Ridge, Frasers, Innes Mills
	RAB	2	152	Unknown	Unknown	Tatea
1987	DD	5	240	Unknown	Unknown	Round Hill
	RC/DD	7	1,023	Unknown	Unknown	Round Hill
	RC	272	19,263	Unknown	Unknown	Round Hill, Golden Bar, Ounce, Macraes North, Frasers, Southern Pit, Golden Point
1988	DD	3	870	Unknown	Unknown	Round Hill
	RC/DD	22	3,201	Unknown	Unknown	Round Hill, Golden Point
	RC	167	13,469	Unknown	Unknown	Round Hill, Frasers, Southern Pit, Golden point, Innes Mills
	RAB	119	1,643	Unknown	Unknown	Stoneburn, Round Hill, Innes Mills
1989	DD	6	205	Unknown	Unknown	Round Hill
1990-1991	DD	11	225	Unknown	Unknown	Southern Pit, Innes Mills, Frasers
	Met	4	52	Unknown	Unknown	Round Hill
	RC	378	19,884	Unknown	Unknown	Round Hill, Southern Pit, Innes Mills, Frasers
	Open hole	4	64	Unknown	Unknown	Innes Mills, Frasers, Golden Ridge
1992	RC	247	28,499	Unknown	Unknown	Round Hill, Southern Pit, Golden Point, Deepdell, Macraes North
	Open hole	69	1,625	Unknown	Unknown	Coronation, Macraes North
1993	DD	2	412	Unknown	Unknown	Round Hill
	RC/DD	1	436	Hoods	T685W	Frasers
	RC	40	7,152	Hoods	Unknown	Round Hill, Frasers
	Open hole	1	24	Hoods	Unknown	Golden Ridge

Year	Hole Type	No. Holes	No. Metres	Contractor	Drill Rig	Prospects
1994-1997	DD	56	6,634	Hoods	Unknown	Deepdell, Innes Mills, Frasers, Ounce, Golden Bar
	RC/DD	185	47,273	Ausdrill	Schramm25M, T685W, IR-T4, UDR650, UDR1000, HYDRILL	Various
	RC	2,225	329,603	Ausdrill	Schramm25M, T685W, IR-T4, UDR1000	Various
	RAB	18	589	Unknown	Unknown	Macraes North
1988-1999	DD	6	370	Ausdrill	Unknown	Southern Pit
	RC/DD	21	3,720	Ausdrill	T685W	Innes Mills, Frasers
	RC	542	42,163	Ausdrill	T685W	Various
2000-2001	DD	1	49	Ausdrill	Unknown	Round Hill
	RC/DD	53	12,377	Ausdrill	T685W	Innes Mills, Frasers
	RC/DD	7	2,747	Ausdrill	T685W	Frasers
	RC	69	6,663	Ausdrill	T685W	Deepdell, Golden Point, Innes Mills, Golden Ridge, Macraes North
	RC	3	200	McNeill Drilling	UDR650	Southern Pit
	RC	82	7,460	Ausdrill	T685W, UDR650	Round Hill, Innes mills, Frasers, SP18, SP22, Coronation, Deepdell
2002-2003	RC/DD	7	805	Major Pontil	T685W	Golden Bar
	RC/DD	29	11,583	Major Pontil	T685W, UDR650, Schramm25M	Frasers
	RC	160	8,808	Major Pontil	T685W	Golden Ridge, Golden Bar, Frasers
	RC	178	10,524	Major Pontil	Schramm25M	Stoneburn, Eastern Lodes, Macraes North, Golden Ridge
2004	RC/DD	116	52,890	Boart Longyear	UDR650, UDR1000, CS1000	Frasers
	RC	23	1,592	Washingtons	SchrammT660H	Deepdell, Frasers
2005	DD	21	5,629	Boart Longyear	UDR650, LF90, UDR1000	Round Hill, Golden Point, Frasers
	RC/DD	61	24,757	Boart Longyear, Washingtons	LF90, UDR650, UDR1000, CS1000, FOREMOST	Innes Mills, Frasers
	RC	18	930	Washingtons	CP650	Southern Pit
2006	DD	2	402	Boart Longyear	UDR650	Frasers
	RC	45	1,787	Washingtons	SchrammT660H	Golden Ridge, Frasers
2007	RC/DD	19	9,197	Boart Longyear	LF90, UDR650	Golden Point, FRUG Panel 2
2008	RC/DD	26	11,718	Boart Longyear	Lf90, UDR650	Frasers, Golden Point, Round Hill, Trig 569, Coronation

Year	Hole Type	No. Holes	No. Metres	Contractor	Drill Rig	Prospects
	RC	44	3,785	Boart Longyear	UDR650	Golden Ridge, Coronation
	AC	30	1,296	McNeill Drilling	Edson	Tailings dams: MTD & SP11
	UGDD	10	601	Boart Longyear	LM45	FRUG: Panel 2 Deeps
2009	RC/DD	21	7,510	Washingtons, Boart Longyear	SchrammT660H, UDR650, LF70	Round Hill, Back Road
	AC	47	1,342	McNeill Drilling	Edson	Tailings Dam (MTD) & Horse Flat
	UGDD	21	3,071	Boart Longyear	LM45, LM75	FRUG: Panel 2 Deeps, Panels E&F, Panel 2 infill
2010	DD	8	303	McNeill Drilling	UDR650	Tipperary Dam
	RC/DD	14	6,334	Boart Longyear, Washingtons	LF90, Fly rig 1200, UDR650, SchrammT660H	Innes Mills, Round Hill, FRUG extensions
	RCH	191	22,560	Boart Longyear, Washingtons, McNeill Drilling	UDR650, SchrammT660H	Frasers, Stoneburn, Ounce, Coronation, Golden Bar, Macraes North, Innes Mills, Round Hill
	UGDD	55	10,498	Boart Longyear	LM45, LM75, Kempe	FRUG: Panel 2 infill & extensions
2011	RC/DD	8	4,653	Boart Longyear	UDR650	FRUG extensions, Innes Mills
	RCH	119	10,297	Washingtons	SchrammT660H	Ounce, Frasers, Longdale, Golden Bar
	UGDD	68	10,948	Boart Longyear	LM45, LM75, Kempe, Bobcat	FRUG: Panel 2 infill & extensions
2012	DD	1	1,074	Boart Longyear	KWL1600	FRUG extensions
	RC/DD	7	1,823	Boart Longyear, Washingtons	UDR650, SchrammT60H	Frasers, Coronation Round Hill, Innes Mills
	RCH	62	12,135	Washingtons	SchrammT660H	Frasers, Coronation
	UGDD	75	16,835	Boart Longyear	LM75, LM45, Bobcat	FRUG: Panel 2 infill & extensions
2013	DD	7	1,073	Boart Longyear	UDR650	Coronation, FRIM
	RC/DD	11	1,596	Boart Longyear	UDR650	Deepdell
	RCH	76	5,712	Washingtons	SchrammT660H	Deepdell, Coronation
	UGDD	16	1,891	Boart Longyear	LM45	FRUG: Panel 2 extensions
2014	RC/DD	18	3,368	Boart Longyear, Washingtons	SchrammT660H, UDR650	Coronation, Round Hill
	RCH	46	3,748	Boart Longyear, Washingtons	SchrammT660H, UDR650	Coronation, Innes Mills
	UGDD	16	1,769	Boart Longyear	LM45, MDR150	FRUG: Panel 2 extension
2015	DD	11	1,591	Boart Longyear, Washingtons,	LF90, Hydrill1000,	Coronation North, Round Hill, Southern Pit, FRUG extensions

Year	Hole Type	No. Holes	No. Metres	Contractor	Drill Rig	Prospects
				McNeill Drilling	HD900 Eltin, UDR650	
	RC/DD	34	6,451	Boart Longyear, Washingtons	LF90, Hydrill1000, SchrammT660H	Coronation North, Coronation, FRUG extensions
	RCH	299	31,946	Washingtons, OceanaGold	SchrammT660H, CP650, Montabert	Coronation North, Coronation, Longdale, Frasers West
	SON	6	476	McNeill Drilling	Fraste Sonic	Tailings dam (MTD)
	UGDD	41	7,917	Boart Longyear	LM45, LM75	FRUG: Panel 1 and Panel 2 extensions
2016	DD	6	923	Boart Longyear, Washingtons	LF90, Hydrill1000, HD900 Eltin	Coronation North
	RC/DD	48	8,370	Boart Longyear, Washingtons, Altons Drilling	LF90, Hydrill 1000, HD900 Eltin, SchrammT660H, ALD1150	Coronation North, Coronation, Golden Point
	RCH	181	17,549	Washingtons	SchrammT660H, KWL700, L8	Golden Point, Coronation, Coronation North, Mareburn, Mt Highlay, Golden Point
	RCL	13	640	OceanaGold	L8	Trimbells Gully, Coronation North
	UGDD	34	5,887	Boart Longyear	LM45, LM90	FRUG: Panel 2 extensions, 3Black and 3A veins
2017	DD	25	4,907	Boart Longyear, Altons Drilling	LF90, ALD1150	Coronation North, Golden Point, Nunns
	RC/DD	23	6,130	Altons Drilling, Washingtons	ALD1150, SchrammT660H	Coronation North, Golden Point, Innes Mills
	RCH	218	21,820	Washingtons	SchrammT660H, KWL700	Golden Point, Coronation, Frasers West, Eastern Lodes, Coronation North, Deepdell, Innes Mills
	UGDD	11	1,753	Altons Drilling, Boart Longyear	LM45, LM90	FRUG: Panel 2 extensions, 3Black veins
2018	DD	25	4,989	Altons Drilling	ALD1150, LF90	Coronation, Coronation North, Deepdell, Golden Point
	RC/DD	31	5,277	Altons, Washingtons	ALD1150, KWL700	Coronation, Coronation North, Golden Point
	RCH	173	17,830	Washingtons	KWL700	Deepdell, Coronation North, Coronation, Golden Point
	UGDD	45	2,683	Altons Drilling	MDR150, LM45	FRUG: Panel 2 extensions, 3Black & 4Z veins
2019	DD	68	17,144	Altons Drilling	ALD1150, LF90, HD900	Golden Point, Coronation North
	RCH	360	21,649	Washingtons	SchrammT660H, KWL700	Frasers
	UGDD	96	3,598	Altons Drilling	MDR150, LM45	Panel 2 extensions
H1, 2020	DD	43	12,827.3	Altons Drilling	ALD1150, LF90, HD900	Golden Point, Round Hill

Year	Hole Type	No. Holes	No. Metres	Contractor	Drill Rig	Prospects
	RCD	6	1,380.2	Altons Drilling, Washingtons	ALD1150, KWL700	Deepdell
	RCH	43	2,851	Washingtons	KWL700	Frasers

10.4 Surveys

All drill hole collars were surveyed using the Macraes local grid to ± 10mm accuracy in easting, northing and elevation.

Prior to March 1994, down-hole deviation surveys were not completed on any of the RC percussion or percussion drill holes. For holes drilled since March 1994, down-hole deviation surveys have been attempted on all RC percussion holes that exceeded 50m in depth, using an Eastman single shot or multi- shot camera. Holes are generally surveyed at 50m intervals to the end of the hole.

Surface diamond holes are routinely surveyed every 25m to 50m. Current survey equipment is typically an electronic single shot or multi-shot camera. Survey information is routinely recorded in an *acQuire* geological database.

Underground diamond holes are routinely surveyed at 10m then at every 15m to the end of hole.

Air-core holes do not have down-hole surveys.

10.4.1 Magnetic to Macraes Grid Conversion

For downhole surveys magnetic azimuths are recorded then converted to Macraes mine grid azimuths by adding a correction. Up until the end of 2011 this correction was assumed to be 67 degrees (that is 67 degrees is added to the magnetic reading to give the Macraes grid azimuth).

However, in September 2011 a check using a 105m long underground probe hole along a development drive in the Frasers Underground found that this correction should have been 69.5 degrees relative to the Macraes grid. This is due to the location of the magnetic North Pole drifting east by around 4.5 minutes per year at this location in NZ. It is uncertain when the original Macraes grid was set up but if it was based on a topographical map from the early 1980s this would explain the difference.

As a result of this study, the earlier drill hole azimuths were adjusted in the Acquire database at the end of 2011 as shown in Table 10.3.

Table 10.3: Magnetic to Macraes grid azimuth corrections

Drill hole Date Range	Correction Factor	Records Affected
1/1/2005 to 2011	70.5	4,127
1/1/1995-31/12/2004	70	13,408
1/1/1985-31/12/1994	69.5	3,667
Pre 1985	69	36

Drill hole surveys from 2011 to 2015 had a correction factor of 70.5 degrees applied.

Drill hole surveys from 2016 onwards have a correction factor of 71 degrees applied.

The next adjustment will be in 2026 from which a correction factor of 71.5 degrees will apply.

10.5 Logging Procedures

RC percussion and most air core program drill holes are geologically logged at one-metre intervals, with each metre being classified into one of twenty summary rock codes listed in Table 10.4. Rock code classification is based on a combination of textural and mineralogical properties.

Diamond drill core is photographed and then geologically logged using the same twenty summary rock codes and additional detailed pre, post and syn-mineralisation structure and mineralogy are recorded. The summary rock codes are plotted on cross sections and are used in combination with the assays to develop a geological interpretation which include 3 mineralised elements.

These elements are the Hangingwall Shear, concordant lodes and stockwork. The Hangingwall and concordant lodes consist of a combination of Cataclasite, Quartz Cataclasite, Silicified Breccia and Lode Schist. In general, the Hangingwall has greater proportion of cataclasite lithologies logged than the concordant lodes, which typically consist of more Lode Schist lithologies. The stockwork mineralisation is identified on cross sections by a combination of Stockwork and Quartz vein lithologies.

Drill hole information is stored in an *acQuire* database. For holes prior to 1994 only collar, interval and assay information has been entered into the database, while for all holes from 1994 onward the database contains all logged information.

Aircore drilling holes on the tailing's dams are geologically logged using two codes only: 'C' records the schist boulders and gravel used to build mattresses, causeways and embankment lifts; 'T' is used to record tailings material of fine-medium grained sand. The distinction is easily recognized by field technicians and the contacts are typically defined to within a decimetre by the drilling crew. The colour the tailings material is usually a monotonous grey although thin (<2m) horizons of yellow-brown oxidation staining are noted and can be correlated between holes.

Table 10.4: Summary of rock code descriptions

Name	Code	Description
Cataclasite	ca	Quartz poor (<15%) dark grey/black fine grained cataclasite
Quartz cataclasite	qca	Quartz rich (15-50%) dark grey/black fie grained cataclasite
Silicified breccia	sb	>50% brecciated quartz. Generally associated with cataclasite
Quartz vein	qv	>50% banded or milky quartz veins with no associated brecciation or cataclasis
Lode schist	ls	Weakly sheared schist with minor cataclasite/brecciated quartz
Stockwork	swpe or swpa	From trace to 50% banded or milky quartz veins with no associated brecciation or cataclasis and hosted by either pelitic (swpe) or psammitic (swpa) schist
Pelite	pe	Massive to laminated medium to dark grey mica-quartz-chlorite schist
Semi-pelite	spe	Inter-layered pelite and psammite, more than 50% pelitic layers > 1 cm thick
Semi-psammite	spa	Inter-layered psammite and pelite, more than 50% psammitic layers > 1 cm thick
Psammite	pa	Massive to light grey-green quartz-feldspar-mica-chlorite schist, 90% psammitic
Footwall psammite	fwpa	Light greenish-grey, often finely laminated quartz-feldspar-chlorite+/- biotite +/- garnet psammite, grain size typically 0.1-0.3mm. Found beneath the Footwall Fault
Greenschist	gs	Light green/brown massive quartz-mica schist
Basalt	Ba	Massive, grey fine-grained volcanic rock of Miocene age
Basalt breccia	bab	As for basalt but brecciated
Lapilli tuff	tuff	Basaltic fragments 2-64mm in diameter in fine matrix. Product of ashfall from basaltic eruptions.
Clay	cly	Clay of variable colour and origin. May form through weathering or deposition
Sandstone	ss	Sandstone of variable origin and colour. May form through weathering or deposition
Alluvial	alv	Transported cover
Fault	flt	Light to medium grey gouge or pug, may be associated with mineralisation

10.6 Drilling Orientation

Drill holes at Macraes have typically been collared vertically, although most diamond drill holes targeting potential underground resources are started with an inclination of ca. -75º oriented towards the northwest. Down-hole survey information indicates that within a shallow depth (~100m) the holes can significantly deviate, generally veering perpendicular to the schist foliation and to the HMSZ orientation. Exceptions to this trend may occur where the foliation orientation has been disrupted, or where the schists are cut by later fault zones.

Underground drill holes are restricted to whatever mine development is available at the time and are collared in a variety of orientations and inclinations, including up-hole directions.

10.7 Sampling Methods and Approach

10.7.1 Introduction

The diamond drilling sampling approach has remained relatively constant over the life of the project while the sampling of the percussion drilling has changed dependent on the drilling method. A discussion of the sampling methods applied is provided below.

Drilling has typically been conducted on a regularly spaced grid. Measured deviation of drill holes indicates that holes quickly trend sub-perpendicular to the host schist foliation direction and consequently drilling intersections from surface drilling typically represent the true width of the mineralized shear zone. Underground drill holes are drilled in a wide range of inclinations and directions and true widths need to be assessed on an individual basis.

10.7.2 RC Percussion Sampling

The percussion drilling methods have varied substantially over the life of the project. Early drilling was open hole percussion where the drill cuttings are returned outside the drill rod and captured in a stuffing box on the drill collar prior to being sampled via a cyclone. This drilling method is historically of a lesser quality than face sampling RC due to down-hole sample contamination and loss of sample.

After the open hole percussion programmes, RC percussion drilling was completed using a crossover sampling sub. This method of RC percussion drilling collects the drill cuttings via a sampling tool (the crossover sub) which was positioned in the drill string above the RC hammer. The sample quality of this form of RC percussion drilling is superior to that of the open hole percussion, however down-hole contamination is still more prevalent than samples collected with a face sampling RC hammer.

Programmes of RC percussion drilling since 1990 were completed with a face sampling RC hammer. This technology is considered to provide the most representative sample.

Sampling of the RC percussion drilling has been completed by trained OceanaGold employees and is supervised by OceanaGold technical staff. Definition of sampling intervals for RC percussion drilling has generally been based on 1m intervals, over the full depth of the drill hole.

Sampling of RC percussion drill holes up until 2009 was completed using the methods detailed below.

- RC cuttings from the drill hole are blown into a trailer-mounted or rig-mounted cyclone, then pass through a tiered riffle splitter. At the completion of each metre, the overall sample is split into a smaller analytical “A” split and larger “B” split. Both samples are collected in uniquely numbered polythene bags;
- Where the drilling sample is mineralised, the full A split is sent for analysis. Where geology is less well constrained, all A split samples are analysed. The B split is taken to a storage area, to be kept for any further possible test work that may be required;
- Where the drilling sample is collected from rocks considered to be unmineralised (i.e. schist sequence overlying the HMSZ) then composite samples may be collected. In this case, either four or six sub-samples are collected from the B samples, transferred to a new bag, and submitted for analysis. Anomalous assay results from composite samples are verified by analysis of the original A splits.

- Sample tickets were used in the sampling process with one half (identical halves) of each ticket placed in the sample bag; and
- Once the entire metre had been sampled and placed in the polythene bag, along with the sample ticket, the bag was closed and sealed. Certified standards and blanks were also regularly inserted into the sample sequence as part of the quality control protocols. Samples were transported directly to the on-site laboratory for preparation and subsequent analyses, along with a dispatch sheet. Bags were transported by OceanaGold personnel.

From 2010 onwards the following changes have been made to the sampling protocol:

- The A split is collected in calico bags rather than polyethylene bags and the B split is left on site at the drill site. If not required, the B split bags are then emptied or buried on completion of the programme; and
- composite sampling was largely abandoned.

Further changes were made in 2017 with the replacement of the SchrammT660H drill rigs by the KWL700 drill rig:

- The B split is collected as a duplicate sample in a similar sized calico bag to the A split. Both samples are weighed. The B split samples are taken back to the core shed and stored in larger plastic bags in case later required for duplicate sampling; and
- where possible the remainder of each metre is captured in a large plastic bag and weighed before being discarded. This is to enable sample recoveries to be more accurately determined (previously visually estimated).

Prior to 1998, samples were collected from wet percussion drilling. The wet RC percussion drilling is further discussed later in the text and remains a material data quality issue. The sampling of wet RC percussion/percussion drilling is considered fundamentally flawed and has been discontinued since 1998.

The (OceanaGold) RC percussion drilling sampling protocols were assessed by external consultants in 2007 and were considered acceptable and consistent with industry standards.

An internal review was conducted by OceanaGold personnel in 2016 and some changes to the sample collection made which have since been implemented with the arrival of the KWL700 drill rig in 2017.

Historical drilling completed by Homestake and BHP had defined sampling protocols, which included the logging of moisture content and some twin drilling. Where holes were not wet, a good correlation was observed. These historical drilling practices are acceptable to OceanaGold. All resources associated with this drilling have been mined out.

10.7.3 Diamond Core Sampling

After drill core has been geologically logged and photographed, the sections of core considered to be mineralized, or proximal to mineralized zones are cut in half using a core saw. The drill core was sampled in intervals from 0.3 up to 1.3 metres by trained and supervised technicians and geologists. Each interval was sampled by taking the same half of each piece of core for that metre (i.e. leaving the half with the orientation line and / or metre marks in the tray) and placing them into the appropriate sample bag.

Definition of sampling intervals for diamond drilling are based on geological intervals or 1m intervals, within and beyond the margins of mineralised zones identified during logging. Higher grade intervals within a lower grade intersection are characterised by more abundant sulphide mineralisation and generally can be detected visually during core logging. The 1m sampling interval established by OceanaGold is sufficient to define these higher-grade intervals and sampling intervals can go as low as 0.3m to honour geological boundaries.

Sample tickets were also used in the sampling process with one half (identical halves) of each ticket placed in the sample bag.

Once the entire metre had been sampled and placed in the polythene bag (calico bags since 2010), along with the sample ticket, the bag was closed and sealed. Certified standards and blanks were also regularly inserted into the sample sequence as part of the quality control protocols. Samples were transported directly to the on-site laboratory for preparation and subsequent analyses, along with a dispatch sheet. Bags were transported by OceanaGold personnel.

The diamond drilling and sampling is consistent with industry standard practice.

10.7.4 Aircore Sampling

An Edson aircore rig was used in September 2008 and January 2009 to sample the tailings dams (both the Mixed Tails and SP11) as part of a project to assess the contained scheelite and gold resource. This technique is a fast and convenient method to sample the tailings although excessive torque on the rod string limited final depths to ~90m.

Water injection is used during drilling to maintain recovery of the unconsolidated tailings and consequently the samples are saturated. Therefore, a sample from each 1m interval down-hole is contained in a pre- numbered calico bag, fastened directly beneath the cyclone. The bag is securely tied with as much water and suspended fines contained as possible. Inevitably, some water along with suspended fine material is lost through spillage and overflow.

The calico bags are left on the ground in the field to de-water for a day, and then are transported directly to the on-site laboratory for preparation and subsequent analyses, along with a dispatch sheet. Bags were transported by OceanaGold personnel. Certified standards (both gold and tungsten) and blanks are regularly inserted into the sample sequence as part of the quality control protocols.

10.7.5 Sonic Core Sampling

In 2015 six core holes (475.9m) were drilled into the Mixed Tails Storage facility using the Sonic drilling method to provide samples for geotechnical testwork as part of the Macraes Gold-Tungsten project. The Sonic method is a way to maximise core recovery in soft sediment and relies on vibration and pressure to advance the drill string rather than cutting by rotation.

Once the geotechnical testwork was completed the core was sampled in 0.5m lengths and analysed for gold and tungsten. The core was split in half with a spatula with the half core bagged in calico bags for dispatch to the laboratory.

10.8 Sample Quality

10.8.1 Summary

The sample quality for diamond drilling is high. Sample quality for RC percussion drilling is lower than for diamond drilling but generally sufficient to define the position and grade of mineralisation. Where RC sample quality issues have caused a grade bias, this bias has been addressed (section 10.8.3).

10.8.2 Sample Recovery

Sample recovery from RC percussion drilling and diamond drill core is routinely recorded in geological logs and recovery data is stored in an acQuire database. Recovery is generally high and there is no observed correlation between recovery and grade. From 2018, where possible, each metre of RC sample drilled has been weighted to give a better estimate of sample recovery.

10.8.3 RC Wet Sample Bias

The potential for wet sampling bias for RC percussion drilling was first identified at Frasers in June 1997; some reverse circulation (RC) drill holes were sampled under wet drilling conditions leading to the potential for sampling bias and contamination. Since that time, biases have also been identified at Golden Bar, Innes Mills and Round Hill.

Much of the legacy risk associated with wet RC sampling has been mitigated by subsequent replacement of wet RC drill holes by diamond twins. Where however, wet RC drill holes have not been replaced, RC sample grades have been factored, based on relationships between twinned RC versus diamond core sample grades.

This approach, which has been applied by OceanaGold for a number of pits, the relatively low proportions of remaining wet RC samples, and acceptable annual resource estimate to mine to mine reconciliations for areas mined with wet RC samples, mean that the residual risk to the resource estimates is considered to be low.

10.9 Definition of Sample Intervals

Definition of sampling intervals for RC percussion drilling has generally been based on 1m intervals through mineralized zones, or more recently, over the full depth of the drill hole.

Definition of sampling intervals for diamond drilling are based on geological intervals or 1m intervals, within and beyond the margins of mineralized zones identified during logging. Sample intervals can range from 0.3m up to a maximum of 1.3m.

Higher grade intervals within a lower grade intersection are 82characterised by more abundant sulphide mineralisation and generally can be detected visually during core logging. The 1m sampling interval established by OceanaGold is enough to define these higher-grade intervals.

Sampling intervals in air-core holes on the tailing’s dams include all intersections of tailings material. If the hole is collared in on the embankment, then sampling is not started until the first tailings material is recovered (typically ca. 7m depth).

Drilling has typically been conducted on a regularly spaced grid. Measured deviation of drill holes indicates that holes quickly trend sub-perpendicular to the host schist foliation direction and consequently drilling intersections typically represent the true width of the mineralized shear zone.

10.10 Summary of Mineralised Widths

Most mineralized intersections have been accounted for in the resource estimates for the Macraes Project (see Section 14).

11 Sample Preparation, Analysis and Security

11.1 Sample Preparation Statement

Half cut core samples (diamond drill core) and drill cuttings (RC percussion drilling) samples from the OceanaGold drilling programmes at Macraes were collected from the source drill samples by employees of OceanaGold.

Subsequent sample preparation and assay was not conducted by any employee, officer, director or associate of OceanaGold except for tungsten analyses of pulps using a portable XRF analyser as discussed in Section 11.3.

11.2 Sample Preparation, Assay and Analytical Procedures

11.2.1 Graysons/AMDEL Limited

From 1990 to 1998, RC percussion drill chips and diamond drill core samples from the OceanaGold drilling programmes at Macraes have typically undergone sample preparation and assay for Au, As and S by Graysons Laboratories, initially at Palmerston and then at Macraes. Graysons was bought by AMDEL Limited (AMDEL) in 1998 and who then ran the laboratory until 2009.

Sample preparation of geological samples by AMDEL routinely includes drying, crushing (to 4mm), splitting (if required) to a maximum of 1kg and 83pulverising to obtain an analytical sample of 250g with >95% passing 75µm.

Table 11.1: Graysons/AMDEL Assay Techniques

Element	Sub – Sample Size (g)	Digest	Analysis	Detection Limit (ppm)
Gold Arsenic Sulphur	50	Aqua Regia Perchloric/Mixed Acid N/A	Fire/AAS Leco	0.01
	0.2 – 1			10
Tungsten (WO_3)	0.25 – 0.5	Sodium perchloride	ICP-OES	100
	0.2			0.001%

WO_3 Analysis undertaken by OceanaGold for the air-core drilling between September 2008 and January 2009 (see Section 11.4) had been performed by AMDEL in Auckland, New Zealand. Sample preparation was undertaken on site and pulps sent to the Auckland Laboratory for analysis. The analytical method for tungsten (reported as WO_3) is preparation of a fusion bead from a 0.2g sample followed by ICP-OES.

11.2.2 SGS New Zealand Limited

From June 2009 until the end of 2012 most exploration samples have been prepared and analysed off site, with the remainder (mainly Frasers in-pit infill drilling) prepared and analysed at the on-site AMDEL laboratory. Samples were prepared at the SGS New Zealand Limited (SGS) Laboratory at Ngakawau, Westport, and analysed there for arsenic, tungsten (by pressed pellet XRF) and 83sulphur (Leco). Pulp splits were sent on to the SGS New Zealand Waihi Laboratory for gold analysis by Fire Assay.

Samples were dried, coarse crushed to a nominal -6mm, riffle split and then 84pulverised in Cr steel grinding mills to -75 microns.

One 50g pulp split was then sent to SGS Waihi for gold analysis by fire assay. A second 50g sample was retained at Westport and used to make pressed powder pellets for x-ray fluorescence spectrometry (XRF) analyses for arsenic and tungsten. Pulp from core samples were also analysed at Westport for total 84sulphur by furnace/ IR.

Table 11.2: SGS (NZ) Limited Assay Techniques 2009-2012

Element	Method	Sub-sample size (g)	Digest	Analysis	Detection Limit (ppm or %)
Gold	FAA515	50	Aqua regia	Fire/AAS	0.02
Arsenic	XRF75W	20	N/A	XRF	2
Sulphur (total)	CSA06V	0.5	N/A	Leco/IR	0.03%
Tungsten	XRF75W	20	N/A	XRF	10

11.2.3 ALS Minerals Laboratory, Australia

During 2009, three diamond drill holes were sent to ALS Laboratory Group Minerals Laboratory, Brisbane, Australia for sample preparation and analyses for gold (Fire Assay), sulphur (Leco) and arsenic and tungsten (pressed pellet XRF). Samples returning relatively high grades of tungsten (>1000ppm) or arsenic (>5000ppm) were re-analysed by fused bead XRF.

Drill core samples were first crushed to a nominal 70% passing -6mm, then riffle split to a maximum weight of 3 kgs and pulverised to 85% passing 75 microns. A 50g sub-sample was analysed for gold by fire assay. 20g samples were taken for pressed powder XRF for tungsten and arsenic.

Table 11.3: ALS Minerals Laboratory Assay Techniques 2009-2012

Element	Method	Sub-sample size (g)	Digest	Analysis	Detection Limit (ppm or %)
Gold	Au-AA26	50	Aqua regia	Fire/AAS	0.02
Arsenic	MEXRF05	20	N/A	XRF	5
Arsenic	ME-XRF15b	20	Acid	XRF	0.01%
Sulphur (total)	S-IR08	1	N/A	Leco/IR	0.01%
Tungsten	MEXRF05	20	N/A	XRF	10
Tungsten	ME-XRF15b	20	Acid	XRF	0.001%

11.2.4 SGS NZ Limited 2011 Onwards

SGS New Zealand Limited took over the Macraes on-site laboratory from AMDEL in June 2011 and from 2013 onwards all the exploration samples have been processed at this laboratory. Gold is usually the only element analysed for but at times sulphur, arsenic, carbon and tungsten are required. Samples requiring arsenic or tungsten analyses are sent to SGS Westport for pressed powder XRF after being prepared at Macraes. Any samples greater than 1000 ppm tungsten are re-analysed using the fused bead method.

The sample preparation process for diamond and RC samples process is as follows.

- Samples were dried at 105 degrees, coarse crushed to a nominal –6mm, rotary split and then pulverized with a Cr steel grinding head to 95 % passing – 75µm. The sample is then mat rolled and sub-sampled to 250g. From this 250g a 50g pulp is taken for fire assay and analysed for gold using the atomic absorption method. From mid-2019 this was changed to a 30g pulp to be consistent with grade control drill samples; and
- Diamond core is treated as for the RC chips after being jaw crushed first to produce a course 2mm crush.

Table 11.4: SGS (NZ) Limited Assay Techniques 2013 onwards

Element	Method	Sub-sample size	Digest	Analysis	Detection Limit (ppm)
Gold	FAA505	50	Aqua regia	Fire/AAS	0.01
Gold (from mid-2019)	FAA303	30	Aqua regia	Fire/AAS	0.01
Arsenic	XRF75V	20	N/A	XRF	2
Sulphur (total)	CSA06V	0.2g	N/A	Leco/IR	0.005%
Carbon (organic)	CSA03V	0.25g	acid	Leco/IR	0.1%
Tungsten	XRF74V	20	N/A	XRF	6
Tungsten	XRF78S	20	acid	XRF	80

11.2.5 Historical Analyses

From commencement of the project to when Macraes mining took over in 1988 (i.e. under Homestake and BHP), various laboratories and analytical methods have been used for gold and tungsten analysis. Most of these methods are documented and appear to be the valid methods of the day. Assay methods and detection limits are shown in Table 11.5.

Apart from some drill holes at Round Hill, all the resources associated with areas drilled, sampled and assayed by Homestake and BHP have now been mined out.

Table 11.5: Historical Laboratories and Assay Techniques

Year	Company	Element	Laboratory	Analysis	Detection Limit
Pre 87	Homestake BHP	Gold Tungsten (WO_3) Gold	Analabs (Auckland) Analabs (Perth) Analabs (Auckland) Analabs (Cairns)	FA-AAS XRF CFA	0.001 ppm
		Tungsten (WO_3) Gold		PP XRF CFA	0.002 %
1987	Macraes	Tungsten (WO_3) Gold	Graysons (Auckland or Palmerston)	PP-XRF	
		Tungsten (WO_3)	Southland Co-operative Phosphate Company Ltd Graysons (Macraes) Environment (Sydney)	FA-AAS ICP	
1989					0.01 ppm

11.3 OceanaGold Tungsten Analyses

11.3.1 Introduction

Routine analysis of exploration and resource definition drill sample intervals for tungsten ceased around 1990 though selected sampling of gold mineralised intervals for tungsten continued until 1995 (Robinson, 2008). Regular analysis of exploration drill samples for tungsten only re-started in about 2009 but ceased in 2012. The frequency of tungsten sampling has been variable after that. Hence there are many 10s of thousands of samples that were analysed for gold but never analysed for tungsten.

A programme of tungsten sampling to address this commenced in August 2013 focusing initially on Round Hill/Southern Pit (14,500N to 16,000N) but later extended to include the proposed extension to Frasers pit, Frasers Stage 6 (12300N to 13200N). This phase of work was completed in February 2014.

Tungsten analysis was done by a combination of a portable XRF analyser (pXRF) and commercial laboratory XRF analyses (SGS Westport in this case) with all higher-grade samples send to SGS for fused bead ("fusion") tungsten analysis. Initially this higher-grade threshold was set at 2,000 ppm W for raw pXRF readings and 4,000 ppm W for SGS but was subsequently lowered to 1,000 ppm W for all.

Tungsten sampling by both pXRF analyser and commercial laboratories has continued since then with specific campaigns analysing samples from Innes Mills, Coronation North and Round Hill/Golden Point. Over 50,000 exploration and resource samples have now been analysed for tungsten by pXRF.

The use of pXRF to obtain tungsten analyses for use in resource estimation required an orientation study to be completed and protocols and procedures developed to ensure consistent presentation of each sample to the instrument. Factoring studies were also required to convert the raw pXRF tungsten readings to readings that reflected the true tungsten value, considering the interferences from other elements. These issues were addressed in 2013 prior to the commencement of the analytical programme (Edwards, 2015) and repeated when required subsequently, for example with the purchase of a new analyser in 2018.

The detection limit for tungsten using pXRF is 10ppm W.

11.3.2 QA/QC Studies for the Use of pXRF Analysers for Tungsten Analysis

In 2013 several studies were carried out and procedures implemented to ensure the tungsten results obtained by the pXRF were of a high quality and able to demonstrate compliance under JORC. These include:

- developing sampling procedures/work Instructions for using a pXRF analyser for tungsten analysis;
- orientation studies to examine and quantify issues that could affect the readings obtained by the pXRF analyser;
- audit of the procedures and studies by an external consultant; and
- factoring studies for converting the raw tungsten pXRF readings to “true” tungsten readings.

Additional studies were also undertaken to check several specific issues:

- check analyses of historical samples with W assays already in the database; and
- comparison of SGS pressed powder results versus fusion results.

Sampling Procedures

A sampling procedure was developed with assistance from external consultant Quantitative Group (QG) prior to the orientation study to demonstrate that as many of the variables as practicable have been removed or minimised and to show each sample is presented in as true and consistent a fashion as possible.

In order to standardise the presentation of the sample to the analyser plastic sample cups were used. The sample is placed into the cup and tamped down firmly. This could then be placed on top of the analyser beam in the workstation and analysed as per the Work Instruction.

Tungsten Standards

OceanaGold and SGS have used 3 certified W standards obtained from the Canadian Certified Reference Material Project:

TLG-1	830 ppm W
MP-2	6,500 ppm W
CT-1	10,400 ppm W

These 3 standards were supplied to SGS Westport for use as a standard when carrying out tungsten analyses. 2 internal tungsten standards using Macraes material were also developed and certified by Rocklabs for the higher-grade samples. These standards are run every 20 samples as a check on performance.

Factoring Studies for Using the pXRF Analyser

In order to convert raw pXRF readings to true analysis values a factor needs to be determined for each element to account for interference due to other elements in the matrix and by the sample container. Factors were determined by analysing a standard set of approximately 200 samples which had been previously analysed for tungsten by a certified commercial laboratory. Factors will vary from instrument to instrument and even for different software versions on the same instrument, so it is important that the factoring exercise is repeated with each new instrument and software update.

A summary of the factors applicable to the current analysers is shown in Table 11.6.

Table 11.6: Conversion Factors for Current pXRF Analysers

Container	Analyser	W Factor			As	Factor
		<0.4%W	0.4-1% W	>=1% W	<1% As	>= 1%As
Paper Envelope	511320	1.4	1.4	1	1	1
Sample Cup	511320	1.35	1.29	1	1	1
Paper envelope	804265	1.56	1.52	1	0.89	0.89
Sample cup	804265	1.50	1.40	1	0.89	0.89

11.3.3 Data Checking of Historical Assays

Over 58,000 W by AAS assays (W_AAS field) exist in the Macraes acQuire database. These assays date from the 1980s and 1990s and are mainly from drilling in the now mined out parts of Round Hill, Southern Pit, Innes Mills and Frasers.

A verification programme was undertaken to check the quality and accuracy of these historical results by check sampling as many of the higher-grade W samples as possible. Several errors were found and corrected.

11.4 Sample Security

11.4.1 On-site sample preparation

OceanaGold managed drilling has been sampled and submitted to the on-site AMDEL (SGS from June 2011 onwards) laboratory by trained OceanaGold staff. Once the samples have been submitted to the laboratory, AMDEL/SGS staff process the samples and have completed all aspects of the assaying independent of the OceanaGold personnel.

No measures are in place to ensure the samples' security. However, the substantial reconciliation data supports the veracity of the data.

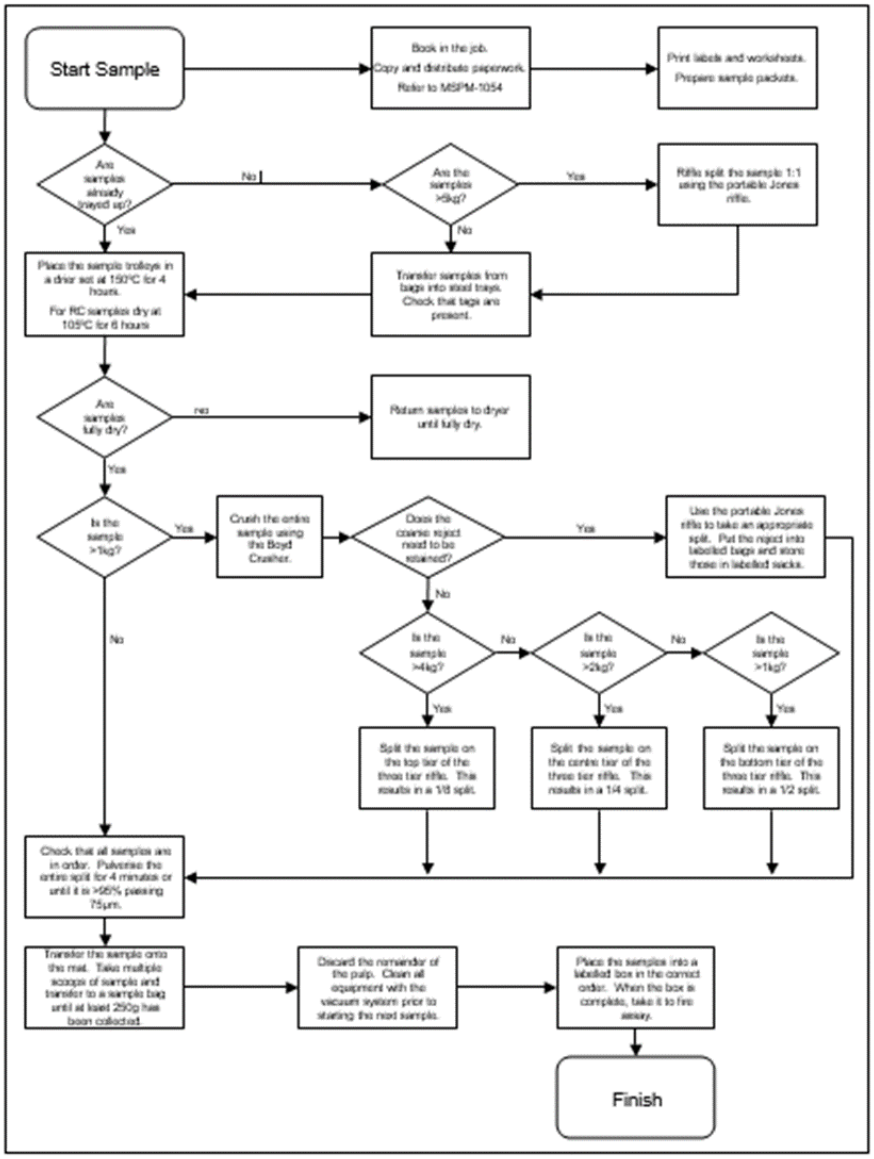

Figure 11-1: Sample Preparation and Assaying Flowsheet

11.4.2 Off-site sample preparation

From June 2009 to end 2012 most exploration samples were sent off-site for sample preparation and analysis.

SGS Westport and Waihi

The samples (RC and half drill core) were dispatched in calico bags to SGS Westport by OceanaGold personnel for sample preparation and arsenic, tungsten and total sulphur analysis. Once the samples have been submitted to the laboratory, SGS staff process the samples and have completed all aspects of the assaying independent of the OceanaGold personnel.

No measures are in place to ensure the samples' security however the substantial reconciliation data supports the veracity of the data.

ALS Minerals Laboratory, Brisbane

The half drill core) were dispatched in calico bags to ALS Minerals Laboratory, Brisbane by OceanaGold personnel for sample preparation and arsenic, tungsten and total sulphur analysis. Once the samples have been submitted to the laboratory, ALS staff process the samples and have completed all aspects of the assaying independent of the OceanaGold personnel.

No measures are in place to ensure the samples' security however the substantial reconciliation data supports the veracity of the data.

11.5 Sample Analysis

The laboratories used are all accredited and have internal quality control procedures to manage the quality of the data reported to the clients.

Analytical methods and detection limits are described in Section 11.2.

11.6 Quality Assurance/Quality Control Procedures

11.6.1 Standards

Gold

Certified standards are routinely inserted at a rate of one in twenty samples (5%). Standards used by OceanaGold are purchased from and certified by Rocklabs up to May 2018 and Geostats Pty Limited from June 2018 onwards and include various grades. Most standards are sulphide standards.

Tungsten

Three certified tungsten standards from the Canadian Certified Reference Material Project were used throughout the project by the commercial laboratories and by OceanaGold. In addition, 2 standards were created and certified by Rocklabs in 2013 using known tungsten bearing material from Macraes. Standards are inserted every 20-30 samples during analysis.

11.6.2 Blanks

Blanks are routinely inserted at a rate of around one in 40 samples. Blanks used by OceanaGold include blanks supplied by Rocklabs, basalt blanks (from Tertiary basalt near Macraes) and Footwall schist samples from under the Footwall fault which assayed <0.01 ppm Au.

11.6.3 Duplicates

Duplicate sampling is now routinely carried out as part of the drilling programmes and are designated field duplicates ("FD") in the datafiles. For RC drilling field duplicates are a second split off the sample interval. For diamond drill core a quarter core sample is taken selected intervals of the remaining half core in the tray after the first pass sampling.

In addition, coarse reject and pulp duplicate sampling and replicate sampling is routinely carried by the laboratory.

11.6.4 Core and Sample Storage

All pulps are returned to OceanaGold and stored in one of three storage sheds at Macraes. However, many of the pulps from the pre-2010 drilling have been lost or destroyed over time.

Exploration drill core is stored in core boxes in either one of 3 storage sheds or outside in a yard on pallets with the boxes strapped. Not all the core is kept and the waste rock intervals above the Hangingwall shear have been discarded in many cases.

11.6.5 Actions

Sample submissions are typically done by hole. When the results are received from the laboratory the standards are checked against the expected values before the data is loaded into the acQuire database. If any standards are found to be more than 3 standard deviations from the expected value, then that run of samples (typically 40 samples) around that standard is re-assayed. If more than 2 standards in a submission are found to be more than 3 standard deviations out the entire submission batch is re-assayed.

Monthly meetings are held with the on-site laboratory to discuss results and address any problems with the data quality, sample quality and sample volume.

11.7 Opinion on Adequacy of Sample Preparation, Analysis and Security

The adoption of the sample preparation and analytical methods, including fire assay for gold, is entirely appropriate. Enough quality control data exists to allow review of the analytical performance of assay laboratories for the recent drilling only.

The sampling methods, sample preparation procedures and analytical techniques are all considered appropriate when supported with the production and reconciliation data.

12 Data Verification

12.1 Introduction

In early 2007, external consultants reviewed the data collection protocols and quality control procedures (Redden & Moore, 2010). Only minor changes to current practices have been made since this review.

The Macraes Project has a long history of exploration and mining. Data collection protocols and quality control procedure have varied substantially over this period. The analytical quality is monitored by the submission of certified standards, blanks, laboratory duplicates and field duplicates. In addition to the quality control data, a substantial amount of reconciliation data is available and has been used as the final measure of data quality.

12.2 Drill Hole Database

12.2.1 Historical Data

Homestake and subsequently BHP data was stored digitally and transferred to Macraes Mining when BHP left the project. Original Au assay data was recorded in parts per million and grams per tonne format. Tungsten was recorded in parts per million or percentage WO_3 format to 3 significant figures. This data was entered into the Macraes Mining Techbase Database with all tungsten data recorded as percentage WO_3. The percentage values were rounded to 2 decimal places. Repeat analyses were combined and the average result recorded in Techbase.

Digital data and metadata for all drilling post 1994 was captured in the Techbase database.

In 2002 the acQuire geoscientific database was installed and Techbase assay data transferred to acQuire. Tungsten assays in acQuire are denoted as W but represent WO_3 values (checks against historical digital files and original reports confirm this).

Further checking of the historical tungsten data was carried out in 2013 and again in 2019. Some errors were detected and corrected.

12.2.2 Recent Data

The drill hole database is stored in acQuire geoscientific database software with the assay data directly loaded from digital data supplied by AMDEL up to 2010 and then by SGS from 2011 onwards. A review of the drill hole database and data flow processes was completed by external consultants in 2005, including random checks of the drill hole database against laboratory assay data during the site visit with no material errors identified. While no exhaustive review of the data has been completed, the mining and reconciliation data can be used as a check of the data robustness.

The surface drilling, underground and open pit grade control data are held in 3 separate databases within acQuire.

OceanaGold consider the drill hole database management is appropriate and the final database to be robust.

12.3 Comparison of Wet RC Percussion Drilling

The Macraes Project database contains surface diamond and RC percussion drill holes and trench samples, although the assaying from the trench samples has been excluded from resource estimates. Prior to 1998 samples were collected from wet percussion drilling which is a quality issue. Diamond twinning of some wet percussion holes has been carried out at Frasers, Innes Mills and Round Hill to quantify and address the problem along with globally determined grade dependent factors as discussed in Section 10.8.3.

Further discussion on the wet RC percussion drilling, where applicable, is also provided on a deposit by deposit basis in Section 10.8.3.

12.4 Analysis of Assay Quality Control Data

Detailed statistical analysis of the available exploration assay quality control data for the Macraes Project on drilling completed from 2007 to the end of 2009 is reported in Redden & Moore (2010). This work showed that the quality control database assessed by OceanaGold has acceptable levels of assay precision and accuracy and was supported by available reconciliation data.

Since then monthly tracking of standards and blanks for samples assayed at the Macraes on-site laboratory is routinely carried out and results discussed in the monthly meetings with the laboratory so any issues can be addressed immediately. This includes all the underground exploration drilling and surface exploration drilling from 2013 onwards.

For exploration samples assayed at off-site laboratories in the period 2010-2012 analysis of assay quality control data is included in the annual technical reports on exploration.

An internal audit was completed in 2016 and some improvements made to the way assay quality control data is managed.

12.5 Summary

Due to the long exploration and mining history of the project, the quality control database is incomplete for the Macraes Project making complete and thorough investigation impossible. The risk associated with the incomplete quality control data set is offset by the available mining and reconciliation data which supports the quality of the data.

Notwithstanding the limitations in the data set, the available recovery and QAQC data indicates the assay data meets acceptable limits of accuracy and precision and is therefore suitable for the purposes of grade estimation. OceanaGold has taken steps to mitigate the risks associated with the RC drilling sampling under wet conditions. Whilst ultimately only removal of this data can remove the risk, the relatively low proportions of remaining wet RC samples and previous successful mining history provide the basis for OceanaGold considering the residual risk to the resource estimates to be low.

The introduction and use of a portable handheld XRF analyser for tungsten analysis in 2013 is well implemented and the assay is suitable for the purposes of grade estimation.

In addition to the assay data, the survey data both collar and down-the-hole survey, is robust and present little risk.

It is the opinion of the QP (Sean Doyle) that the drill hole data used in the production of the resource estimates reported in this report meet acceptable limits of accuracy and precision and that all reasonable steps and process have been undertaken to validate thedrill hole data.

13 Mineral Processing and Metallurgical Testing

13.1 Introduction

The Macraes processing facility is projected to treat 4-6 Mtpa of gold bearing sulphide ore sourced from the Macraes Open Pit and Underground projects. The Macraes sulphide ore is refractory containing preg-robbing carbonaceous material. The metallurgical processes of treating the gold bearing sulphide ore is crushing, milling, flotation, pressure oxidation, Carbon in Leach (CIL), elution and electrowinning unit operations to extract maximum value. Approximately 1,5 million tonnes of oxide ore stockpiled will be processed with a simplified crushing, grinding and CIL flowsheet.

13.2 Throughput

Throughput predicted for each month is based on mill utilisation and historical throughputs. The main SAG mill processes approximately 85% of the total feed at a maximum throughput rate of 550 tph with processing soft to medium ore hardness material. ML-500 throughput is limited to 200 tph due to infrastructure design.

13.3 Mass Pull

Approximately 2.5% of total feed tonnes is recovered to the concentrate stream, the tailings tonnage is 97.5% of feed tonnes. The split proportion of contained gold is used to determine flotation recovery.

The mass pull to the concentrate stream is calculated from a model based on feed sulphur grade, which is generated from daily process data of the active pit and underground ore sources.

13.4 Flotation Tails Gold Grade

The tails gold grade is calculated from a model based on recent plant performance of the active open pit and underground ore sources.

13.5 CIL Recoveries

The average Macraes CIL recovery, 95.5%, is based on CIL performance and historical tail grades, Figure 13-1, and the achievable oxidation in the autoclave. Figure 13-1 demonstrates the actual plant CIL recovery achieved over the last 4 years of plant operation.

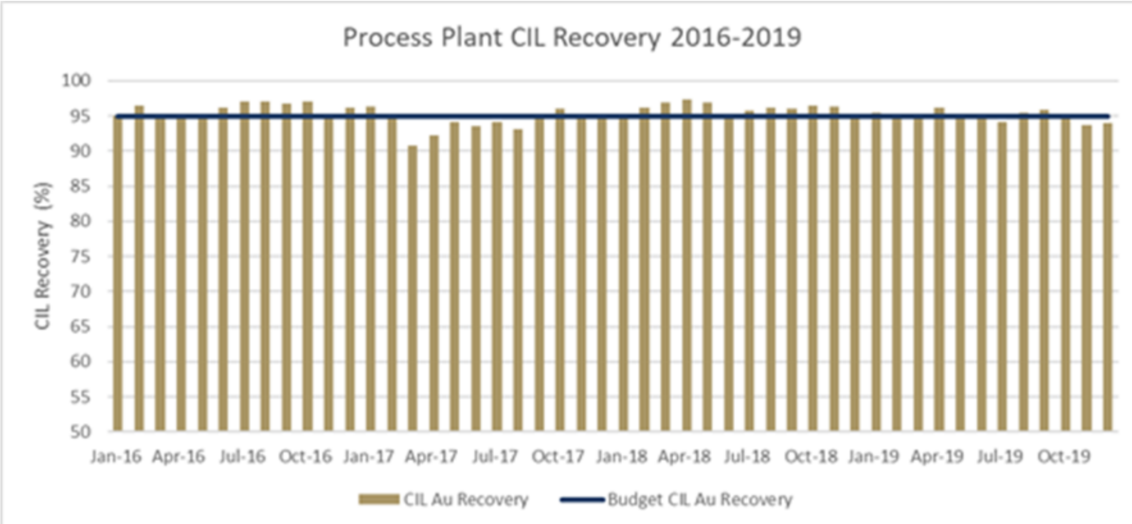

Figure 13-1: Plant CIL recovery comparison between budget and actual CIL recovery

13.6 Flotation Recovery

Flotation recovery is calculated using the feed grade-recovery curve based on recent plant performance (Figure 13-2 of the active pit and underground ore sources. Figure 13-2 demonstrates the actual plant flotation recovery of gold over the last 4 years compared to the budget forecast.

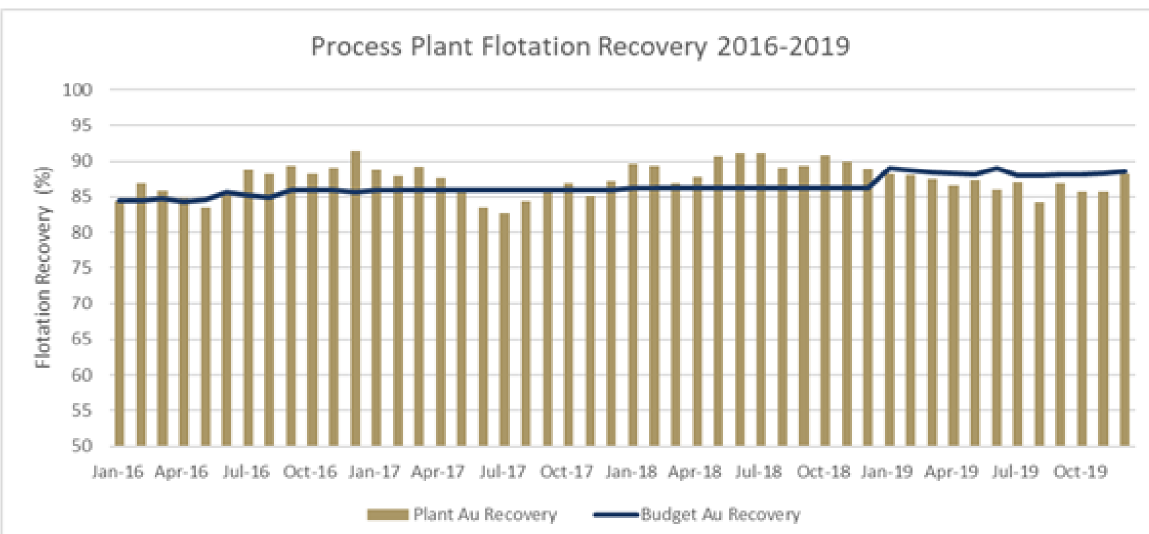

Figure 13-2: Plant flotation recovery comparison between budget and actual flotation recovery

13.7 Overall Recovery

The flotation and CIL recoveries for the open pit and underground ore sources at Macraes are combined. Yearly forecast recoveries for Macraes open pit and underground mines are presented in Table 13.1.

Table 13.1: Forecast Recoveries used in LOMP20 for Macraes Open Pit and FRUG Mines

Year	Flotation Recovery (%)	CIL Recovery (%)	Overall Recovery (%)
2020	86.4	95	82.1
2021	87.2	95	82.8
2022	86.1	95	81.8
2023	85.7	95	81.4
2024	87.6	95	83.1
2025	88.6	95	81.8
2026	88.4	95	82.3
2027	86	95	82.7
2028	86	95	81.7

13.8 Future Ore

The purpose of metallurgical testing of the future ore samples is to determine metallurgical performance of new future planned ore sources such as mill throughputs, flotation recovery and CIL recovery. It also provides valuable information to understand any variations in ore hardness and address any potential process risk that may affect current process plant performance.

The future ore test program is only performed on diamond core samples of existing and new ore sources developed. The future test program involves a series of tests.

Grind Determination Test – This test is derived from the time taken in the laboratory rod mill to achieve a P80 of 106 microns for the flotation testwork from core samples stage crushed to -3.35mm. This test work provides data on relative hardness in relationship to SAG and ball mill throughput.

Kinetic flotation testing. This is a float test that produces 4 concentrates and 1 tail stream for assay. Concentrates are floated off over a 1, 4, 8- and 13-minute time period using the standard OceanaGold laboratory float procedure and reagent doses. This float test indicates the expected rougher- scavenger flotation performance.

Release analysis flotation testing. This is a 2-staged cleaner float test that produces a primary, cleaner and re-cleaner concentrate as well as a primary, cleaner and re-cleaner tail. Three concentrates are floated off over 26 minutes for the primary float. The times are 3, 8- and 15-minutes time period. For the cleaner and re-cleaner, three concentrates are floated off over 3, 8- and 10-minutes time period. This test produces a grade recovery curve to determine the ‘optimum’ grade and recovery of the Macraes flotation plant. The test products are analysed for Au, S, As, Fe and total organic carbon (TOC).

A standard bottle roll Preg-Robbing Factor (PRF) leach testing. This test assesses the preg-robbing characteristics and leach recovery of the ore prior to the pressure oxidation process. This is a leach of a concentrate produced using a bulk float test. The concentrate is then bead milled to a P90 of 18 microns for a standard PRF leach to be conducted. While the test cannot determine a CIL recovery, it highlights the impact of high PRF areas within the orebody for budget planning and forecasting.

The results of ore source testing are presented in Table 13.2 and Table 13.3 by ore type. It is evident the future ore testwork conducted on the ore sources have confirmed economic benefits on how the future ore will behave in the Macraes plant and the flotation recovery determined from this testwork has achieved a variance of +1.2%

recovery compared to actual plant performance. And therefore, supports the continuation of the future ore testwork program for the rest of Macraes LOM.

Table 13.2: Flotation recoveries from future ore testing programme to 2010

Ore Source	Hangingwall Lode (%)	Concordant Lode (%)	Lower Lode (%)
Frasers North 4	90.3	87.1	87.0
Frasers North 5	89.2	87.0	87.0
FRUG	92.1	-	-
Golden Bar	89.8	89.8	89.8
Southern Pit	85.0	93.0	79.0
Innes Mills	85.3	88.4	90.1

Table 13.3: Flotation recoveries from future ore testing programme, 2010-2019

Ore Source	Hangingwall Lode (%)	Lower Shear Structure (%)	Lower Lode (%)
Coronation	84.0	71.0	-
Coronation North	86.1	80.8	91.6
FRUG	90.2	-	-
Deepdell North	-	-	81.0

13.9 Golden Point Underground Testing

During 2019/20 a series of ore composites were prepared from diamond drilling of the proposed Golden Point Underground (GPUG) resource for metallurgical testing. Between 1998 and 2003, ore from the Golden Point open pit resource was processed through the Macraes plant with flotation reported recoveries of 87-89% for gold. This period coincided with the installation of the Pressure Oxidation circuit leading to improved leach recoveries of 95%.

Four lithologically-based composites were prepared from geological interpretation of the predominant domains expected for the mining method planned. The overall estimate of mined mill feed by lithology type was estimated as:

- Lode Schist 43%;
- Quartz Cataclasite/Silicified Breccia/Quartz Vein 18%; and
- Other Lithologies 39%.

These were subjected to grind determinations, kinetic flotation testing and the two stage release analysis tests described above to provide estimates of flotation recovery at a target 8% sulphur concentrate grade. The key conclusions of the testwork on these samples were:

- Grind determination showed the sampled material to be highly competent, although consistent with FRUG ore grindability, so should not cause a restriction when being treated through ML-500.
- The sampled material responded reasonably well to flotation, although kinetics were variable. Despite the observed variability between samples, it was possible to upgrade the concentrate to 8% sulphur while achieving relatively high recovery rates.

- Total Organic Carbon (TOC) concentrations indicate that PRF will be low which may result in higher CIL recovery. Nonetheless, leach testing is required to better understand the aggressiveness of the TOC.
- The ROM recovery rate of 83.7% can be used as an approximation of expected performance, although given the limited data set, a significantly larger second stage program is required to better define the ore source and improve confidence in recovery rates.

Table 13.4 summaries the results of the testing program. Estimated flotation recovery is used when targeting an 8% sulphur concentrate grade required for autoclave feed, and estimated ROM recovery at a 95% CIL recovery was used based on the low TOC assays. The weighted recovery from this program is based on a geological assessment of the proportion of each lithology.

Table 13.4 Result of GPUG Round 1 Composites

Composite	Grind Time to 106um	Flotation Recovery @ 8% Sulphur	CIL Recovery %	ROM Recovery %	Resource Weighting %
GPM004	6’46”	89.2	95	84.7	43
GPM005	5’06”	83.3	95	79.1	19.5
GPM006	8’28”	91.9	95	87.3	18
GPM008	6’32”	87.0	95	82.7	19.5
Weighted Average	6’43”			83.7	

A subsequent variability program was undertaken with a further eight composites prepared from drill core representing stope intercept lengths commensurate with the expected extracted grades based upon assumed mining selectivity. Intercepts were selected across the GPUG deposit for this round of testing capturing a larger portion of the contained gold in the mine design and representing expected mill feed grades from stope extraction. The results of the second round of variability testing is outlined in Table 13.5.

Table 13.5 Results of GPUG Round 2 Variability Composites

Composite	Grind Time to 106um	Flotation Recovery @ 8% Conc Grade	CIL Recovery %	ROM Recovery %
GPM011	7:11	91.1	95.0	86.5
GPM014	7:42	91.0	95.0	86.5
GPM022	6:36	89.7	95.0	85.3
GPM038	6:04	90.2	95.0	85.7
GPM043	6:58	89.8	95.0	85.3
GPM046	6:27	87.4	95.0	83.0
GPM048	4:58	85.6	95.0	81.3
GPM050	7:00	91.3	95.0	86.8
Average	**6:37**	**89.5**	**95.0**	**85.0**

From this round of variability testing, the results continue to show similar grind times to the initial program and are in line with those for FRUG samples tested previously. Current practice of feeding FRUG ore to the ML-500 SAG mill up to 50% of its feed is expected to be applicable to GPUG ore without any significant issues.

Flotation recovery from the release analysis test indicates an average of 89.5% over the 8 composites. Some variability was seen in flotation recovery as interpreted at the target 8% sulphur concentrate grade, In practice GPUG would provide a maximum of 15% of the overall flotation feed, with the remainder being sourced from other open pit sources. At these blend ratios there appears no issue with being able to generate a target concentrate grade at high flotation recovery on the proposed resource. . Overall low TOC levels indicate that a low to moderate level of organic pre-robbing material is expected. Given the inclusion of the autoclave, current practice typically achieves a 95% leach recovery.

The overall recovery of 85.0% remains in line with both historical plant performance on previously mined Golden Point open pit material as well as results of the initial program of testwork. The improved result from the second round of testing was not available at the time assumptions were finalised for cut off grade determination. This value exceeds the 83.7% that has been assumed for the cut off grade calculations, economic analysis and reserve calculations and shows a robust assumption was used relative to laboratory testwork.

13.10 Issues

Allocation of gold between Macraes open pit and underground mines as the ore is mixed within the crushing process. Higher underground gold grades could reasonably be expected to return higher recoveries and produce concentrates with higher gold grades. However, in practice, measuring actual flotation recovery and concentrate grades produced individually by Frasers underground and Macraes open pit ores is not possible. These differences, although not affecting total gold recovered, do impact on the financial performance of both mines. Investigations to accurately measure and attribute gold recovered between Macraes open pit and FRUG ore streams in 2010 concluded that the split was not achievable due to insufficient supply of underground ore required to consistently process in the smaller SAG mill and maintain steady flotation circuit performance.

14 Mineral Resource Estimate

14.1 Introduction

All mineral resource estimates are carried out by OceanaGold personnel at Macraes under the supervision of the Principal Resource Geologist, Sean Doyle. All estimates are peer reviewed by OceanaGold's Group Geologist, Chief Geologist or site geologists. Independent consultants are used where appropriate.

This section summarises the methodology used by OceanaGold to prepare and classify the Mineral Resource Estimates. The open pit and underground resource estimates are described separately.

14.2 Qualified Persons Responsible for Resource Estimates

Mr. Sean Doyle, Principal Resource Geologist at Macraes is the Qualified Person responsible for the Macraes Project Resource Estimates.

14.3 Open Pit Mineral Resource Estimate

14.3.1 Drillhole Database

Drill holes are extracted from the surface drilling acQuire database for each of the areas of resource estimates as defined by the X, Y, Z coordinates.

Generally only holes with DDH, DDW, RCD and RCH prefixes are used for resource estimates. Occasionally select RCL prefixed holes are used. These prefixes are diamond core (DDH), diamond daughter (DDW), Reverse Circulation (RC), reverse circulation pre-collars with diamond tails (RCD), and Grade Control RC holes (RCL) drill holes respectively. Some holes with these prefixes may be excluded, usually where wet sampling may have led to downhole contamination or sampling bias. This will be discussed in the individual resource estimate sections below.

14.3.2 Software Used

Minesight/Compass software is used for creating the wireframes for database extraction, geologic modelling, coding and final resource reporting. The use of Leapfrog software for wireframing was introduced during 2019 and has mainly been used for the construction of the underground wire frames.

GS3M software is used for geostatistical analysis and large panel recoverable resource estimation for open pit estimates. The block models created are then imported into Minesight/Compass for final reporting.

14.3.3 Geologic Model Methodology

Wireframes are created in Minesight of the domains to be used in resource estimation. A combination of grade (0.4 g/t gold) and lithology is used to define the top and bottom contacts of the ore domains.

Most of the economic mineralisation is confined to the Intrashear schist. The top of the Hangingwall shear usually marks the top of the Intrashear schist and the bottom marked by the Footwall fault. Within the Intrashear schist there may be domains for the Hangingwall shear, one or more concordant lodes and zones of quartz vein arrays with subsidiary shears. Domains will vary from area to area and are discussed for the individual areas below.

14.3.4 Assay Capping and Compositing

Outliers

For resources estimated by Multiple Indicator Kriging (MIK) top caps may be applied to mitigate outliers. Top caps applied are specified for each resource estimate below. Typically, the top-class mean is replaced with a value between the mean and median of the top MIK class.

For resources estimated by Ordinary Kriging (OK) top caps are always applied, typically at around the 95 or 97.5 percentile. Top caps applied are specified for each resource estimate below.

Compositing

The raw assay data is composited to one metre lengths to allow geological resolution for wireframing and for resource estimation. The one exception is the Frasers (Gay Tan) resource estimate which used 2m composites. No wireframe constraints are used for this estimate.

14.3.5 Density

The density assumptions for all estimates are shown in Table 14.1. These are based upon core immersion test results and are assigned to blocks based on geological coding. The only exception to this is the Gay Tan SG which was calculated using a surveyed mining volume and the weight of the material moved as recorded by the trucks.

Table 14.1: Density assumptions

Material Type	Density (t/m^3)
Fresh rock	2.65
Weathered rock	2.50
Loose rock fill	2.18
Gay Tan*	2.35
Tailings	1.77

Gay Tan covers an area of the failed Frasers west wall

14.3.6 Variogram Analysis and Modelling

Variogram modelling is carried out in GS3M for each of the domains specified in the resource estimate. 14 indicator variograms (typically each variogram is modelled in 5 to 10 directions) and one gold variogram is required for each domain using MIK. So, between 75 and 150 directional variograms are modelled for each domain.

Ordinary kriging only requires a single gold variogram for each domain.

Once completed the resource estimates are exported out of GS3M in ascii format and imported into Minesight/Compass.

14.3.7 Block Model

Block model dimensions will vary for area to area but the standard block size for open pit resources is:

X = 25m, Y = 25m, Z = 2.5m.

14.3.8 Estimation Methodology

Search distances and directions are derived from a combination of geology, drill spacing, variography and previous modelling. Typical drill spacings are 25, 37.5m and 50m so the primary search distance is generally set around these lengths.

Since 2001, large panel recoverable resource estimation using Multiple Indicator Kriging (MIK) has been the preferred estimation for open pit resources where there is sufficient data. Ordinary Kriged (OK) E-Type estimates are used where data is sparse. Ordinary Kriged (OK) E-Type estimates are also the current method for underground resource estimates given that large panel recoverable estimates selectivity assumptions are not appropriate for UG estimates.

Ordinary Kriging (OK)

Ordinary kriging is a form of linear estimation. In simple terms, linear estimation assumes the influence of a sample on the grade of a block is some function of its distance from that block. Inverse distance weighting (IDW) is another example of linear estimation. (Schofield, 2016).

Large Panel Recoverable Resource Estimation using MIK

Large panel recoverable resource estimation is implemented at Macraes using multiple indicator kriging (MIK), a non-linear approach suited well to skewed gold distributions. Grades are estimated into large blocks, with dimensions typically reflecting the nominal drill hole spacing. Rather than providing more traditional whole block grade estimates, the estimates are expressed as a series of nested proportions and grades estimated for a range of cut-off grades; in essence, a cumulative histogram for each block. The approach provides significantly more accurate estimates for the less continuous styles of mineralisation at Macraes, namely quartz vein arrays and erratic subsidiary shear-hosted mineralisation.

Large panel recoverable resource estimation has been used successfully at Macraes since 2001.

14.3.9 Model Validation

Several methods are used to check to resource estimates.

Visual Comparison

The block model is viewed in Minesight against the drilling and domains to see that the block grades reasonably represent the input data.

Comparative Statistics

Methods include:

- Check mean composite grade versus average estimate grade for each domain. Results should be reasonably close; and
- swarth plots of mean composite grade against model grade.

Against Previous Models

The new estimate is often compared against previous estimate to see what the variation is. Variations that cannot be explained are investigated.

Reconciliations

Where a deposit has been partially mined the estimate is reconciled against the actual mined tonnage, grade and contained metal. See section 14.5.

14.3.10 Resource Classification

The resource classification for MIK resource estimates are determined in GS3M during the estimation process using a combination of the search criteria, the expansion factor and cut-off grade reporting threshold. These are tabulated in Table 14.2. The parameters used for resource classification for the OK resource estimates are shown in Table 14.3.

Table 14.2: MIK resource classification parameters

Resource Area	Domain	Search	Exp an	Min Data	Min Octants	Max Data	Classif Grade	Measured Threshold	Indicated Threshold
Coronation North	Dom1-5	27x27x6	0.5	16	4	48	0.4g/t	80%	30%
Coronation *	Dom10	50x50x7	0.5	16	6	48	0.4g/t	80%	30%
	Dom20	50x50x4	0.5	16	4	48		80%	30%
	Dom30	50x50x4	0.5	16	4	48		80%	30%
Deepdell#	Dom10,11,12,31,32,33	27x27x6	0.50	8	4	48	0.4g/t	80%	30%
	Dom50	37x37x5	0.50	12	4	48		80%	30%
GPRHSP	Dom11,14,15,20,21,30	28x28x4	1.40	10	4	48	0.4g/t	80%	30%
	Dom42 &50	22x22x5	1.30	16	8	48		80%	30%
	Dom43	30x30x5	1.30	16	8	48		80%	30%
Innes Mills	Dom5	20x30x8	1.00	16	8	48	0.4g/t	80%	30%
	Dom10-31	25x25x6	1.00	12	4	48		80%	30%
	Dom50	25x25x8	1.00	16	8	48		80%	30%
Frasers West	Dom40-43	32x32x8	0.80	16	5	48	0.4g/t	80%	30%
Gay Tan	Dom1	28x28x6	0.60	16	4	48	0.3g/t	80%	30%
Golden Bar	Dom1	25x25x4	1.50	16	4	48	0.5g/t	80%	30%
	Dom2-3	25x25x4	0.20	16	4	48		80%	30%

Table 14.3: 0K Resource Classification Parameters

Resource Area	Domain	Resource Classification	Search	Min Data	Min Octants	Max Data
Nunns	Dom1	Ind	50x50x5	16	6	64
NZGT	Dom1	Inf	50x50x5	12	4	32
	Dom2	Inf	80x80x5	12	4	32
GPRHUG	All Domains	Mea	32 x 32 x 4	8	Not applied	32
		Ind	62 x 62 x 4	8	Not applied	32
		Inf	120 x 120 x 4	8	Not applied	32
Taylors	Dom1-3	Ind	50x50x5	12	6	32
	Dom1-3	Inf	50x50x5	4	4	32

- Resource classification for Coronation is for Domains 10 & 20 areas drilled to 50x50 are indicated otherwise inferred. Domain 30 Inferred for areas of 50 x 50 drilling.
- Deepdell resource classification for Hangingwall (HW) and Lodes used a polygon the defined the 50 x 50 drill spacing. HW drill spacing ≤50 x 50 Measured, ≤100 x 100 Inferred; Lodes drill spacing ≤50 x 50 Indicated, ≤100 x 100 Inferred; Stockwork ≤100 x 100 Inferred.
- The FRUG resource is classified by polygons based on drilling spacing. Measured are drilled at 25 x 25m or less, Indicated at 50 x 50 m or less and Inferred > 50 x 50m drill spacing.

All open pit resources are quoted at a 0.3 g/t or 0.4 g/t gold cut-off unless otherwise stated.

14.3.11 Resource Estimate Tonnes and Grade

Unless otherwise stated, all reported open pit resources are constrained within pit shells optimised via Whittle at an assumed NZD2,394 gold price (2020 LOMP long term gold price of US1,700 and NZ:US exchange rate of 0.71) and either surface topography or as-mined surface as at the June 30, 2020.

An open pit cut-off grade of 0.3 g/t Au is based on the NZD2,394 gold price, mining costs and recovery assumptions. Not all the open pit estimates have been rebuilt to the 0.3 g/t Au cut-off grade, in these cases, a 0.4 g/t Au cut-off grade is used.

14.3.12 Nunns

Background

Small scale mining and prospecting in the Nunns and adjacent NZGT area occurred intermittently from 1868 to 1918, yielding around 650 oz. of gold and 29 tons of scheelite (Williamson, 1939).

Modern exploration commenced in 1985 by BP Oil followed by Kiwi International who between them drilled 49 shallow holes (1,981.9m). OceanaGold conducted drilling campaigns in 2002/2003 and again in 2016/2017. Metallurgical test work on diamond drill core was completed in 2017.

Geology & Mineralisation

Mineralisation at Nunns is mostly confined to a single, shallowly dipping lode of low angle grey-white quartz veins with associated silicified and brecciated schist containing arsenopyrite, pyrite, scheelite and gold.

Resource Estimation

- Last resource estimate completed in 2017;
- 0.2 g/t Au cut-off grade used to define the lode horizon for kriging;
- Drill spacing 37.5m or 50m;
- OK estimation was used with search distances of X, Y = 50 and 80 metres, Z = 5m;
- Only RCH and DDH prefixed drill holes used in the estimation; and
- A gold top cut of 8 g/t was applied affecting 5 assays (0.7% of the data).

The current resource as at June 30, 2020 at a 0.4g/t Au cut-off grade is shown on Table 14.4.

Table 14.4: Nunns resource at 0.4g/t Au cut-off

Category	Tonnes (Mt)	Grade (g/t Au)	Contained Gold (koz)
Measured	-	-	-
Indicated	0.23	0.83	0.0066
Measured & Indicated	0.23	0.83	0.0066
Inferred	0.64	0.92	0.019

14.3.13 Coronation North

Background

In 2014 two sterilisation drill holes returned weak gold intercepts. The results were sufficiently encouraging for additional 250m spaced holes to be drilled which led to the discovery intercept in the eleventh hole drilled in the area: RCH5759: 15m @ 0.95 g/t from 114m. A 100m spaced drilling programme immediately followed and as more gold intercepts were recorded and the drill spacing reduced to 50m spacing, locally 25m spacing as the core of the higher grade mineralisation was defined. Diamond drilling commenced in June 2015 to confirm the RC intercepts, provide samples for metallurgical test work and for geotechnical information.

The first resource estimate was released at the end of 2015. Drilling continued through 2016 and mine planning commenced. Following the granting of resource consent, pre-stripping commenced in April 2017 and first ore was excavated in June 2017. Infill drilling continued through 2017 and 2018 to reduce the drilling spacing to 37.5m or 25m spacing.

To 30th June 2020, Coronation North has produced 9.72 Mt @ 1.02 g/t for 319kozs of gold and is currently scheduled to be completed in 2021.

Geology & Mineralisation

Coronation North is the most recent discovery in the belt (2015) and has some unique features that set it apart from the other deposits in the HMSZ.

- The projected surface expression of the HW shear and adjacent mineralisation lies under Cretaceous sediments and Tertiary volcanics and hence there were no geochemical indications of the deposit; and
- Higher grade mineralisation at Coronation North is located on a left-hand bend in the strike of the Hangingwall shear (HWS) that plunges to the ENE. The dip of this bend decreases as the strike curves towards the west. Steeply dipping, en-echelon mineralised splays are developed beneath this bend in the HWS. Finely laminated mineralised quartz veins that strike perpendicular to the HWS are also present beneath the bend. The WSW-strike of the HWS, narrow (~100 m) width, and ENE-plunge of

the mineralised zone distinguish Coronation North from other deposits in the HMSZ. The core of the mineralised Intrashear schist is highly fractured pelite riddled with clayey fractures and thin quartz veins.

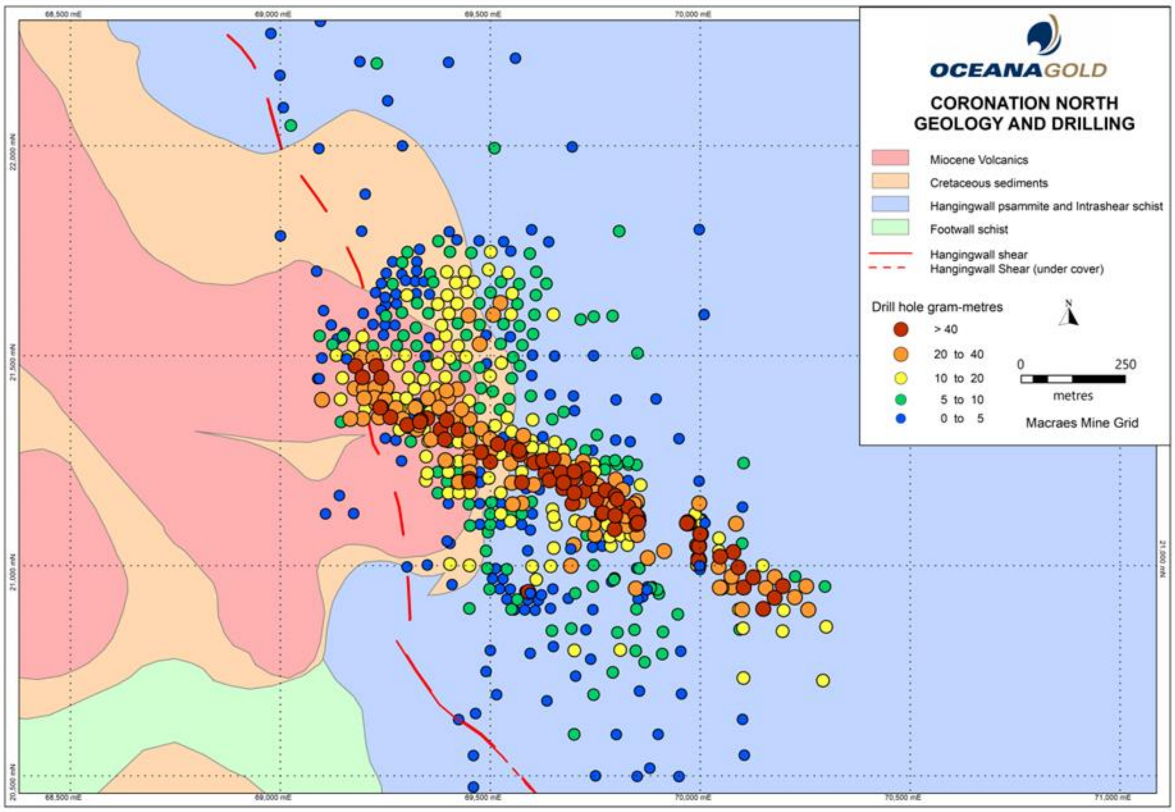

Figure 14-1: Coronation North Geology and Drilling

Resource Estimates

- Last updated in February 2020;
- Only hole prefixed RCH, RCD, DDH and DDW used in resource estimate;
- Drill spacings mainly 25m or 37.5m;
- Simple 4 domain model used with the Intrashear Schist containing the mineralisation divided into north, south and high-grade domains; and
- MIK used for the estimation.

The current resource as at June 30, 2020 at a 0.3g/t Au cut-off grade is in Table 14.5.

Table 14.5: Coronation North resource @ 0.3g/t Au cut-off

Category	Tonnes (Mt)	Grade g/t Au)	Contained Gold (koz)
Measured	1.30	1.26	53
Indicated	4.32	0.75	104
Measured & Indicated	5.61	0.87	157
Inferred	2.82	0.65	59

Mining & Reconciliation

Mining of ore commenced in June 2017 and reconciliations against resource estimates have been carried out on a monthly basis since then.

To date 9.72Mt at a grade of 1.02 g/t au and containing 319 kozs of gold have been mined. Coronation North stage 4 pre strip is in progress with mining to of Stage 4 to be completed in 2021.

Mining commenced at a 0.4 g/t au cut-off, however, in January the cut-off was lowered to 0.3 g/t Au.

The annual reconciliation for mining up to 30th June 2020 against the current resource estimates is shown in section 14.5.

Since mining commenced the Coronation North resource estimate has consistently underestimated the contained gold. This is a function of insufficient drilling density to adequately define the complexity of the mineralisation and vertical drill hole orientation (Macraes standard hole orientation) when inclined at 60° @ 225° would be more appropriate. The resource under call is expected to continue until the cessation of mining in 2021.

The current pit optimisation at NZD2,394 is drilling limited. Step-out drilling would allow evaluation of a potential cut back.

Coronation

Background

The Coronation area was first worked in 1886 with a second period of activity in 1911/12. During the 1980s the landowner at Coronation dug a series of trenches and pits. In 1992 12 RC holes were drilled by Sigma Resources. Between 1998 and 2001 OceanaGold's predecessor company GRD Macraes drilled 31 holes and the first resource estimate was produced.

OceanaGold conducted further drilling campaigns in 2008, 2011, 2012 and 2014. Mining commenced in 2014. Infill drilling of stages 5 and a potential stage 6 was undertaken in 2015, 2016 and 2018. Mining of stage 5 commenced in 2019 and will be completed in September 2020.

Geology & Mineralisation

The HMSZ at Coronation is a predominately pelitic package of schist up to 90m thick. The package is constrained above by the Hanging wall Shear and below by the Footwall Fault as shown on Figure 14-2. The geology of the Coronation deposit is comparatively simple. It comprises the Hangingwall Shear which has a generally planar geometry and dips 15° to 20° to the east. A second, less extensive shear has been interpreted immediately below the Hangingwall Shear. A north-south subvertical fault has been interpreted to offset both mineralised shears. Quartz vein arrays and subsidiary shears styles of mineralisation are generally absent at Coronation.

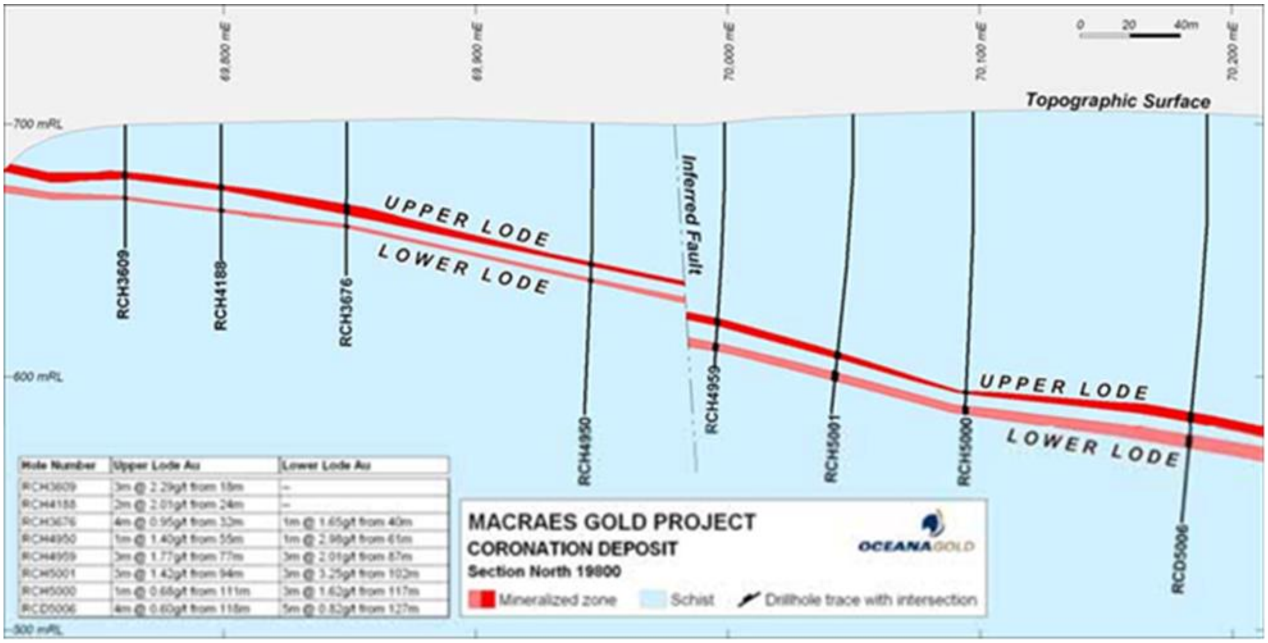

Figure 14-2: Coronation Schematic Cross-section

Resource Estimate

- Last updated in August 2018;
- Only hole prefixed RCH, RCD, DDH and DDW used in resource estimate;
- Drill spacings 37.5m or 50m;
- 2 lode domains cut by North-south fault; and
- MIK used for the estimation.

The current resource as at June 30, 2020 is shown in Table 14.6.

Table 14.6: Coronation Resource @ 0.3 g/t Au cut-off

Category	Tonnes (Mt)	Grade (g/t Au)	Contained Gold (koz)
Measured	-	-	-
Indicated	2.43	1.06	83
Measured & Indicated	2.43	1.06	83
Inferred	1.67	0.74	40

Mining and Reconciliation

Pre-stripping commenced at the end of September 2014 with the first ore mined in December 2014. Mining has progressed in stages and is currently in stage 5.

To date 7.60 Mt at a grade of 1.01 g/t Au and containing 247 kozs of gold have been mined. Coronation stage 5 is scheduled to finish in September 2020 with a potential Stage 6 after that.

Mining commenced at a 0.4g/t cut-off grade, however, in January 2020 the cut-off grade was lowered to 0.3 g/t Au.

The Annual reconciliation for mining up to 30th June 2020 against the current resource estimates is shown in Section 14.5.

Since mining commenced the Coronation the resource estimate has consistently underestimated the contained gold due to insufficient drilling density (initially on 50m x 50m) to representatively test a series of 10m to 20m wide high-grade shoots. The drilling spacing was infilled to 37.5m x 37.5m prior to commencement of mining Coronation Stage 5.

Following the completion of mining in Coronation Stage 5 the resource estimate will be recompiled to reflect the current 0.3 g/t Au cut-off and investigate strategies to improve the reconciliation. The current pit optimisation at NZD2,394 is drilling limited. Step-out drilling would allow evaluation of a larger Stage 6 cut back.

14.3.14 Deepdell

Background

Alluvial mining on Horse Flat to the north was first recorded in 1892. Quartz mining started in 1901 and continued intermittently until 1924 as the lines of lode were followed south to Deepdell creek.

There have been several phases of drilling at Deepdell leading up to the start of mining in 2001. The first phase of modern exploration commenced in 1985 when Homestake drilled 5 percussion and 7 diamond holes. This was followed by another 6 phases of drilling by OceanaGold's predecessor companies Macraes Mining and GRD Macraes.

Mining of the north pit commenced in 2001 and continued to 2003. Mining of the south pit concluded in October 2003. The north pit was subsequently backfilled with waste rock.

Drilling for down-dip extensions to the north pit began in 2013 and further infill drilling was carried out in 2017 and 2018 following which the resource estimate was updated.

A resource consent application was lodged in 2019 to re-open the Deepdell north pit. The resource consent is still being processed.

Geology & Mineralisation

The HMSZ at Deepdell consists of a 50 to 60m thick pelite, constrained by the Hangingwall and Footwall shears. The geology of Deepdell North is comparatively simple. It comprises the Hangingwall shear, which has a planar geometry and dips 15° to 20° to the east. Beneath the Hangingwall shear, up to 3 subparallel shears have been identified. These shears are generally thin (less than 3m thick), weakly mineralized, do not have the continuity of the Hangingwall shear.

At Deepdell South the Hangingwall shear geometry is a little more complex. The Hangingwall shear has been rotated into a south to southeast orientation and is cut by a northeast-southwest striking fault. The western portion of the Hangingwall dips at 20° to 25° to the southeast while the eastern section dips at 35° to 40° to the southwest. The Hangingwall shear is well developed to approximately 70,400mE where it is either offset by a north-south trending faults or is pinched out against a fault. At both Deepdell North and Deepdell South quartz vein arrays and subsidiary shear development beneath the Hangingwall is relatively poor.

A complex fault zone separates Deepdell South from Deepdell North. Four east-west trending faults, which terminate the northeast – southwest trending fault in Deepdell South, have been interpreted. From Deepdell South to Deepdell North the effect of these faults is to uplift the Hangingwall and progressively displace the Hangingwall outcrop position to the west.

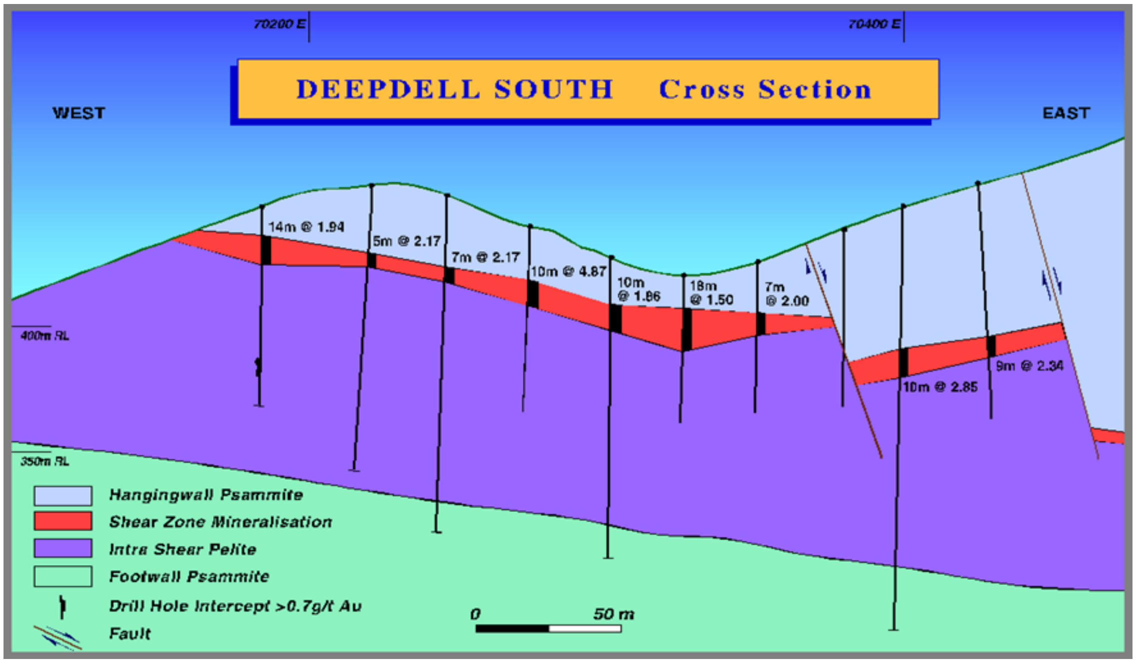

Figure 14-3: Deepdell South Schematic Cross-section

Resource Estimate

The current resource lies under and down dip of the mined-out pits.

- Last updated in August 2018 – DD2018;
- Only holes prefixed RCH, RCD, RDDH and DDW used in resource estimate;
- Drill spacings 25m or 37.5m, out to 50m or more on the outside;
- 4 lode domains in Deepdell North, 2 lode domains in Deepdell South; and
- MIK used for the estimation.

The current resource as at June 30, 2020 at a 0.3g/t Au cut-off grade is shown in Table 14.7.

Table 14.7: Deepdell Resource @ 0.3g/t Au cut-off

Category	Tonnes (Mt)	Grade (g/t Au)	Contained Gold (koz)
Measured	2.25	1.06	77
Indicated	1.81	0.96	56
Measured & Indicated	4.06	1.02	133
Inferred	2.09	0.54	360

Mining & Reconciliation

The Deepdell pits produced 2.55Mt @ 1.44 g/t Au for 0.117Mozs at a 0.5 g/t Au cut-off grade.

A reconciliation of the 2018 resource estimate against mine production and the previous resource estimate DD2013 was reported in September 2018.

Revisions were made to the Deepdell estimate in response to the model to mine to mill reconciliation. The revised Deepdell estimate resulted in a 10% grade drop relative to the previous estimate.

Relevant Factors

Resource consent application has been submitted, but not yet granted.

Based on revised costs and gold price, the cut-off grade has been lowered from 0.5g/t Au to 0.3g/t Au since OceanaGold last mined in Deepdell.

The current resource estimate is based on a 0.4g/t Au wireframe and needs to be recompiled with a 0.3g/t Au wire frame interpretation. This however does not materially affect the quanta of the resource or present a risk to the future mining of Deepdell. The current pit optimisation at NZD2,394 is drilling limited. Step-out drilling would allow evaluation of a potential cut back.

14.3.15 Round Hill/Golden Point Open Pit

Background

The current Round Hill resource estimate combines the Southern Pit, Round Hill and Golden Point areas. Lodes were mined in the area from the 1860s and with the discovery of the Golden Point Lodes in 1889 became a significant producer of gold and scheelite at the time.

Round Hill was the focus of exploration and drilling in the 1980s and mining commenced in 1990. By 1998 mining was completed and the pit partly backfilled as the adjacent Golden Point and Southern Pit deposits were mined. Mining of these pits was completed in mid-2002. A small cut-back of Round Hill was mined in 2003. The Round Hill and adjacent deposits have produced in excess of 1.3 Moz as shown in Table 14.8. Round Hill remains as the largest resource at Macraes.

Each of the areas were drilled intensively leading up to the start of mining. Small drilling campaigns testing down-dip extensions of the mineralisation were conducted intermittently in 2005, 2008, 2009, 2010, 2012, 2014 and 2015. In 2016 the focus shifted to Golden Point and infill and extension drilling has been underway there from the end of 2016 to the present.

Table 14.8: Previous production from the Round Hill Area

Area	Tonnes (Mt)	Grade (g/t Au)	Contained Gold (koz)
Golden Point	5.76	1.78	329
Round Hill	13.01	1.89	797
Southern Pit	4.50	1.40	202
Total	**23.27**	**1.78**	**1,328**

Geology & Mineralisation

From Golden Point, through Round Hill to Southern Pit, the HMSZ is approximately 100m thick and is bounded by a well-developed Hangingwall shear of up to 10m thick and the Footwall shear which is up to 5m thick (Figure 14-4). The shears typically manifest as dark-grey, fine grained, micaceous, graphitic schists with local development of cataclasite, particularly towards the top of the hanging wall shear. Shearing intensity is highly variable, as is associated silicification, quartz veining and brecciation.

Zones of sheeted veins, in which individual veins are discontinuous and steeply dipping, are a common feature at Round Hill. These veins commonly strike northeast and dip predominantly to the north. Vein thickness varies from one millimetre to one metre. Large veins can be traced for up to 100m along strike and 10m down-dip but are typically less than 10m long. Vein textures range from massive milky quartz to finely laminated milky quartz and dark-grey quartz, with rare scheelite mineralisation.

The geometry of the mineralized shears is strongly controlled by large lenticular bodies of weakly to un-mineralised psammite, the shears being most thickly developed along the lower margins of the psammite lenses. Psammite lenses typically have dimensions in the order of >250m north-south, 100m east-west and 30-40m vertically. Thick zones of strongly developed mineralisation are also developed around the western terminations of the lenses, in what are interpreted as zones of pressure shadow. Low angle extensional faulting has contributed to the present disposition of ore, but these structures elude interpretation at the resource drilling scale.

Mapping and dating studies completed in the Round Hill Pit during production have identified a number of important structural features that elucidate the mineralisation history of the HMSZ. The north dipping quartz vein arrays appear to have been the first mineralised structures developed. The quartz vein arrays are crosscut by later concordant shears and ramp veins and are approximately 145 million years (Ma) old. A similar age for quartz veins in the Hangingwall shear indicated that through-going movement had begun to occur at this time, although a proto-Hangingwall may have developed earlier than this. As displacement continued and became more localised, flat or concordant shears formed within the Intrashear package. The concordant and ramp veins have been dated at 135 Ma.

Over most of its extent, the Hangingwall shear can be delineated and wireframed via a combination of logged geology and gold proxy (approximately 0.4 g/t Au cut-off). Below the Hangingwall however, the shear contacts tend to be more difficult to delineate, particularly with RC chip logging, so in many cases the wireframe interpretations use gold grade as a proxy for defining mineralized lodes. The intensity and continuity of these shears below the Hangingwall decreases to the south of 15,000mN (southern Round Hill) to the point where, south of 14,800mN, the wireframe interpretation, based on resource drilling becomes impractical.

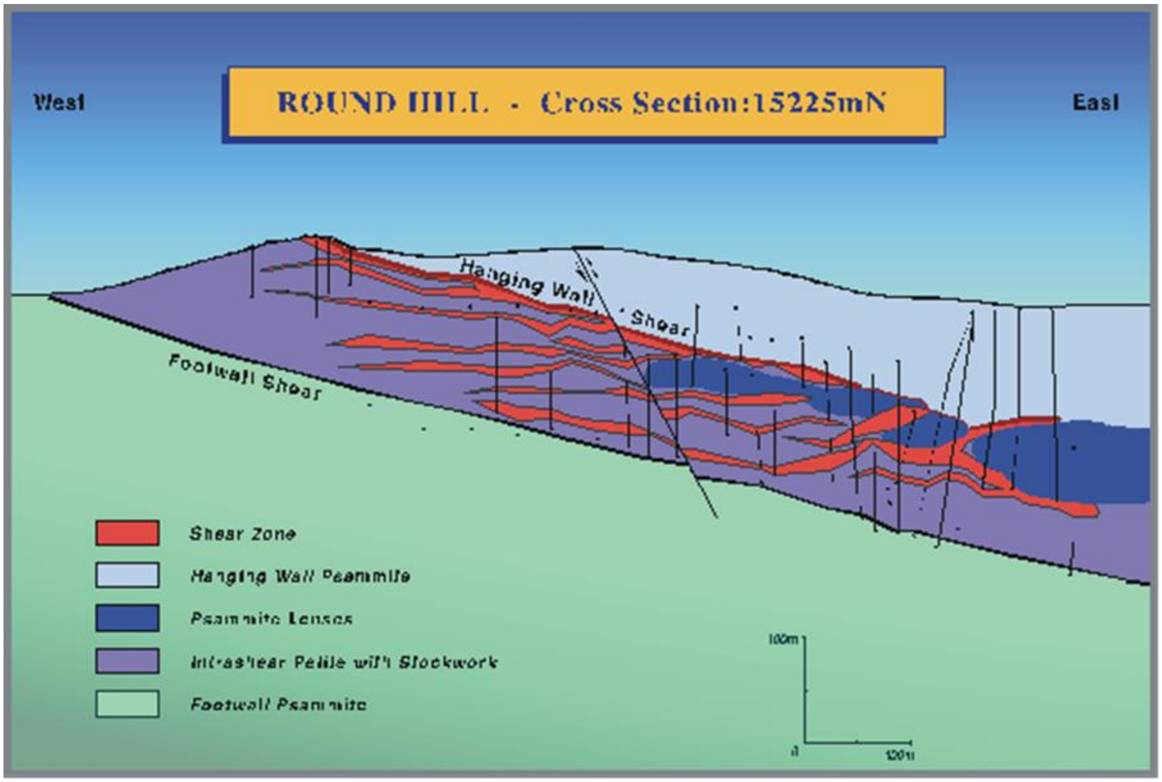

Figure 14-4: Round Hill Schematic Cross-section

Gold Resource Estimate

The current resource estimate is based on the simplified geological interpretation completed in December 2019.

- Resource estimate completed December 2019;
- Drill spacing 25m in the core out to 50m on the periphery;
- Holes prefixed RCH, RCD, DDH and DDW used. 14 RCH drill holes excluded due to concerns about contamination and smearing of grade;
- The geological wire frame interpretation consists of 3 Hanging Wall domains, 10 lode domains and 2 quartz vein array / subsidiary shear domains. The domains on a combination of fault-offsets, orientation (west, east or flat dipping) and grade;
- For estimation purposes these domains are simplified to 8 domains comprising 3 Hangingwall domains, 3 lode domains and 2 quartz vein arrays / subsidiary shear domains;
- MIK used for the estimation;
- Part of the Round Hill / Golden Point pit will be mined by underground methods. As a result, the open pit resource has had 2.34 Mt @ 2.59 g/t Au for 195koz of underground resource excised; and
- The open pit resource is reported within a NZD2,394 optimised shell. Prior to Whittle optimisation, the open pit model was depleted for the proposed underground mine.

The current pit optimisation at NZD2,394 is drilling limited. Step-out drilling would allow evaluation of a potential cut back. The current resource as at the 30th June 2020 at a 0.3g/t cut-off grade is shown on Table 14.9.

Table 14.9: Round Hill Gold resource @ 0.3 g/t Au cut-off

Category	Tonnes (Mt)	Grade (g/t Au)	Contained Gold (koz)
Measured	8.72	1.25	350
Indicated	44.23	0.82	1,162
Measured & Indicated	52.95	0.89	1,512
Inferred	11.62	0.65	242

Mining & Reconciliation

The mining reconciliation history at Round Hill-Golden Point is complex due to:

- Changing cut-off grades from 1.0 g/t Au to 0.5 g/t Au over the course of mining the Round Hill and to a lesser extent the Golden Point Pit; and
- Change in grade control practice from polygonal grade control to using conditional simulation.

As a result, the reconciliation for the Round Hill and Golden Point areas was restricted to a period when the mining cut-off grade was 0.5g/t Au for the entire mining volume reconciled. This analysis validated the resource estimates within acceptable limits.

Relevant Factors

- Proximity to the processing plant and potential for renewed movement along the Footwall Fault currently affects the mining of this resource;
- Mining the entire resource will require the relocation of the processing plant and the mixed tailings dams;
- Tungsten metallurgical studies are underway to determine if tungsten as a by-product (or coproduct) of gold mining is economically feasible;
- In the deeper sections of Round Hill some RC drill holes were sampled under wet conditions. Historically at Macraes, wet RC sampling has resulted in positively biased samples and / or down hole contamination. To mitigate this risk, 14 holes were removed from the drilling database and wet sample grade bias factors, derived using a set of diamond twined holes, were applied. This process has been applied successfully at Innes Mills and Frasers which also at depth suffered from wet sample bias. As a result, the residual resource estimation risk for Round Hill is now considered to be low; and
- The current pit optimisation at NZD2,394 is drilling limited. Step-out drilling would allow evaluation of a potential cut back.

14.3.16 Innes Mills

Background

The earliest prospecting shaft and adit is thought to date back to around 1900 (Hamel, 1991) with report of an "80 ft" shaft and "150 ft" drive. From 1915 the landowner, Mr. A. Innes, worked the property in partnership with others. Mining via shafts, adits or small open cuts continued intermittently until 1944. No records of production have been located.

OceanaGold and its predecessor company Macraes Mining, mined the area as an open cut from 1996 to 2004 producing 8.11 Mt @ 1.58 g/t Au for 0.41 Moz. The open cuts were then backfilled. A small extension, Innes Mills West, was mined in 2016 and was backfilled to allow realignment of the Macraes-Dunback road to cross it.

From 2004 to 2014 only a limited amount of drilling was carried out at Innes Mills. In 2005, 2011 and 2012 small drilling campaigns tested for extensions down-dip of the mined-out pit. Drilling resumed at the end of 2014 and continued in 2015, defining the Innes Mills West resource, subsequently mined in 2016. The last drilling campaign was in 2017, mainly targeting quartz vein arrays / subsidiary shears in the west wall of the mined-out pits.

Geology & Mineralisation

Innes Milles has been interpreted as a set of stacked mineralised structures as shown on Figure 14-5.

The geology of Innes Mills is further complicated due the interaction of three faults; the Northern Gully Fault (NGF), the Innes Mills fault, which is interpreted as a splay of the Macraes Fault, and the Macraes Fault.

The Hangingwall, as shown in red, north of 13,150mN is interpreted as a 4 to 10m thick, 15 to 20° east-dipping structure until it intersects the north south trending Northern Gully Fault (NGF) at about 70,075m east. On intersecting the NGF, the Hangingwall rapidly thins to 1m and can be traced a further 100m to the east. From 13,200mN to 13,800mN, a 2 to 6m thick concordant lode is developed 40m below, and is subparallel to, the Hangingwall. Between the Hangingwall and the concordant lode is a zone of quartz vein arrays and subsidiary shear mineralisation which is interpreted to be a result of differential movement directions on the two structural features. 40m below the concordant load is a second concordant lode, again with quartz vein arrays and subsidiary shear mineralisation developed between the two features. The mining of Innes Mills Stage 4, shown in grey on Figure 14-5 confirmed this geological interpretation.

A unique feature of Innes Mills was a volume of quartz vein array mineralisation above the HW shear. All this mineralisation has now been mined out.

All the structures south of 13,150mN are cut by the 050° striking Innes Mills fault. Approximately 150m to the south is the Macraes Fault Zone which truncates all the mineralised structures. The Macraes Fault Zone is a 100m wide, east west trending fault zone and is also used as the boundary between the Innes Mills resource area and the Frasers Resource area.

The differential movement in both the vertical and horizontal planes between the two faults has caused both the Hangingwall and the concordant lodes dip to be steepened to between 30° to 45° and for the strike to be progressively rotated into an east – west orientation.

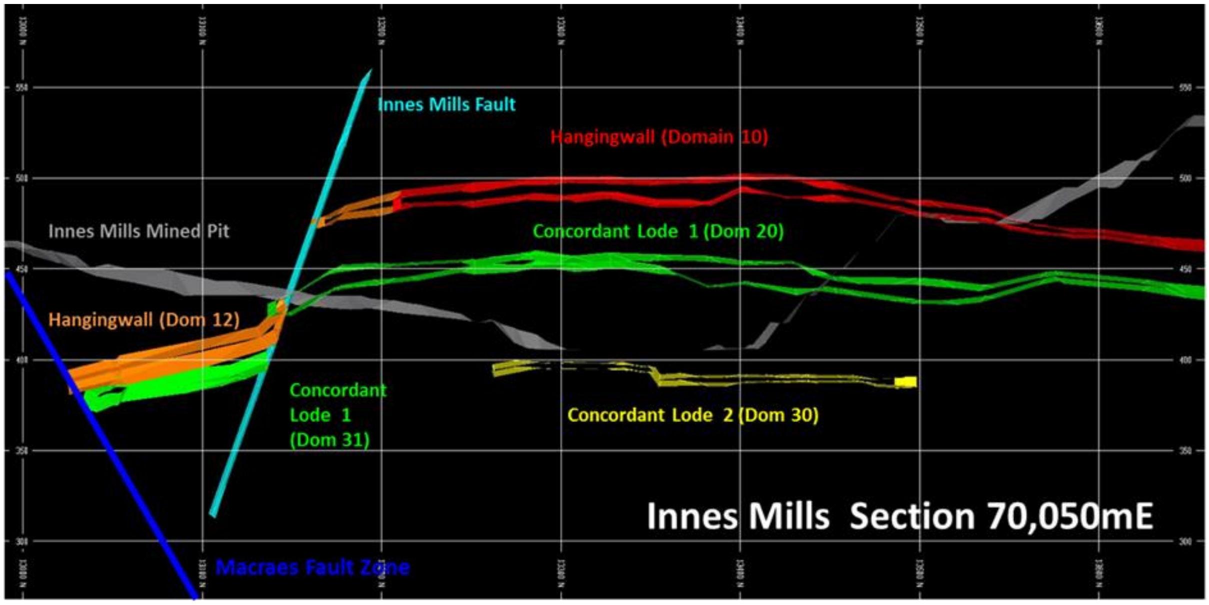

Figure 14-5: Innes Mills Schematic Long-section

Gold Resource Estimate

The last resource gold only estimate was completed in 2017. There are 6 lode domains and 2 quartz vein arrays / subsidiary shear domains.

- Resource estimate completed October 2019 for gold only;
- Drill spacing 25m in the core out to 50m on the periphery;
- Holes prefixed RCH, RCD, DDH and DDW used;
- Wet Bias correction factors applied to gold;
- 6 lode domains and 2 quartz vein arrays and subsidiary shear domains used; and
- MIK used for the estimation.

The Annual reconciliation for mining up to 30th June 2020 against the current resource estimates is shown in section 14.5.

The current resource as at the 30th June 2020 at a 0.3 g/t Au cut-off grade is shown in Table 14.10.

Table 14.10: Innes Mills Resource @ 0.3g/t Au cut-off

Category	Tonnes (Mt)	Grade (g/t Au)	Contained Gold (koz)
Measured	2.53	1.07	87
Indicated	17.20	0.72	398
Measured & Indicated	19.72	0.76	485
Inferred	9.61	0.52	161

Relevant Factors

The re-location of the Macraes-Dunback road across the northern end of the resource is near completion and will enable the mining of the southern end of the resource. A further road re-alignment will be required in the future to allow the mining of the northern third of the resource.

Like Frasers and Round Hill, in the deeper sections of Innes Mills, some RC drill holes were sampled under wet conditions To mitigate the potential for wet sample bias 18 diamond twin holes were completed and a set of gold grade factors generated for factoring wet RC sample grades. The 18 RC holes twinned by diamond holes where excluded from the resource estimate. Mining in stages 3 and 4 mined out some of the areas drilled with wet RC and based on an acceptable reconciliation was achieved. As a result, the residual resource estimation risk for Innes Mills is considered low.

The current pit optimisation at NZD2,394 is drilling limited. Step-out drilling would allow evaluation of a potential cut back.

14.3.17 Frasers West

Background

The Frasers Underground and Frasers open pit surface infrastructure currently sit above an area of quartz vein array and subsidiary shear style mineralisation that extends from the edge of the Frasers pit toward the Macraes Fault. All the infrastructure is scheduled to be relocated by the end of 2021 and together with the re-location of the Macraes-Dunback will make this block assessible for mining.

Drilling of this area on a 100m spacing was completed as part of the initial drill-out of Frasers. Infill drilling to 37.5 and 50m was completed during 2017.

Geology & Mineralisation

The mineralisation at Frasers West consists of high angle quartz vein arrays and rare concordant veins that are below the Hangingwall and are hosted within pelitic Intrashear schist down to the Footwall Fault. As is typical for this style of mineralisation, the distribution of grade is erratic.

Resource Estimate

- Completed in 2017;
- Drill hole spacings 37.5 or 50m; and
- MIK used for the estimation.

The current resource as at 30th June 202019 at a 0.3g/t Au cut-off grade is shown in Table 14.11.

Table 14.11: Frasers West Resource @ 0.3g/t Au cut-off

Category	Tonnes (Mt)	Grade (g/t Au)	Contained Gold (koz)
Measured	2.47	1.04	83
Indicated	8.21	0.70	186
Measured & Indicated	10.68	0.78	268
Inferred	3.76	0.56	67

Mining & Reconciliations

Mining in Frasers West has not yet commenced and so no reconciliation is available, Reconciliation performance for similar style mineralisation in the adjacent Frasers and Gay Tan open pits, however, reflects a tendency for the resource estimates to underpredict contained metal.

Relevant Factors

- The re-location of the Macraes-Dunback road and the Frasers surface infrastructure need to be completed before any mining can occur at Frasers West. This should be completed by Q4 2020; and
- The west wall of the Frasers pit is moves incrementally on a combination of the Footwall Fault and the Macraes in response to mining activity Fault. Frasers West mining is expected unload these structures and movement is expected to decrease.

14.3.18 Frasers – Gay Tan

Background

Mining in Frasers pit commenced at the end of 1998 and it was a significant source of mill feed until 2014. As the pit deepened failure along the Footwall Fault plane was observed and monitoring stations were installed. In January 2013 the block on the west wall within the pit failed, temporarily preventing access to FRUG. Mining resumed and increasing movement along the Footwall fault occurred. In April 2014 a major failure occurred along the entire west wall and resulted in material slumping and pushing up against the east wall of the Frasers pit. Mining was stopped and a Prohibition Notice placed by Worksafe NZ. At the end of June 2014, the Prohibition Notice was partially lifted allowing mining of FRIM on the northern edge of the slip and a small pit on the southern boundary of the slip. However, access was precluded to the bulk of the slumped material, estimated to contain 400kozs of gold. By 2018 the combination of successful mining and continual monitoring showed that slumped material was stable enough to allow mining to safely resume. An evaluation of the slumped material identified potential mineralised areas that could be mined safely but as the material had moved significantly, the entire area required re-drilling. A major RC drilling programme commenced in January 2019 and continued through to the end of September 2019. This enabled stage 1 of the newly named Gay Tan pit (within the larger Frasers pit) to be designed and mining commenced in July 2019. Further drilling in two stages has been completed in 2020 to complete the drill-out of Gay Tan stages 2 and 3.

Geology & Mineralisation

The Frasers open pit deposit is defined by the Hangingwall shear. In outcrop, the shear dips 15° to 20° to the east and is ~5 m thick. At depth, the dip of the shear flattens to around 5° to 10° and develops into a ~20m to 30m thick high-grade zone of quartz cataclasite and lode schist. This interpreted ramp-flat geometry is relatively common at Frasers.

Within the Frasers pit, gold mineralisation comprises a combination of Hangingwall shear, shear-parallel quartz veins, and quartz vein arrays and subsidiary shears. Hangingwall shear and quartz vein arrays comprise the majority of mineralisation within the Frasers pit, although there are several shear-parallel quartz veins. These veins typically splay off the Hangingwall and dip at between 5° and 10° to the east. A large amount of erratically developed mineralisation occurs between the base of the Hangingwall and the Footwall Fault. This is quartz vein array and subsidiary shear mineralisation and generally presents as clusters of elevated gold grades that appear discontinuous at the resource drilling scale. The Footwall Fault lies between 80m and 120m below the Hangingwall Shear and is easily identified in drill holes as a 10m wide zone of shearing. To date, no economic mineralisation has been located below the Footwall Fault.

Gold-scheelite-pyrite-arsenopyrite mineralisation is associated with replacement and fissure quartz veins within D4 post-metamorphic shear zones (Lee et al. 1989). Within the Frasers pit scheelite mineralisation is predominantly found in proximity to the Hangingwall shear. It is associated with gold mineralisation, associated quartz veining, and displays complex crosscutting relationships.

At Gay Tan the mineralisation is pre-dominantly quartz vein array and subsidiary shear style but with remnants of HW lode towards the bottom of the Frasers pit.

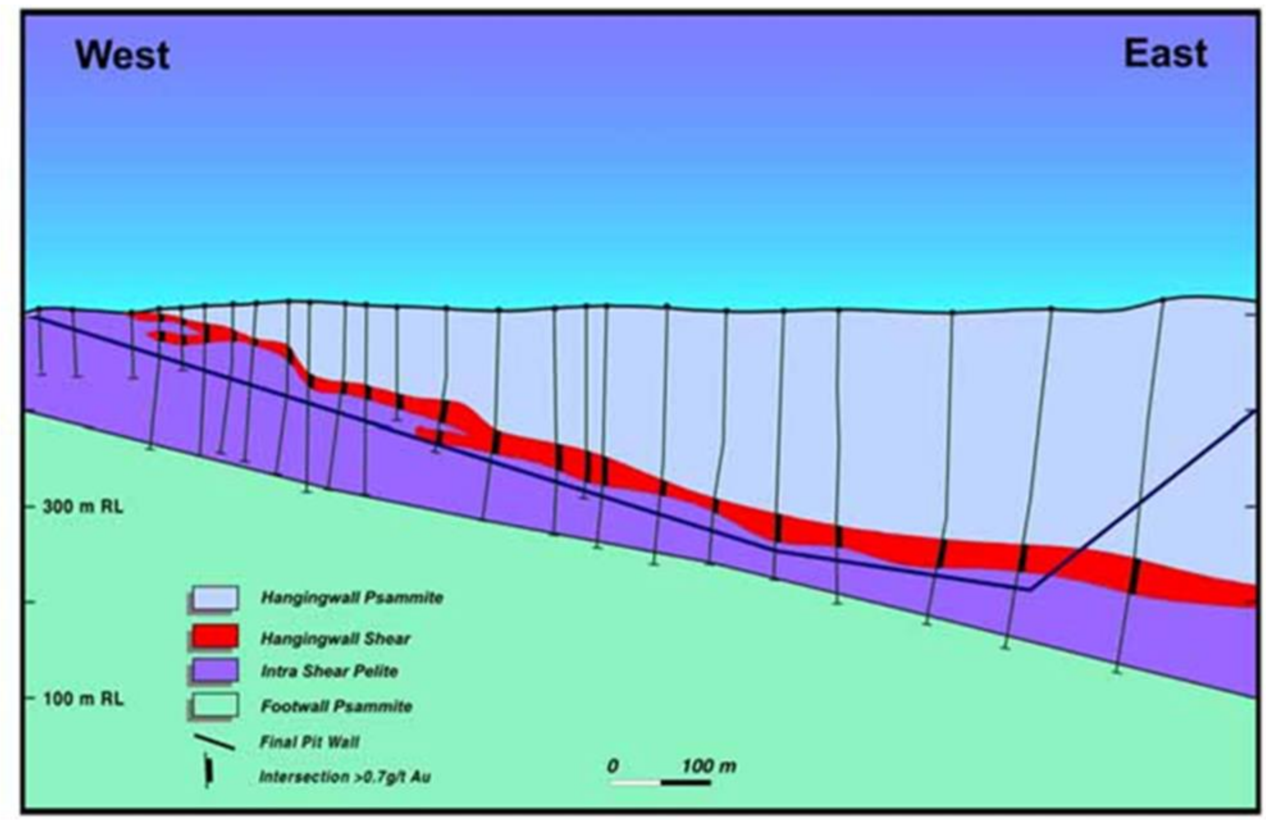

Figure 14-6: Fraser Pit Schematic Cross-section

Resource Estimate

- Completed in May 2020 following completion of the first stage of drilling;
- Drill spacing 25m or 37.5m;
- DDH, RCD, RCH and RCL prefixed holes used in the estimate. The 2019-2020 drill holes are angled at various dips and orientations due to access difficulties on the slip face;
- 2 metre composites used;
- 1 domain; and
- MIK used for the estimation.

The Annual reconciliation for mining up to 30th June 2020 against the current resource estimates is shown in section 14.5.

The current resource as at 30th June 2020 at a 0.3g/t cut-off is shown in Table 14.12.

Table 14.12: Gay Tan Resource @ 0.3g/t Au cut-off

Category	Tonnes (Mt)	Grade (g/t Au)	Contained Gold (koz)
Measured	2.98	0.57	55
Indicated	10.81	0.54	188
Measured & Indicated	13.79	0.55	243
Inferred	1.04	0.65	22

Relevant Factors

The current resource estimate will be updated to include the 2020 Stage 2 drilling completed in May/June 2020.

Continuous monitoring of movement at Gay Tan is in place. Further geotechnical evaluation is required before mine designs will be finalised.

14.3.19 Ounce

Background

The first recorded mining activity at Ounce dates to 1898 but alluvial mining in the creek bed may have occurred as early as 1862. Mining by various parties continued intermittently until 1952.

The area was first drilled by BP Minerals (NZ) Ltd in 1985. Macraes Mining Company followed in 1994 and 1997. The last campaign was by OceanaGold in 2010/2011. Only 3 diamond holes have been drilled (1985 and 1994). No metallurgical test work has been completed.

Geology & Mineralisation

The Ounce deposit lies along HMSZ, to the south of Frasers. The Ounce structure is a low angle thrust zone with an unusual orientation for the HMSZ, dipping 28° towards the southeast and cross-cutting dominantly psammitic schists. The main package is bound by a weakly mineralised cataclastic upper concordant shear with another mineralised horizon located approximately 30m structurally above this zone. Mineralisation is hosted by concordant, sigmoidal and rare quartz vein arrays. Sigmoidal veins merge with, and are truncated by, concordant structures providing evidence of repeated cycles of vein formation/activation.

Resource Estimation

The last resource estimate was completed in 2017. A schematic cross-section showing the domains used is in Figure 14-7. Domain 20 is the lode domain and is defined by a 0.2 g/t cut-off. Scattered mineralisation does occur outside this zone.

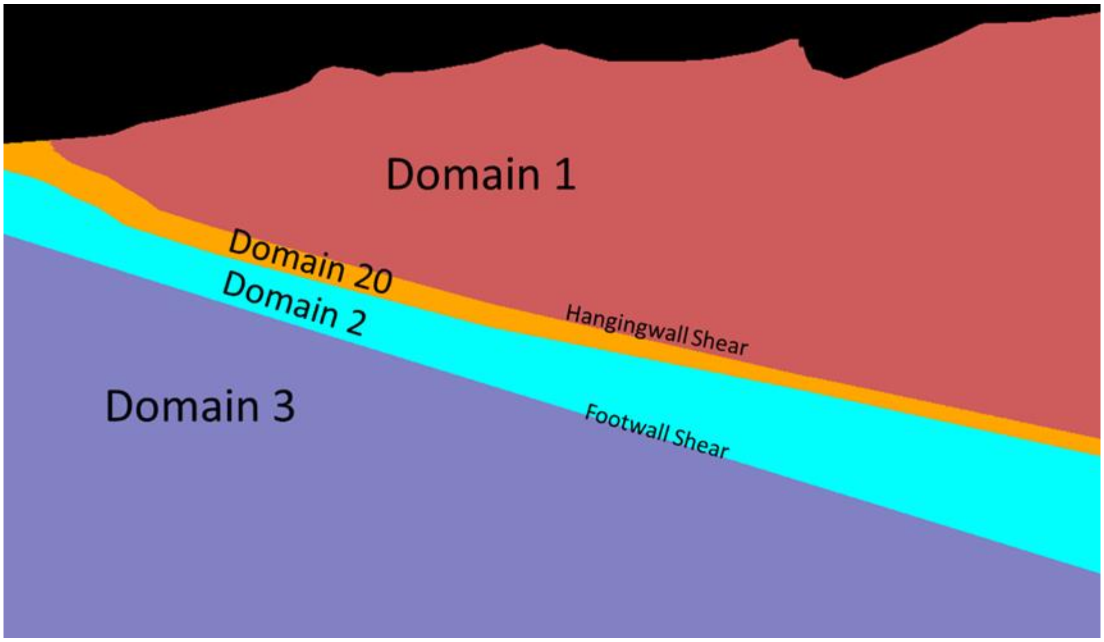

Figure 14-7: Ounce Schematic Cross-section with 2017 Resource Domains

- Drill spacing 50m;
- OK estimation was used with search distances of X, Y =75m, Z = 5m;
- Only RCH, RCD and DDH prefixed drill holes used in the estimation;
- A gold top cut at the 97.5 percentile was applied. This was 2.6 g/t Au gold for domain 20; and
- Entire resource is classified as inferred.

The current resource as at 30th June 2020 at a 0.4g/t Au cut-off grade is shown in Table 14.13.

Table 14.13: Ounce Resource @ 0.4g/t Au cut-off

Category	Tonnes (Mt)	Grade (g/t Au)	Contained Gold (koz)
Measured	-	-	-
Indicated	-	-	-
Measured & Indicated	-	-	-
Inferred	0.76	0.75	18

14.3.20 Relevant Factors

While OceanaGold owns the land on which the resource is located, OceanaGold does not currently hold the necessary resource consents to mine this resource.

14.3.21 Golden Bar

Background

The Golden Bar resource area is centred on the small historic Golden Bar workings, approximately 9km south of Macraes. These were worked at various times from 1889-1942, producing approximately 5,000 oz and a minor amount of scheelite.

The area was drilled initially by BP Minerals (NZ) Ltd in 1985 and then by OceanaGold from 1994-1997. The main drilling phase was completed in 1997 with drilling on 25x25m centres. During 2002 several RC and diamond holes were drilled to twin previously drilled wet RC percussion holes.

The current resource model, GB02a, was built in November 2002 and has been used for all subsequent resource reporting.

OceanaGold mined Golden Bar from February 2004 to October 2005. The open cut yielded 1.74Mt @ 1.72 g/t Au for 0.096Mozs at a 0.5 g/t Au cut-off grade for oxide ore and a 0.7 g/t Au cut-off grade for sulphide ore.

Geology & Mineralisation

The Golden Bar deposit lies to the south of Frasers.

The current interpretation has the Golden Bar prospect lying some 400m vertically above the interpreted position of the HMSZ Footwall Fault and located within the Hangingwall psammites. By this interpretation Golden Bar is grouped with the Eastern Lodes, which outcrop 2-3km to the east of the main shear zone. The main shear zone thins to the south of the Ounce deposit, which is coincident with the start of the Golden Bar shear zone.

An alternative interpretation has the Hangingwall Lode at Golden Bar is in the same structural position as the Hangingwall lodes seen at Ounce and further north and may be an offset of this main lode system. Doyle and Stewart (1997) suggested that the main Hangingwall Lode at Golden Bar lies at the contact between psammitic schist above and pelitic schist which is a typical Hangingwall lode position.

Two distinctive structural styles have been identified at Golden Bar:

- Concordant lodes which anastomose and are generally thinly developed, and
- sigmoidal vein structures. The sigmoidal veins are strongly mineralized and dominated by quartz veining. These structures link between the upper and lower concordant lodes.

The concordant lodes vary in style from thin (<1m) discrete cataclastic shears to thick (15m) quartz rich lode schist. South or south-easterly dipping shears are generally thin, highly sheared, while flat or northerly dipping shears are thick, strongly mineralized and show evidence of extension.

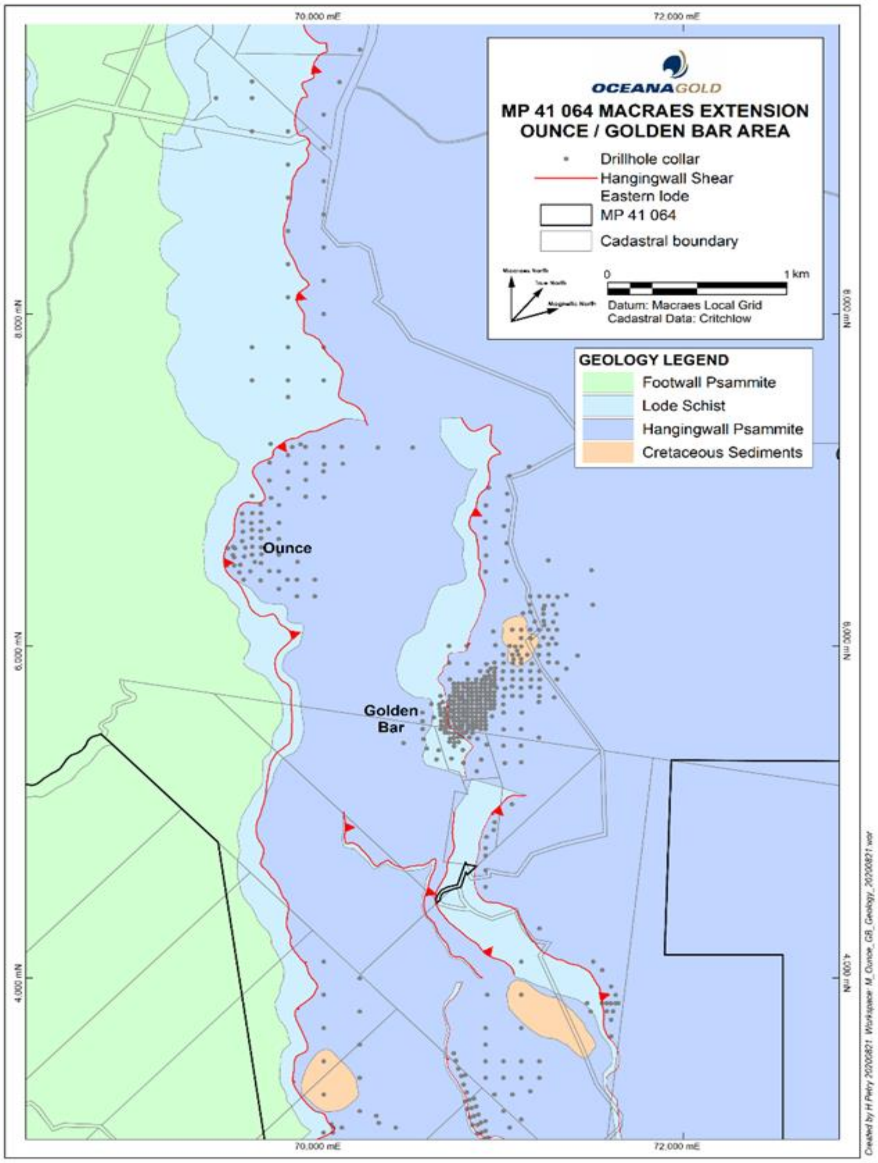

Figure 14-8: Ounce and Golden Bar Geology and Deposits

Two major shears are present as illustrated in Figure 14-9. These structures are 40m apart at surface but converge into a single structure at depth with the line of intersection trending northeast. The lower shear to the west of this splitting is thickly developed and strongly mineralized. The rock between the shears contains several sigmoidal extension veins. Although no gross lithological differences could be clearly identified from logging, it is likely that this rock is more competent than the surrounding rock mass and has accommodated deformation by brittle extension, thus creating sites for development of the sigmoidal veins.

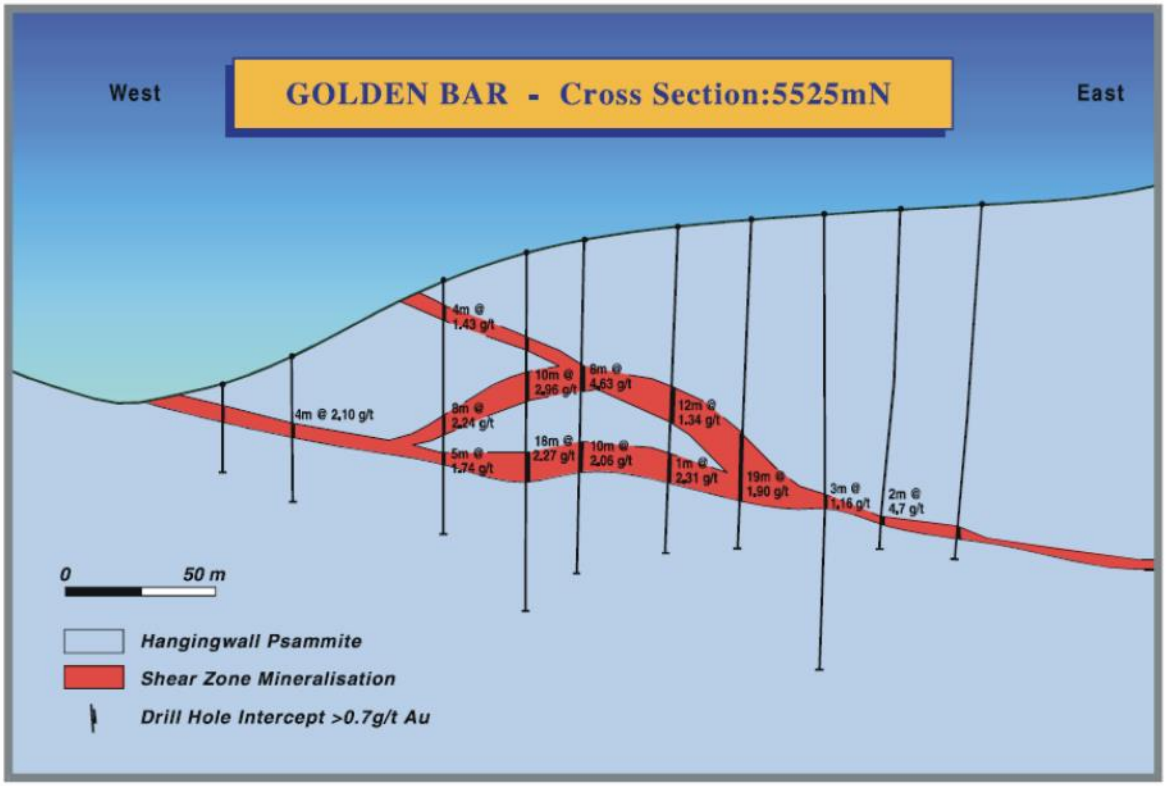

Figure 14-9: Golden Bar Schematic Cross-section

The sigmoidal vein packages have a curved tabular geometry, striking to the northeast and dipping to the northwest at around 25°. The vein dip is steepest (and most dilatational) where the intra-shear distance between upper and lower concordant structures is larger. In areas where these structures converge, the sigmoidal veins are more concordant.

The sigmoidal veins were the target of historic underground mining. All accessible mine workings have been mapped in detail and the observations included in interpretation of the geological wire frame.

Resource Estimate

The last resource estimate was GB02a, which was completed in 2002 before mining commenced.

The current resource as at the 30th June 2020 is based on the unmined GB02a resource estimate constrained to an optimised pit shell at an NZD$2,394 price and is shown on Table 14.14.

Table 14.14: Golden Bar Resource @ 0.4 g/t Au cut-off

Category	Tonnes (Mt)	Grade (g/t Au)	Contained Gold (koz)
Measured	0.09	1.54	4
Indicated	1.21	1.35	52
Measured & Indicated	1.30	1.37	57
Inferred	4.31	1.33	183

Mining and Reconciliation

Golden Bar was mined by open pit from February 2004 to October 2005. A total of 1.74Mt @ 1.72 g/t for 0.096Mozs was mined at a 0.5 g/t cut-off for oxide ore and 0.7 g/t cut-off for sulphide ore.

A reconciliation report was completed following mining (see Redden & Moore (2010) for details).

- The report found the resource estimate under-called the tonnes by 17%, over-called by grade by 3% for a net under-call of contained gold by 12%.

Relevant Factors

- The resource estimate needs to be re-estimated so that it can be reported at 0.3g/t Au cut-off grade;
- A review of the wet sample bias factors needs to be completed as part of the resource update;
- Most of the land under MP41-064 is owned by OceanaGold, however but the land to the east of the Golden Bar road as shown on Figure 14-8 containing the resource extension is privately owned. OceanaGold does not have an access agreement/option to purchase on this land; and
- A further cut-back at Golden Bar would require the Golden Bar public road to be re-located and an application for resource consents to mine.

The current pit optimisation at NZD2,394 is to a degree drilling limited. Step-out drilling would allow evaluation of a potential cut back.

14.3.22 Taylors

Background

The Taylor's gold deposit is one of several small gold deposits found at the southern end of the Hyde-Macraes Shear Zone. Other deposits include Wilsons North and South, Shaws and Home Reef and these are referred to collectively as the Stoneburn Resource Group.

A few historic workings are present but there is no record of production.

BHP drilled 14 shallow percussion holes in the 1980s from Home Reef down to Taylors. Between1994 and 1999, Macraes Mining Company drilled 29 RC holes in the Stoneburn area including Taylors. In 2003, 39 RC holes were drilled at Taylors on a 25m spacing.

No diamond drilling or metallurgical test work has been completed at Taylors.

Geology & Mineralisation

Aldrich (2003) describes the mineralisation at Taylors as two sub-concordant mineralised shears ("lodes") that are thought to be the southern extension of the Home Reef and Golden Bar structures.

The upper lode is 1-3m thick and lies 25-30m above the lower lode. The lower lode is more extensive and thicker (up to 8m). There are no indications that these 2 shears link as at Golden Bar. The shear zones strike 350 degrees and dip 12-20 degrees to the east. An NNE plunging ore shoot on the lower lode has been identified and remains open at depth. Mineralisation in the shear zones is dominated by quartz veining with minor arsenopyrite and pyrite. The few tungsten assays available indicate some scheelite is present (up to 1.46%W recorded in assay). No quartz vein array mineralisation has been identified below the lower zone.

Resource Estimation

The lode mineralised zones were defined based on a 0.2 g/t Au cut-off grade and a minimum 2m mining width. Each drill interval had to include at least 1 metre of waste below the 0.4 g/t Au economic cut-off grade.

Surfaces were created for both the upper and lower lodes and for the surrounding schist and oxide zones and these were used to construct the lode solids for coding. The interpretations were in general extended 25m beyond the last drill hole or halfway to next drill hole if that hole was unmineralised.

A schematic cross-section is shown in Figure 14-10.

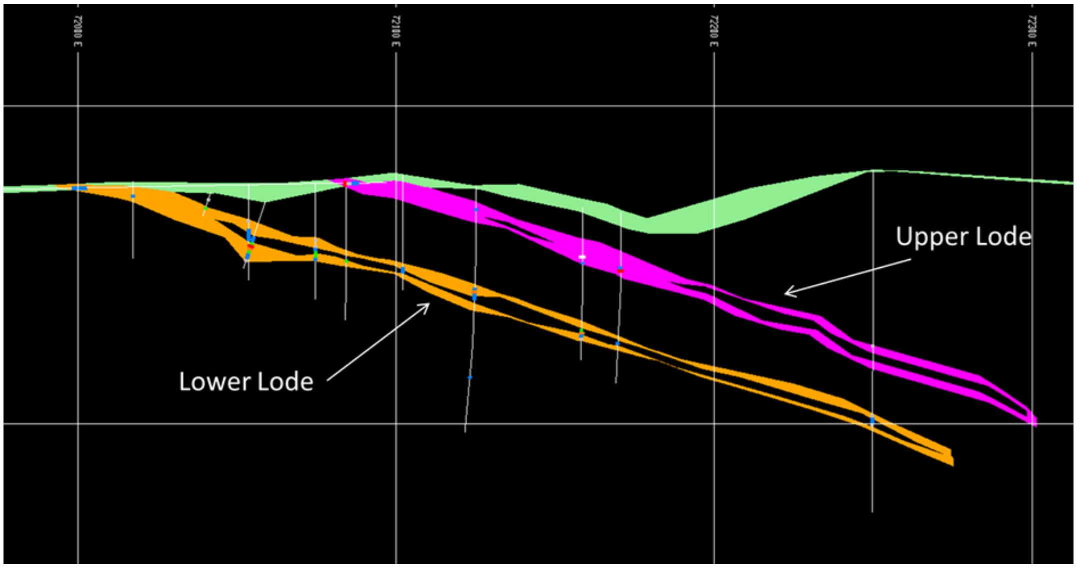

Figure 14-10: Taylors Schematic Cross Section – line 1400mN

- Drill spacing 25m to 50m;
- Only RCH prefixed holes used in the estimation;
- Top cut of 8 g/t Au applied affecting 6 assays; and
- OK estimation with search distances of X, Y = 50m, Z = 5m.

The current resource as at the 30th June 2020 is shown in Table 14.15.

Table 14.15: Taylors Resource @ 0.4g/t Au cut-off

Category	Tonnes (Mt)	Grade (g/t Au)	Contained Gold (koz)
Measured	-	-	-
Indicated	0.23	0.84	6
Measured & Indicated	0.23	0.84	6
Inferred	0.43	0.76	11

14.3.23 Stoneburn Group

Background

The Stoneburn group refers to five small gold resources in the Stoneburn area: Wilsons North, Wilsons South, Home Reef, Shaw's and Shaw's South as shown on Figure 14-11.

Historic mining in the area is generally limited to pits, trenches and adits along strike of the lode traces with minor alluvial workings throughout.

Production records from the Stoneburn area are poor. In 1902, 60 tons of quartz from the “Stoneburn Mine” was crushed and returned 4.2 g/t gold. Between 1915 and 1917 a further 2,264 tons of quartz was treated returning 1.7 g/t gold. Apparently mining ceased in 1917 as the gold grade was too low and only scheelite was worth recovering. The location of the “Stoneburn Mine” is not known but was probably the combined workings of Wilsons and Shaws (Aldrich 2003).

BHP conducted percussion drilling from 1988 to 1989 along the strike of the lodes targeting the shallow areas of the lodes (<20m) with 25m drilling traverses across the trace of the lode spaced 50m apart. In 1996 and 1998 RC drilling by OGL tested the deeper sections of the lodes (up to 200m) on a 100m x100m drilling grid, with localised 50m x 50m infill. There is no diamond drilling and no metallurgical test work was completed.

Geology & Mineralisation

Mineralisation in the Stoneburn resource area is associated with shallow east-dipping shears, slightly oblique to the regional penetrative schistosity. These structures consist of four concordant shears within a 450m package of finer grained schists forming the southern continuation of the HMSZ Zone.

The Wilson’s Lode structures has been mapped through scattered shallow pits and adits, outcrops and float of mineralised quartz, cataclasite and sheared pelitic schist for 8km. The Wilson’s Lode is thought to be the extension of the Hangingwall shear from Ounce to the north and extends to the south until it is obscured by overlying sediments. The Footwall Fault is interpreted to lie immediately below the lower Lode structure at Wilsons (Bleakley, 1996, Aldrich, 2003). At least two lodes are present with potentially more concordant lodes at the northern end of the Wilsons North area.

Shaw’s Lode and Shaw’s Lode South consist of structures hosted by narrow semi-pelitic to semi-psammitic units 1.50km east of the Hangingwall-Footwall contact. The Home Reef structure is thought to be a continuation of the Golden Bar structure and extends over a strike length of 3.3km. In places it occurs as a series of stacked lodes as at Taylor’s. Individual shears consist of quartz veins generally less than 1m thick within concordant lode structures from 1 to 7 metres thick. The Shaw’s Lode, a single concordant shear from 1 to 5 metres thick, has a strike length of at least 4.5km.

Two styles of mineralisation are evident at Stoneburn: quartz veins up to 1 m thick within concordant lode structures up to 8m thick and broad zones of shearing with associated mineralized quartz, cataclasite and lode schist situated above the Footwall fault on the Wilsons lode structure.

Gold-scheelite-pyrite-arsenopyrite mineralisation occurs within the lode structures. Silicification is the dominant form of alteration. As a rule, the higher the lode quartz content, the stronger the gold mineralisation. Argillic alteration is present within lode schist associated with quartz veining.

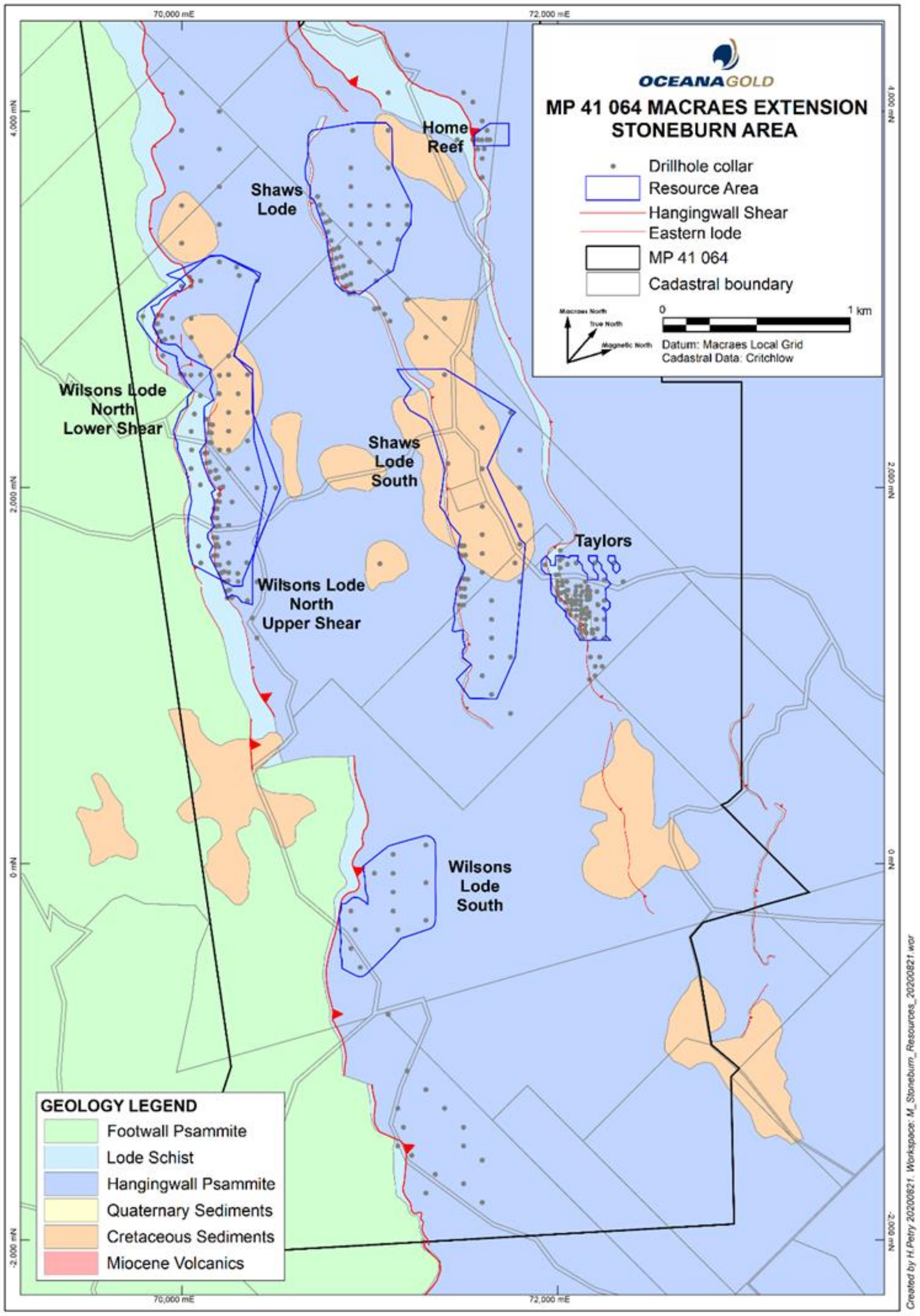

Figure 14-11: Stoneburn Geology and Deposits

Resource Estimation

The lode zones were based on a combination of lithology and a 0.2 g/t gold cut-off. All the drill holes were used in the interpretation but only RCH prefixed holes were used in the resource estimation.

- Drill spacing generally 100m;
- Only RCH prefixed holes used in the estimation;
- Top caps applied at the 97.5 percentile (gold grades 2.5-5g/t Au); and
- OK estimation with search distances of X, Y=150m, Z = 5m.

The current resource as at the 30th June 20201 at a 0.4g/t cut-off grade is shown in Table 14.16.

Table 14.16: Stoneburn Resources @ 0.4 g/t Au cut-off

Area	Category	Tonnes (Mt)	Grade (g/t Au)	Contained Gold (koz)
Wilsons North	Inferred	0.48	0.75	12
Wilsons South	Inferred	0.51	0.71	112
Shaws	Inferred	0.27	0.71	6
Shaws South	Inferred	0.13	0.60	3
Home Reef	Inferred	0.05	0.81	1
Total		**1.44**	**0.72**	**33**

Relevant Factors

The Stoneburn deposits are small shallow resources with a high proportion of oxide ore.

No resource consents have been applied for to mine the Stoneburn resources. The resources at Stoneburn are covered by privately owned properties. OceanaGold does not have access agreements with options to purchase for these properties. OceanaGold is not currently in negotiation to secure access or purchase options for these properties.

14.4 Underground Mineral Resource Estimate

14.4.1 Drillhole Database

Drill holes are extracted from both the surface and underground databases.

Drill holes with DDH, DDW, RCD or RCH prefixes from the surface drilling database are extracted and used. Drill holes with a UDH prefix or channel samples (“CH” prefix) in the Frasers underground drilling database are extracted and used. Some RC drill holes with prefixes may be excluded, usually due to suspected contamination during sampling under wet conditions. These will be discussed in the individual resource estimate sections below.

14.4.2 Software Used

Up until 2019, Minesight/Compass has been used for creating the wireframes for database extraction, geologic modelling, coding and final resource reporting. As of 2019, Leapfrog software has been used to create the geologic wireframes which are the imported into Minesight for coding and final resource reporting.

Pangeos software is used for geostatistical analysis and resource estimation. The block models created are then imported into Minesight for final reporting.

14.4.3 Geologic Modelling

Domain boundaries are based on geology and structure rather than grade.

Most of the economic mineralisation is confined to the Intrashear schist. The top of the Hangingwall shear usually marks the top of the Intrashear schist and the bottom marked by the Footwall fault. Within the Intrashear schist there may be domains for the Hangingwall lode, one or more concordant lodes and zones of quartz vein arrays with subsidiary shears. Domains will vary from area to area and are discussed for the individual areas below.

14.4.4 Assay Capping and Compositing

Outliers

The underground resources are estimated using Ordinary Kriging (OK). Top caps are always applied. For gold, this varies for each domain but is usually between the 97.5 and 99 percentiles and are specified for each resource estimate in the relevant sections below.

Compositing

The raw assay data is composited to one metre lengths for resource estimation.

14.4.5 Density

A density of 2.65 t/m3 is assigned based upon average core immersion test results.

14.4.6 Variogram Analysis and Modelling

Prior to spatial analysis, the composite sample locations are flattened ("Unfolded" and "un-faulted") by assigning a relative elevation equivalent to the elevation difference of each composite midpoint to a reference surface. This is done primarily to preserve the vertical grade trends observed in the drill hole sample grades.

Variograms and resource estimations are done using the Pangeos software. Models are kriged into 10m x 10m x 1m parent blocks and subsequently re-scaled or sub-blocked into 5m x 5m x 1m daughter cells. The re-scaled models are then folded back into real space using Pangeos, exported in ASCII text format and imported into Minesight/Compass.

14.4.7 Block Model

Block dimensions are X= 5m, Y = 5m, Z =1m for all the underground block models.

14.4.8 Estimation Methodology

Ordinary Kriging (OK) was used for the underground resource estimate with search ranges of 32, 62 and 120 metres.

14.4.9 Model Validation

Model validation is like that described in Section 14.3.9.

14.4.10 Resource Classification

Frasers Underground (FRUG) Resource Estimate

Resource classifications for the FRUG resource estimates are based on a combination of drill spacing, domain, and geological limits. These are used to define shapes for each class and domain (3-8 only) in Minesight which are then used to code the Class field in the block model. As a rule, Measured resource classification requires drill spacing < 25m, Indicated resource classification 25m to 50m and Inferred resource classification > 50m.

14.4.11 Frasers Underground (FRUG) Resource Estimate

Background

The potential for the Frasers mineralisation to support an underground mining operation was first recognized in 1996 when a number of drill holes intersected locally high grades of gold mineralisation (ca. 6g/t Au) in the top 5-6 metres of the Hangingwall down-dip from the Frasers Open Pit in the area now known as Panel 1. In the following years various conceptual and scoping studies were undertaken leading to a pre-feasibility study that was completed in June 2004.

A decline commenced in the north wall of the Frasers open pit in April 2006 using Byrnecut Mining as the contractor. Development and production of Panel 1 commenced in 2007, with production from Panel 2 starting in 2008. OGL took over as owner-operator of the underground operation in 2011.The original decline was replaced by a second decline in 2016 as mining of the FRIM resource impacted on the integrity of the original portal and decline. This decline provides the current access into the underground mining operation.

Exploration drilling for resource extensions is on-going with the main phase occurring between 2009 and 2012. The remaining area of mineralisation in Panel 2 will be drilled in Q3/Q4 2020 by underground from the 2EX4 and the resource estimate updated. The mine has now entered partial retreat mode with the commencement of mining regional pillars and permeant development in Au mineralisation. Mining is currently scheduled for completion in late 2022.

Geology & Mineralisation

The mineralisation at FRUG is the down-dip extension of the Hangingwall shear mined in the Frasers open pit. There are two main areas: Panel 1 and Panel 2. Panel 1 is located immediately under and to the northeast of the current pit wall and while Panel 2 is located a further 300m to the southeast.

The geological controls for FRUG are consistent with those described in the Frasers Open Cut. The mineralisation is contained within the 80m to 100m thick intra-shear pelite, bounded by Hangingwall and Footwall psammites. Cataclasite, lode schist (concordant zones) and quartz vein arrays and subsidiary shears gold mineralisation have been identified with the highest-grade mineralisation located proximal to the hanging wall contact. In Panel 2 mining is focused along the Hangingwall Lode and a concordant lode lying approximately 10 to 20m below, called the Lower Zone.

There are also several large, steeply dipping quartz veins mined by narrow vein mining methods. The grades of these veins tend to be higher than the overall FRUG average grade of around 2-3 g/t Au.

At depth Panel 2 is truncated by the Macraes Fault zone. Attempts to locate a possible faulted offset on the other side of the Macraes Fault from surface drilling have so far proved unsuccessful.

Resource Estimation

- The most recent estimation is dated June 2020;
- Eight domains were used of which three contain the bulk of the economic mineralisation: and
- Domains boundaries are based primarily on geology as shown on Figure 14-12.

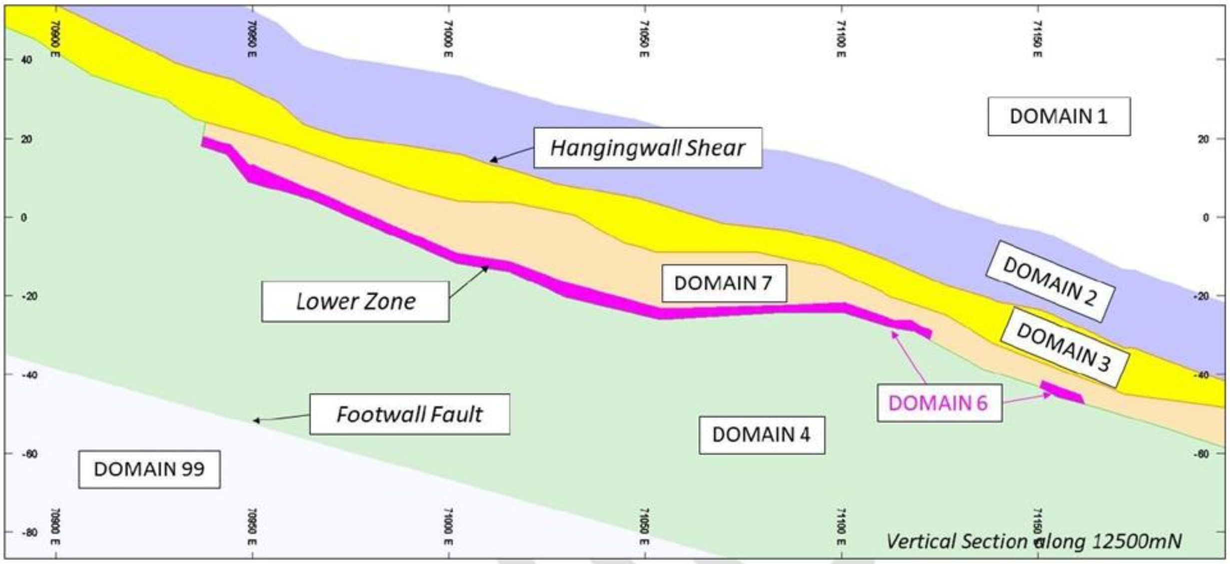

Figure 14-12: FRUG Resource Estimation Domains

- Surface holes prefixed DDH, DDW, RCD and RCH were used together with underground holes prefixed UDH and underground channel samples prefixed “CH”;
- Drill spacing varies from over 100m to <25m;
- Top caps applied at between 97.5 and 99 percentiles. Domains 2,4,5,7 and 8 top capped at 5 g/t Au, Domain 3 at 10 g/t Au and Domain 6 at 15 g/t Au; and
- OK was used for the estimation.
- The quoted resource consists of
    1. the current LOMP development and stope solids expanded by approximately 2.5m:and
    2. 100% of a resource development area at the bottom of the mine which is being drilled in Q3/Q4 2020.
    3. This results in a 30% conversion of Measured & Indicated to Proven & Probable.

The current resource at 30th June 2020 at a 1.20 g/t cut-off grade is shown in Table 14.17.

Table 14.17: FRUG Resource @ 1.20g/t Au cut-off

Category	Tonnes (Mt)	Grade (g/t Au)	Contained Gold (koz)
Measured	1.48	2.90	138
Indicated	1.71	2.16	118
Measured & Indicated	3.18	2.50	256
Inferred	0.32	2.14	22

Relevant Factors

The Q3/Q4 resource development drilling is final drilling program of this type for FRUG.

Mining in FRUG is currently expected to cease in Q4 2022.

The FRUG surface infrastructure will be relocated by Q4 2020 to allow Frasers West open pit mining to commence.

14.4.12 Golden Point Underground (GPUG) Resource Estimate

Background

The Golden Point Mine was the largest hard rock producer in the Otago Schist belt yielding approximately 13,000 oz. of gold and 800 tonnes of scheelite from underground workings up to 1934.

A Pre-Feasibility study on underground mining at Golden Point commenced in 2019 and was completed in July 2020. Infill and step-out diamond drilling commenced in 2017 and is ongoing.

The Proposed Golden Point / Round Hill underground is immediately down-dip of the Round Hill and Golden Point open pits which were mined by OceanaGold between 1990 and 2002 producing approximately 1.3Moz. As a result of this mining, most of the historic underground mine was unearthed. The only remaining part of the historic workings are in the north wall of the Golden Point pit which is not proposed to be mined.

The reader is also referred to section 14.3.15 which covers Round Hill / Golden Point open pit.

Geology & Mineralisation

OceanaGold's open pit mining at Golden Point encountered several stacked lodes 2-10m thick dipping gently (10-15 degrees) to the east. A re-interpretation of the geology in 2017 identified five west-dipping lodes as well as the east-dipping lodes (see Figure 14-13). At depth the stacked lodes disappear, and mineralisation becomes focused along the Hangingwall shear. The Golden Point lodes are more distinct (less diffuse boundaries) than lodes elsewhere at Macraes and quartz vein array mineralisation is noticeably absent.

The lodes contain a variable mix of silicified breccia, quartz cataclasite breccia and lode schist with pyrite, arsenopyrite, scheelite and occasionally visible gold.

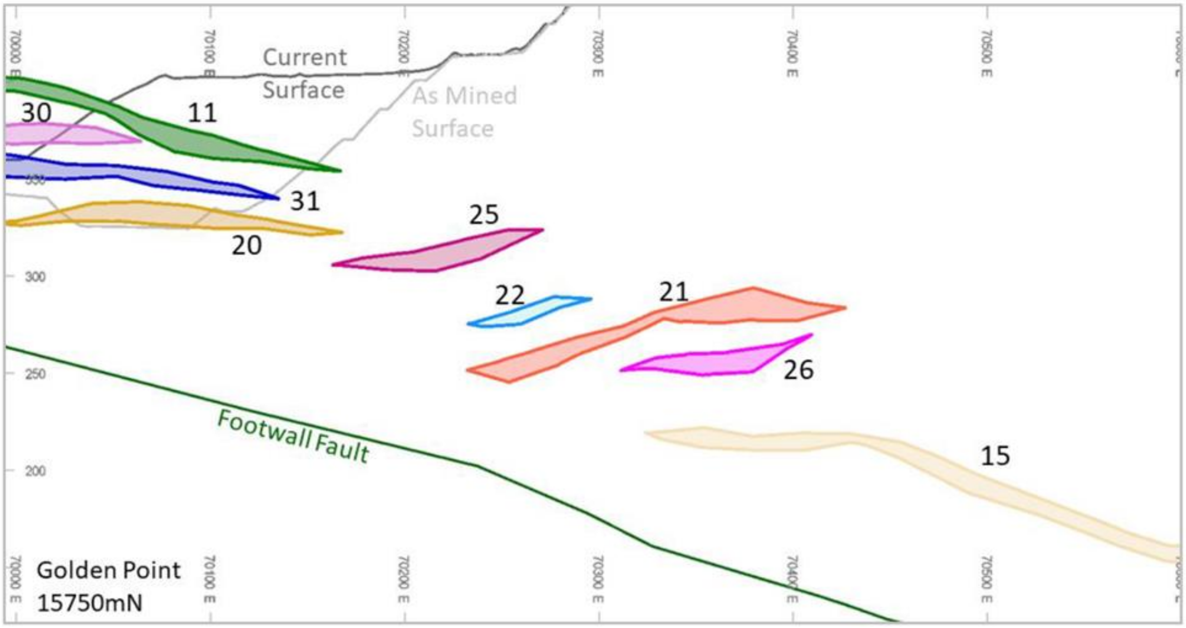

Figure 14-13: Golden Point Lode Domains

Golden Point/Round Hill Underground and Open Pit Resource Interaction.

The proposed Golden / Point Round Hill underground mine is in the east wall of the previously mined Golden Point / Round Hill open pits. The upper portion of the proposed Golden Point / Round Hill underground mine is located within the NZD2,394 open pit resource shell shown on Figure 14-14 below. The current mine plan has an open pit cut-back stage after completion of the underground mining and would partially mine through the underground voids and pillars. This has been done in the Frasers Pit where OceanaGold successfully mined through the FRUG trial stopes.

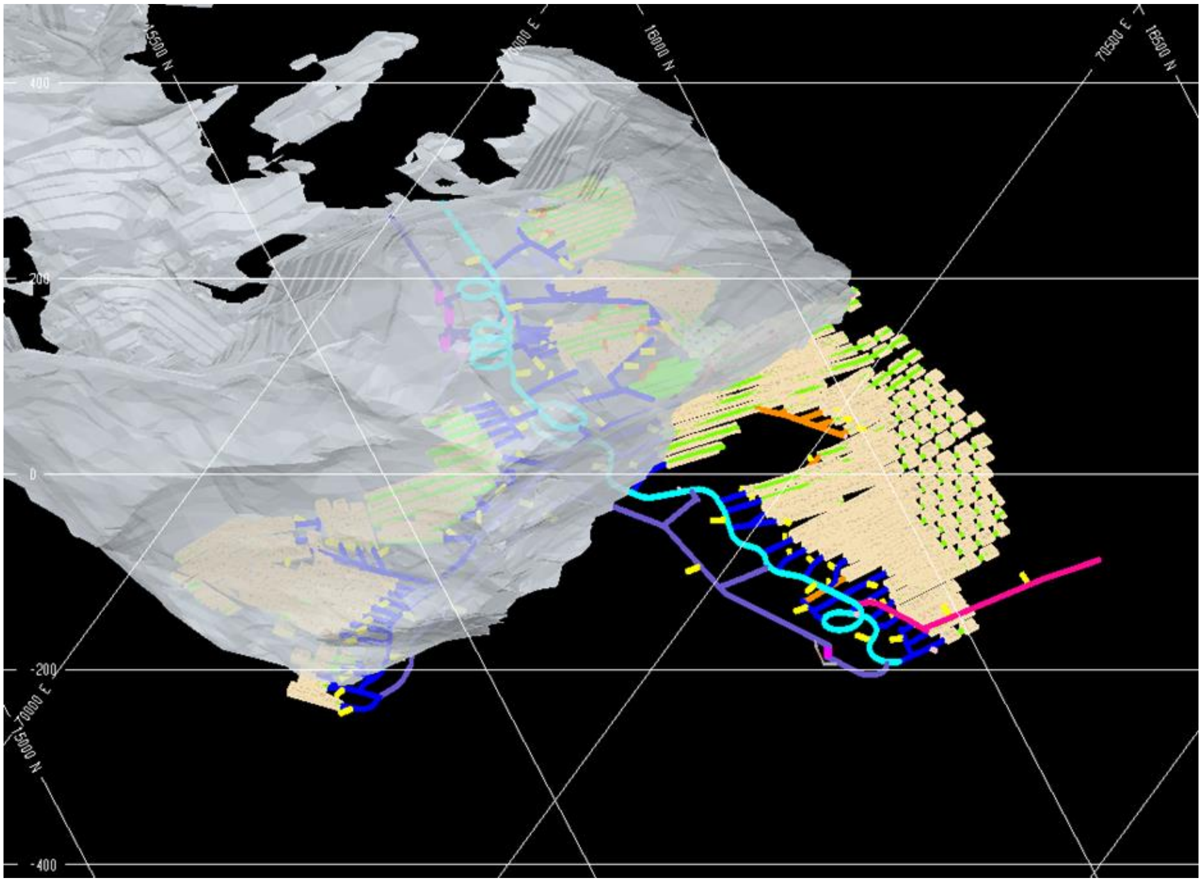

Figure 14-14: Golden Point / Round Hill Underground Mine & NZD2,394 Optimisation Shell

To reflect the spatial overlap of the open pit and underground mines, and avoid double counting of the resource, the following approach was taken:

- An expanded solid was created around the underground designs, with an approximate 2m halo to allow for potential open pit mining losses when mining through the proposed underground mine;
- The underground resource was reported at 1.34 g/t Au cut-off grade within the expanded solid;
- A Whittle open pit optimization, based upon a NZD2,394 gold price, was completed using an open pit resource model depleted for the proposed underground mine; and
- The open pit resource within the Whittle shell was then depleted for the resource within the expanded underground solid at a 0.3 g/t cut-off grade.

Wet Bias Factors

Like Frasers and Innes Mills, in the deeper sections of Round Hill, some RC drill holes were sampled under wet conditions To mitigate the potential for wet sample bias Diamond twin holes were completed and a set of gold grade factors generated for factoring wet RC sample grades. Given this approach, the residual resource estimation risk is low.

Resource Estimation

- Completed October 2019;
- Only drill holes prefixed RCH, RCD, DDH and DDW used. 14 holes excluded due to suspected wet sample bias and down hole contamination;
- Drill spacing 25-50m;
- Top cuts at between 97.5 and 99 percentiles for most domains. Domains 20, 24, 26,30,31 and 32 top capped at 8 g/t Au. Domains 11,15,16 and 22 top capped at 10 g/t Au, Domains 21 and 25 top capped at 15 g/t Au; and
- OK used for resource estimation.

The current resource as at June 30, 2020 is shown in Table 14.18 and is truncated by the Round Hill optimised pit shell up-dip.

Table 14.18: Golden point Underground Resource @ 1.34g/t Au cut-off

Category	Tonnes (Mt)	Grade (g/t Au)	Contained Gold (koz)
Measured	0.15	2.97	14
Indicated	2.86	2.68	246
Measured & Indicated	3.00	2.69	260
Inferred	0.95	2.54	77

Mining & Reconciliation

Mining has yet to commence and so a reconciliation cannot be presented. However, when mining commences reconciliations will be done on a continual monthly basis.

Relevant Factors

The Golden Point / Underground mine is a new operation at Macraes; however, OceanaGold and its predecessors have been open pit mining for nearly 30 years and underground mining for 14 years. As a result of this OceanaGold has a high degree of confidence in the geological interpretation and mining assumptions used to construct the respective resource estimates.

Drilling is currently ongoing and there is a strong expectation that the resource will be extended down-dip.

14.5 Open Pit and Underground Combined Mineral Resource Statement

Mineral Resource estimates for the Macraes Project as at June 30, 2020 by resource category and deposit are shown in Table 14.19. The Mineral Resources have been prepared in accordance with CIM standards and guidelines.

Since 31 December the total Macraes Measured and Indicated Resources and Inferred Resources have increased net of mining depletion by 90 koz and 70 koz respectively since 31 December 2019.

These increases are primarily a result of:

- The first-time reporting of the Golden Point underground resource. Approximately half of the Golden Point underground resource is captured within the Round Hill open pit design. This component of the Golden Point underground resource has been excised from the reported open pit resource.
- The Frasers open pit resource being reported within an open pit shell based on a NZD2,394/oz gold price (previously NZD2,083/oz). Note that some of the open pit resources are data limited at the NZD2,394/oz gold price and require step-out to fully test their potential.

These increases have partially been offset by:

- First half 2020 open pit and underground mining depletion.
- Removal of pillar resources after the completion of a study into the recovery of pillars within the Frasers Underground.
- Operational resource updates.

Table 14.19: Macraes Resource Inventory a at June 30, 2020

Resource Cut-off (g/t Au)	Resource Area	Measured		Indicated		Measured & Indicated			Inferred Resource		
		Mt	Au g/t	Mt	Au g/t	Mt	Au g/t	Au Moz	Mt	Au g/t	Au Moz
0.4	Nunns	-	-	0.23	0.83	0.23	0.83	0.01	0.64	0.92	0.02
0.3	Coronation North	1.30	1.26	4.32	0.75	5.61	0.87	0.16	2.82	0.65	0.06
0.3	Coronation	-	-	2.43	1.06	2.43	1.06	0.08	1.67	0.74	0.04
0.3	Deepdell	2.25	1.06	1.81	0.96	4.06	1.02	0.13	2.09	0.54	0.04
0.3	Round Hill	8.72	1.25	44.2	0.82	53.0	0.89	1.51	11.62	0.65	0.24
1.34	Golden Point Underground	0.15	2.97	2.86	2.68	3.00	2.69	0.26	0.95	2.54	0.08
0.3	Innes Mills	2.53	1.07	17.2	0.72	19.7	0.76	0.48	9.61	0.52	0.16
0.3	Frasers West	2.47	1.04	8.21	0.70	10.7	0.78	0.27	3.76	0.56	0.07
0.3	Gay-Tan	2.98	0.57	10.8	0.54	13.8	0.55	0.24	1.04	0.65	0.02
1.20	Frasers Underground	1.48	2.90	1.71	2.16	3.18	2.50	0.26	0.32	2.14	0.02
0.4	Ounce	-	-	-	-	-	-	-	0.76	0.75	0.02
0.4	Golden Bar	0.09	1.54	1.21	1.35	1.30	1.37	0.06	4.31	1.33	0.18
0.4	Taylors	-	-	0.23	0.84	0.23	0.84	0.01	0.43	0.76	0.01
0.4	Stoneburn	-	-	-	-	-	-	-	1.44	0.72	0.03
0.3	Stockpiles	4.36	0.55	-	-	4.36	0.55	0.08	-	-	-
Totals		**26.3**	**1.11**	**95.2**	**0.85**	**121.5**	**0.91**	**3.54**	**41.50**	**0.74**	**0.99**

Cut-off grades are based upon a gold price of NZD2,394/oz (US$1,700/oz @ USD: NZD 0.71).
Open pit resources are reported within shells optimized using a gold price of NZD2,394/oz (US$1,700/oz @ USD: NZD 0.71).
Mineral Resources reported include the Mineral Reserves reported for the same deposit.
There is no certainty that Mineral Resources that are not Mineral Reserves will be converted to Mineral Reserves.
No dilution is included in the reported figures and no adjustments have been allowed for mining recoveries.
No processing recovery adjustments have been made in the reported figures. The 0.3 to 0.4g/t grade range recovey is based on grade/recovery curve extrapolation and a small amount of metallurgical testing.
The tabulated resources are estimates of metal contained as troy ounces of gold.

The resource estimates are reconciled against mining along with the Mine predicted to mill recovered grade on a monthly basis. The annual reconciliation for open pit and underground is shown in Table 14.20.

This shows that the resource estimates tend to underpredict contained gold. Over the last 5.5 years, the open pits have realised 9%, 2% and 11% more tonnes, grade and contained gold respectively than predicted. Over the last 2.5 years, the Frasers Underground has realised 7%, 0% and 7% more tonnes, grade and contained gold respectively than predicted.

For the same 5.5 year period, the annual mine to mill variance has ranged between -0.5% and -5.1% with an average of -2.5%.

Table 14.20 Macraes Annual Open Pit Reconciliation for Open Pit & Underground

Open Pit Mined				Res Est : MII		
Year	Tonnes (Mt)	Grade (g/t Au)	Contained Gold (Moz)	Tonnes (Mt)	Grade (g/t)	Contained Gold (Moz
2015	2.73	1.11	0.10	1.97	1.08	0.07
2016	3.42	0.82	0.09	3.29	0.89	0.09
2017	3.43	0.99	0.11	3.19	1.01	0.10
2018	5.32	1.19	0.20	5.80	1.05	0.20
2019	5.38	0.84	0.15	4.22	0.84	0.11
2020	2.50	0.73	0.06	2.32	0.73	0.05
Total	**22.78**	**0.96**	**0.70**	**20.81**	**0.94**	**0.63**
Underground Mined				Res Est : MII		
2018	0.99	2.00	0.06	0.89	2.07	0.06
2019	0.99	2.11	0.07	0.96	2.03	0.06
2020	0.37	2.06	0.02	0.34	2.10	0.02
Total	**2.35**	**2.06**	**0.16**	**2.19**	**2.06**	**0.15**

15 Mineral Reserve Estimate

15.1 General

A mineral reserve estimate was generated for the open pit and underground mining methods. As such the following sections explain the open pit and underground mineral reserve estimate separately. A combined mineral reserve statement is provided in 15.4.

15.2 Open Pit Mineral Reserve Estimate

15.2.1 Conversion Assumptions, Parameters and Methods

The Macraes reserve estimate represents that part of the Measured and Indicated resource which can be economically mined and for which the necessary design work and mine planning have been carried out. Proved and Probable reserve blocks are based on Measured and Indicated resource blocks respectively. Inferred blocks are inadequately defined and therefore are not included in reported reserves, although if they fall within the pit outlines, they do represent potential additions to ore mined if confirmed by grade control drilling. The reserves are included within the overall resource figures.

Macraes open pit reserve tonnages and grades are from designs guided by Whittle 4X pit optimizations. Optimizations use projected costs, slope angles based on geotechnical studies, plant recoveries and are based on a USD1,300/oz gold price. An ad valorem royalty of 1% is payable to the New Zealand government and refining and handling charges are included at USD5/oz.

Reserve tonnages and grades are reported in accordance with CIM criteria to include any anticipated mining losses and mining dilution.

For open pit inventory, the resource block model estimation methodology incorporates adequate dilution and provides a reasonable estimate of mined tonnage and grades. No additional dilution or mining losses are applied during the Whittle 4X optimisations to the open pit inventory to the block model inventory

Pit optimization and design inputs and methodologies are described in Chapter 16.

15.2.2 Open Pit Reserve Estimate

The open pit Mineral Reserves summarised in Table 15.1, are reported at a 0.4 g/t Au cut-off.

Table 15.1: Macraes open pit Mineral reserve estimate as at June 30, 2020

Area	Proven		Probable		Total		
	Mt	Au g/t	Mt	Au g/t	Mt	Au g/t	Au Moz
Coro.North	0.98	1.39	1.23	0.92	2.21	1.13	0.08
Coronation			0.22	1.10	0.22	1.10	0.01
Deepdell	1.67	1.06	1.29	0.98	2.96	1.03	0.10
Round Hill	3.89	1.32	8.21	1.00	12.10	1.10	0.43
Innes Mills	1.73	1.26	5.81	0.84	7.54	0.94	0.23
Frasers	1.52	0.69	6.89	0.71	8.41	0.71	0.19
Stockpiles	4.36	0.55			4.36	0.55	0.08
Total	**14.14**	**0.98**	**23.64**	**0.87**	**37.79**	**0.91**	**1.11**

15.2.3 Relevant Factors

- CIM (2014) definitions were followed for Mineral Reserves;
- The effective date of the Mineral Reserves is June 30, 2020; estimated by Pieter Doelman MAusIMM CP(Mining), an employee of OceanaGold (NZ) Ltd; and
- Not all required permits and consents are in place to enable mining of the entire Mineral Reserve, however there are reasonable expectations that such permits and consents will be granted. Resource consent applications were submitted in the first half of 2020 for those areas that are not consented.

15.3 Underground Mineral Reserve Estimate

15.3.1 Conversion Assumptions, Parameters and Methods

The method for determining which part of the Measured and Indicated resource and all relevant factors is described in Chapter 16. This section includes descriptions of:

- the mining method;
- ore loss and dilution; and
- mine design criteria and methodology.

15.3.2 Reserve Estimate

The Underground Mineral Reserves, summarised in Table 15.2 are reported at an Au cut-off of 1.36g/t and 1.61g/t for Frasers Underground and Golden Point Underground respectively where development access is required. Lower cut-offs are used if development access is in place and for development material.

Table 15.2: Macraes Underground Mineral Reserve estimate as at June 30, 2020

Area	Proven		Probable		Total		
	Mt	Au g/t	Mt	Au g/t	Mt	Au g/t	Au Moz
Frasers Underground	0.69	2.11	0.58	1.47	1.28	1.82	0.07
Golden Point Underground	0.12	2.39	2.26	2.12	2.34	2.13	0.16
Total	**0.81**	**2.15**	**2.84**	**1.99**	**3.62**	**2.02**	**0.23**

15.3.3 Relevant Factors

- CIM (2014) definitions were followed for Mineral Reserves; and
- An Underground Remnant Retreat Study is currently underway to maximise ore extraction from FRUG prior to closure and is due for completion by Q2 2020.

15.4 Macraes Mineral Reserves Statement

The Macraes Mineral Reserve estimate is presented in Table 15.3.

Table 15.3: Macraes Mineral Reserve Estimate as at June 30, 2020

Area	Proven		Probable		Total		
	Mt	Au g/t	Mt	Au g/t	Mt	Au g/t	Au Moz
Coro North	0.98	1.39	1.23	0.92	2.21	1.13	0.08
Coronation			0.22	1.10	0.22	1.10	0.01
Deepdell	1.67	1.06	1.29	0.98	2.96	1.03	0.10
Round Hill	3.89	1.32	8.21	1.00	12.1	1.10	0.43
Innes Mills	1.73	1.26	5.81	0.84	7.54	0.94	0.23
Frasers	1.52	0.69	6.89	0.71	8.41	0.71	0.19
Stockpiles	4.36	0.55			4.36	0.55	0.08
Subtotal - Open Pit	**14.14**	**0.98**	**23.64**	**0.87**	**37.79**	**0.91**	**1.11**
Frasers Underground	0.69	2.11	0.58	1.47	1.28	1.82	0.07
Golden Point Underground	0.12	2.39	2.26	2.12	2.34	2.13	0.16
Subtotal - Underground	**0.81**	**2.15**	**2.84**	**1.99**	**3.62**	**2.02**	**0.23**
Total Macraes	**14.96**	**1.04**	**26.49**	**0.99**	**41.42**	**1.01**	**1.34**

All figure are rounded to reflect the relative accuracy of the estimates. Totals may not sum due to rounding.

Mineral reserves ae reported based on CoG based on metal price assumptions, exchange rates and mining, processing, general and administrative costs. Gold Price assumptions include USD1,300/oz for Open Pit and USD1,500/oz for underground and NZD: USD 0.71.

The Macraes processing plant recovery varies based on ore source and feed grade – an average 82% recovery is achieved.

Open pit Dilution and recovery estimates are built into the resource model and no additional factors are applied.

Underground Insitu Recovery, Mining Recovery and Dilution modifying factors have been applied that result in an average underground mining recovery of 98% of the designed tonnage and 89% of the designed grade.

Mineral reserves have been estimated based on mine designs and plans consolidated into a Life of Mine Schedule.

CIM (2014) definitions were followed for Mineral Reserves.

Pieter Doelman, Technical Services & Projects Manager at Macraes is the Qualified Person for the Open Pit Mineral Reserve Estimate.

Tom Cooney, General Manager Studies based in Brisbane Australia is the Qualified Person for the Underground Mineral Reserve Estimate.

16 Mining Methods

16.1 General

The following sections explain the open pit and underground mining methods separately. A combined open pit and underground production schedule is provided in Section 16.4.

16.2 Open Pit Mining Methods

16.2.1 Current or Proposed Mining Methods

Conventional open cut bench mining methods are used at the Macraes Goldfield. Pits are excavated on level benches 2.5m high within the ore zone (approx. 2.8m high after blasting) and 4m high within the waste zone.

Hydraulic backhoe excavators in the 250t and 360t class are used for mining ore and waste.

Ore is mined with different techniques depending on the style of mineralisation.

- Hanging wall lode ore is mined by first removing the hanging-wall waste with an excavator under visual control of a geological technician, then mining the exposed ore. Footwall ore is selectively removed from the underlying footwall waste if it can be visually controlled, otherwise the footwall ore is diluted with the wedge of underlying waste; and
- Stockwork ore is generally mined within the defined ore blocks. Ore blocks are defined with the guidance from a conditionally simulated grade control model.

With this mining method and equipment, the smallest selective mining unit (SMU) used when defining ore blocks is 4m by 4m by 2.5m high (approximately 100t), but blocks are generally a minimum of 500t to minimise dilution.

16.2.2 Parameters Relevant to Mine or Pit Designs and Plans

Geotechnical

The slope design philosophy is one of accepting and managing minor localised slope instability rather than incurring the additional costs of designing conservative slopes to guarantee a zero-failure rate. It is accepted that on average 20% of any wall may experience some minor bench scale failures, however these will largely be contained on berms and will not adversely affect production. However, to optimise pits and reduce costs, slope angles are designed specifically for each pit, based on kinematic analysis and interpretation of existing geotechnical data. For new pit excavations data is collected from air photo interpretation; surface trenching and diamond drill holes, whilst wall performance and in-pit mapping are used to further refine and optimise staged and final pit walls. This practice has proven to be very successful.

Overall slope angles vary by deposit and these are stated in each individual deposit section.

For all pits except for Round Hill the consequences of wall failure are similar, usually requiring additional movement to lay slopes back or alternatively ore loss if the design slope toe cannot be achieved.

At Round Hill, the consequences of a major failure on the footwall surface could be catastrophic for the Macraes Operation because the process plant is located above the potential failure plane. Previous mining at Round Hill and Golden Point activated movement on this plane. This historic information has been used to calibrate a 3D geotechnical model which has shown that Round Hill mining can be carried out without catastrophic failure, however as the potential consequences are high this remains a significant risk.

Mining Dilution and Recovery

Resource models are recoverable indicator kriged models. Dilution is accounted for in the resource model calculations by adding a waste veneer to the hanging wall contact and using dilution estimation during the kriging process. The result is a dilution/recovery factor of close to 2%, which is realistic considering the control techniques applied during mining. To avoid double accounting, Macraes models do not add dilution during optimisation.

Selective ore mining procedures are utilised. This is done to maximise ore recovery and minimise mining dilution. Grade control blasthole assays are used as the input data to a conditional simulation grade control process. The results of bench grade estimates are then used in conjunction with detailed geological mapping to produce mining blocks. Ore mining is supervised by geologists and ore spotters. Mining of the ore waste contacts is done by backhoe excavator. It is assumed that:

- mining recovery is 100%; and
- dilution is 0%.

16.2.3 Pit Optimisation

Open pit optimisations are completed in-house using Whittle 4X software. Due to the maturity of the Macraes operation, optimisations are largely assessments of changes to previous pit designs caused by updates to resource models or input parameters.

Mineral Resource Models

Resource models are prepared by the site Resource Geologists and this includes classification into Measured, Indicated and Inferred categories. Some additional manipulation is performed by the mining engineers to construct a ‘reserve model’ ready for further mine planning work. These manipulations include:

- removal of all in-situ blocks above the chosen ‘as-mined’ topography surface;
- classification of blocks as fill that are below the ‘as-built’ surface and above the ‘as-mined’ surface’;
- calculation of tonnes and grade for each material type, where material types are defined by Weathering, Classification, Basic Geology (hanging wall / stockwork), and Grade Classification (0.4-0.7, 0.7-1.0, 1.0+ g/t Au);
- identification of majority geology zone for the purposes of assigning slope angles; and
- assigning positional mining and processing costs.

The open pit resource models at Macraes are recoverable resource models built using GS3 estimation techniques and constructed in Minesight. Each block in the model reports the proportion and the grade that can be recovered at various cut-offs. A summary of the underlying resource models used in optimisations is shown in Table 16.1.

Table 16.1: Resource models used in pit optimisations

Area	Coronation North	Coronation	Deepdell	Round Hill / Southern Pit	Innes Mills / Frasers (in-situ)	Frasers Gay Tan
Resource model name	corn15.crn	cors15.dat	dd1815.dat	gp1915.dat	im1715.wt2	fspu15.dat
Date published	18/02/2020	20/08/2018	15/08/2018	31/10/2019	24/05/2019	22/05/2020
Block size	25 x 25 x 2.5	25x25x2.5	25x25x2.5	25x25x2.5	25x25x2.5	25x25x2.5
Northing Extent (Macraes Grid)	20525N to 22000N	18000N to 20525N	16200N to 17800N	14000N to16150N	11500N to 14025N	11500N to 13200N
Topography cut to [date]	As mined 30/06/2020	As mined 06/01/2020	As mined 31/03/2018	As mined 01/10/2019	As mined 29/07/2019	As Built 02/04/2020
Costs current at [date]	Jan 2019	Jan 2018	Aug 2018	Jan 2018	Jun 2019	Sep 2019
Reserve model name	corn15.wit	cors15.dat	dd1815.dat	gp1915.dat	imsp15.wt2	fspu15.w20

Optimisation Constraints

Pit optimisations are normally only limited by the boundary of the underlying resource model to avoid optimisation shells artificially daylighting into space. Exceptions where addition constraints are made are:

- Deepdell optimisations exclude the historic covenant just north of the old Deepdell South pit and exclude Deepdell South as there are no shells with mineable widths;
- Round Hill optimisations are constrained by a notional southwest/northeast trending boundary that reduces the risk of mass re-mobilisation of historic movement on the Footwall Fault surface; and
- Innes Mills optimisations are constrained by the public road and bridge corridor to the north.

Optimisation Parameters

Individual blocks in the block model were coded with mining and processing costs. Block model mining cost adjustment factors (MCAF) and processing cost adjustment factor (PCAF) fields were coded with mining and processing costs respectively. Blocks within the Footwall Fault (FF) stand-off zone were coded with high mining and processing cost to exclude these blocks from optimisation.

A summary of the optimisation inputs for each deposit are shown in Table 16.2. Note that the Process Cost (PCOST) is the base cost to mine and process a tonne of ore and is made up of:

- Any additional (or lesser) mining costs associated with mining ore compared to waste;
- ROM ore re-handle into the crushers;
- Ore processing;
- General and administration overhead charges; and
- Sustaining capital and financing charges (includes tails dam construction).

Table 16.2: Optimisation inputs

Area	Coronation North	Coronation	Deepdell	Round Hill / Southern Pit	Innes Mills / Frasers (in-situ)	Frasers Gay Tan
Metallurgical Recovery (%)	Sulphide = 82% Oxide = 75%					
PCOST (NZD/t)	17.48	16.53	16.53	14,70	18.49	18.28
Indicative waste mining cost at design basis shell (NZD/t)	1.55	1.53	1.60	1.92	1.62	1.83
Gold price used for shell generation & analysis (NZD/oz)	1,806	1,786	1,806	1,806	1,806	1,818
Selling costs	1% royalty and NZD5.00 /Oz refining cost					
Pit Slopes	Detailed in section below for each deposit					
Shell Selection Method	Maximum worst case cashflow at a 55Mtpa mining / 4.8Mtpa process rate	Maximum worst case cashflow at a 40Mtpa mining/ 4.8Mtpa process rate	Maximum worst case cashflow at a 30Mtpa mining/ 4.9Mtpa process rate	Maximum Whittle schedule present value using auto pushback chooser	Maximum worst case cashflow at a 53Mtpa mining / 4.9Mtpa process rate	Maximum worst case cashflow at a 53Mtpa mining / 4.9Mtpa process rate

Geotechnical Parameters

Slope angles used in optimisations are coded depending on the rock type, and slope rosettes are used to control those angles that depend on the wall orientation. At Macraes, final ramps can usually be sited within the footwall of the ore so additional slope laybacks are not needed to allow for pit ramps. A summary of the overall slopes used for each area is shown in Table 16.3.

Table 16.3: Pit slopes used in optimisations

Area	Material / Location	Overall Angle (degrees)
Coronation North	Oxide schist	31°
	Fresh schist	43°
	Basalt	37°
	Sediments	22°
	Cracks Zone	37°
Coronation	Oxide Schist	37°
	Fresh Schist/north wall	51°
	Fresh Schist/east and west wall	44.4°
	Fresh Schist/south wall	54.5°
Deepdell	Oxide Schist	37°
	Fresh Schist/north and south wall	49°
	Fresh Schist/east and west wall	43°
	Backfill Waste	31°
Round Hill	Oxide schist	37°
	Fresh Schist/north wall	51°
	Fresh Schist/east and west wall	44.4°
	Fresh Schist/south wall	54.5°
	Backfill waste	28°
	Tailings	10°
Innes Mills / Frasers (in-situ)	Oxide schist	37°
	Fresh Schist/NE and SW wall	42°
	Fresh Schist/SE and NW wall	49°
	Backfill Waste	37°
Frasers Gay Tan	Fresh Schist	42°
	Backfill Waste/Slip Material	37°

Optimisation Results

Summary pit optimisation results are shown in Table 16.4 below for Measured and Indicated (M+I) material classifications only, Inferred or Unclassified material is treated as waste in the pit optimisations. Note that some deposits have been actively mined between when the optimisations were completed and June 30, 2020, in these cases the optimisation results do not reflect the current potential inventory.

Table 16.4: Optimisation results

Area	Coronation North	Coronation	Deepdell	Round Hill / Southern Pit	Innes Mills / Frasers (in-situ)	Frasers Gay Tan
Gold price used for analysis (NZD/oz)	1,806	1,786	1,806	1,806	1,806	1,818
Shell selected for design (NZD/oz)	1,734	1,643	1,698	1,661	1,698	1,709
M+I shell inventory (Mt processed)	2.89	2.25	3.04	11.43	16.11	12.92
M+I shell gold grade (g/t processed)	1.07	1.07	1.04	1.13	0.84	0.77
M+I shell total (Mt)	3.10	29.9	3.04	133.3	19.13	9.97
M+I shell strip ratio (t:t)	6.08	12.2	13.5	10.7	7.45	3.82
Active Mining?	Yes	Yes	No	No	Yes	Yes

16.2.4 Design Criteria

Generic design parameters used in pit and waste rock stack designs are shown in Table 16.5.

Table 16.5: Generic pit design parameters

Parameter	Value
Minimum mining width of lowest 5m cut	30m
Minimum mining width of cutbacks	60m
Ramp width (including 1 x windrow)	30m
Inside turning radius on switchbacks	15.0m
Maximum ramp gradient	10%
Maximum bench height	22.5m
Minimum berm width	7.5m (15m berm interval) 10m (22.5m berm interval)

16.2.5 Waste Rock Storage

Sufficient locations exist to store the anticipated waste rock quantities expected from the various open pits. These are grouped into geographical areas and summarized in Table 16.6.

Table 16.6: Waste rock storage

Waste Sources	Source Quantity (Mt)	Waste Storage Options	Sink Quantity (Mt)
Coronation Nth	12.8	Coro Nth WRS	39.2
Coronation	0.4	Coro Nth Backfill	16.1
		Trimbells WRS	8.0
Subtotal – Coronation Area	13.2	Subtotal – Coronation Area	63.3
Deepdell Nth	48.4	Deepdell East WRS	59.3
Subtotal – Deepdell Area	48.4	Subtotal – Deepdell Area	59.3
Round Hill	158.1	Back Road WRS	201.3
		Innes Mills Backfill	91.0
Subtotal – Round Hill Area	158.1	Subtotal – Round Hill Area	292.3
Innes Mills	93.0	Frasers West Backfill	8.5
Frasers West	12.0	Frasers East WRS	24.4
Gay Tan	14.8	Frasers Pit Backfill	95.3
		Frasers South Backfill	78.6
Subtotal – IM / Frasers Area	119.8	Subtotal – IM / Frasers Area	206.7

The location of the various waste rock stacks is shown in Figure 16-1.

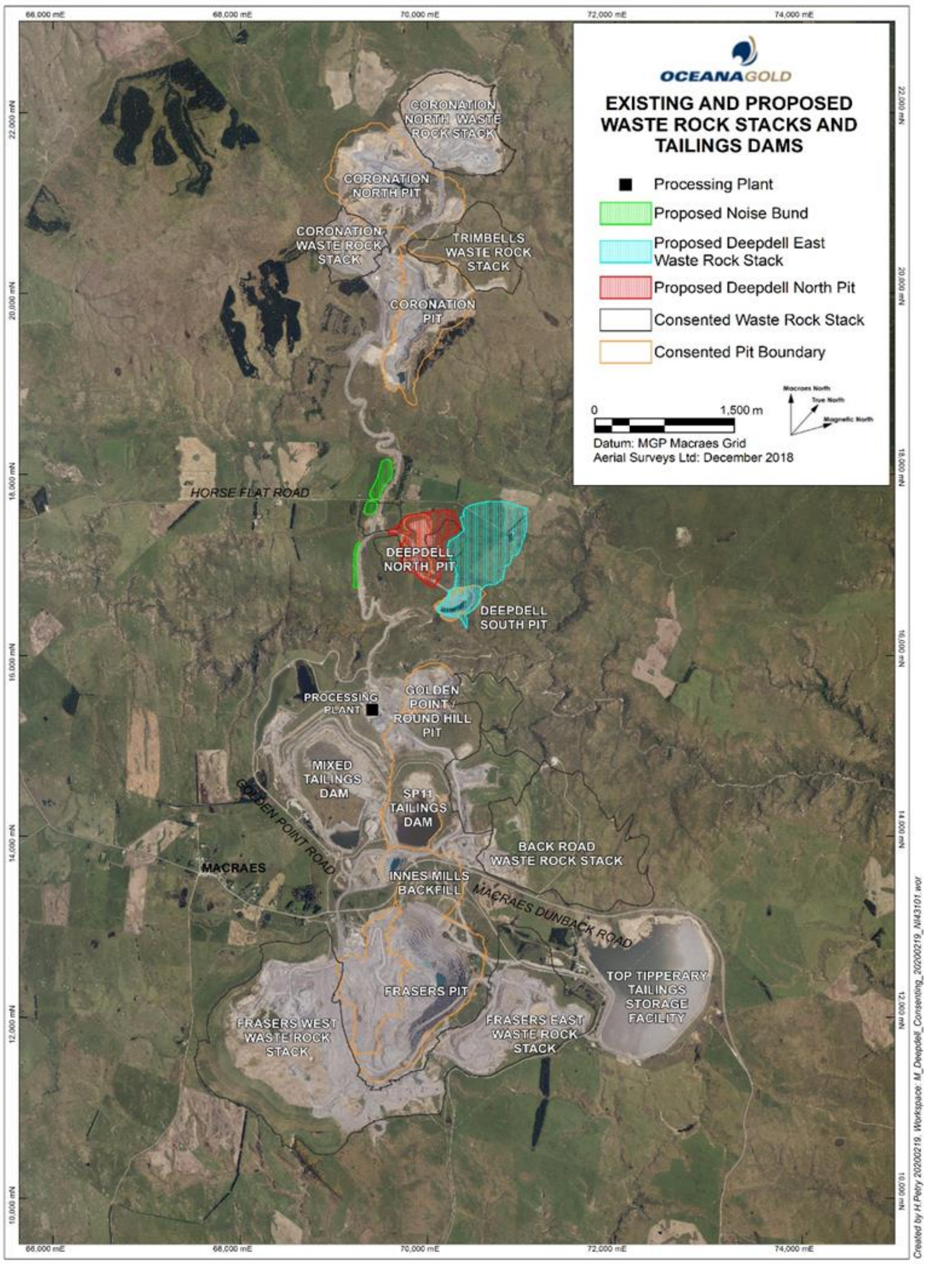

Figure 16-1: Existing and proposed waste rock stacks and tailings dams

16.2.6 Mine Production Schedule

Scheduling Method

Open pit mine scheduling is undertaken using RPMGlobal's *Open Pit Metals Solution (OPMS)* software. This method integrates the mining and dumping schedule, along with the haulage modelling. The OPMS scheduling model was implemented at Macraes in 2016 and is a successor of the Xpac scheduling model that has been used at Macraes since 1998.

Scheduling Objectives

Schedules aim to:

- ensure that the process plant can run at its capacity in all schedule periods and at the maximum mill head grade possible;
- minimise truck haulage cycle time and therefore haulage costs; and
- operate within the loading and hauling fleet capacity constraints.

Scheduling Parameters and Assumptions

Key schedule assumptions are noted in Table 16.7.

Table 16.7: Key open pit schedule assumptions

Parameter	Value
Mill feed target	UG material has priority for mill feed due to higher grades, typical OP targets are approx. 5.2Mtpa
Cut-off grade	0.4g/t
Starting topography	1 July 2020
Operating time	Max 5,700hrs/yr for loading units and 5,500hrs/yr for trucks
Truck payloads	178 dry tonnes
Excavator productivity	EX3600: 2,800 dry tph EX2500: 1,850 dry tph
Vertical advance	10m per month in ore zone 15m per month in waste zone
Excavator proximity	50m

Scheduling Results

The open pit mine is scheduled once the underground mine schedules are completed. Open pit mining quantities by year are shown in Figure 16-2.

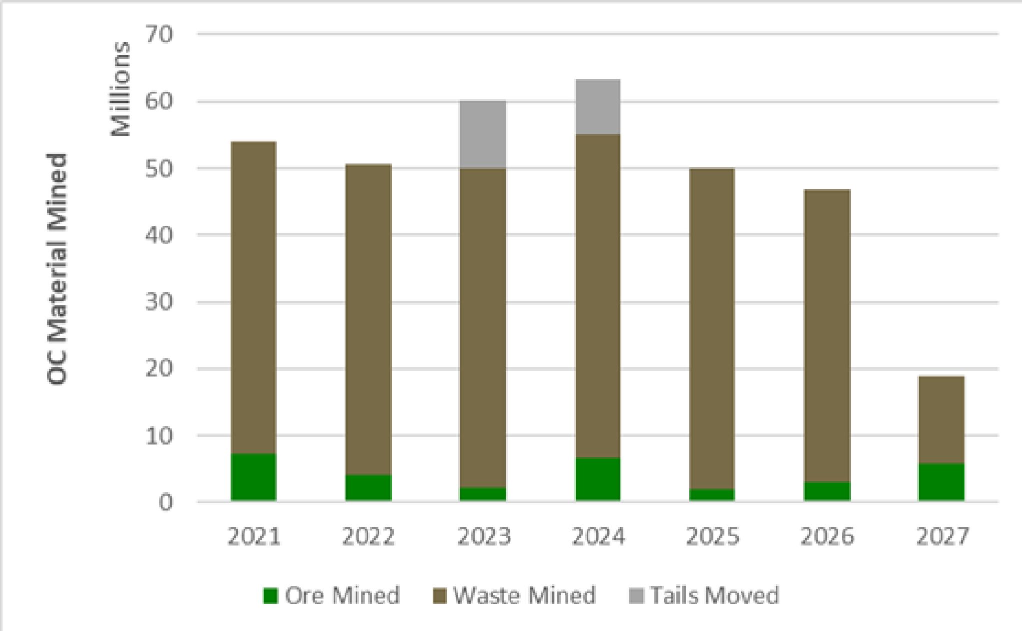

Figure 16-2: Mined quantities by material type

Annual total movement by the main excavator and truck mining fleet averages 52Mt between 2021 and 2026. In 2023 and 2024 tailings re-mining increases the total movements in those years to approximately 60Mt per year. These tailings are intended to be hydraulically mined as part of the initial stage of the Round Hill pit.

Mining movement by area is shown in Figure 16-3.

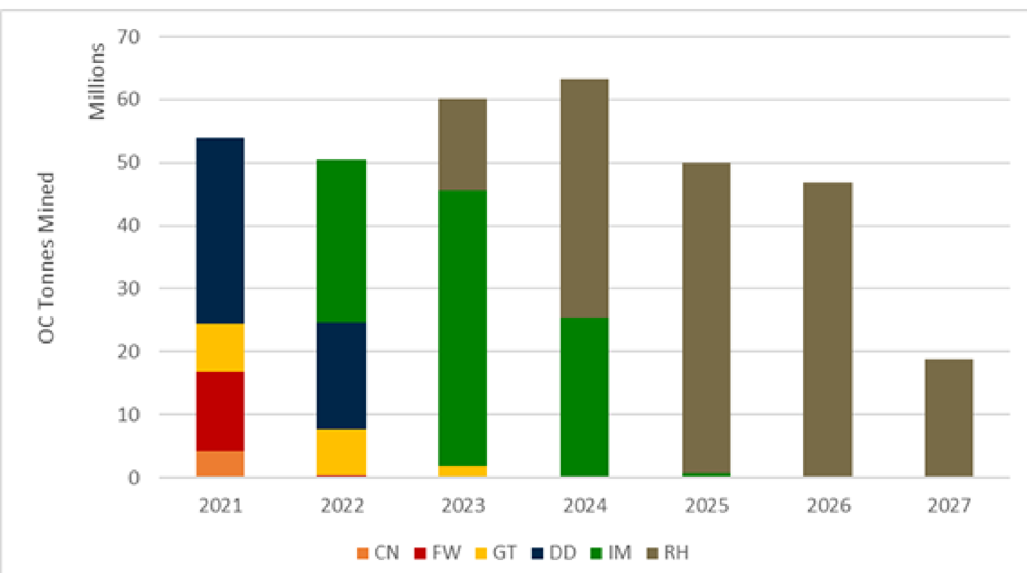

Figure 16-3: Movement by sources

Figure 16-4 shows the mill feed makeup by material source, where:

- CN = Coronation North;
- FW = Frasers West;
- GT = Frasers Gay Tan;
- DD = Deepdell;
- IM = Innes Mills;
- RH = Round Hill;
- SP = Stockpiles; and
- UG = Underground sources (FRUG and GPUG).

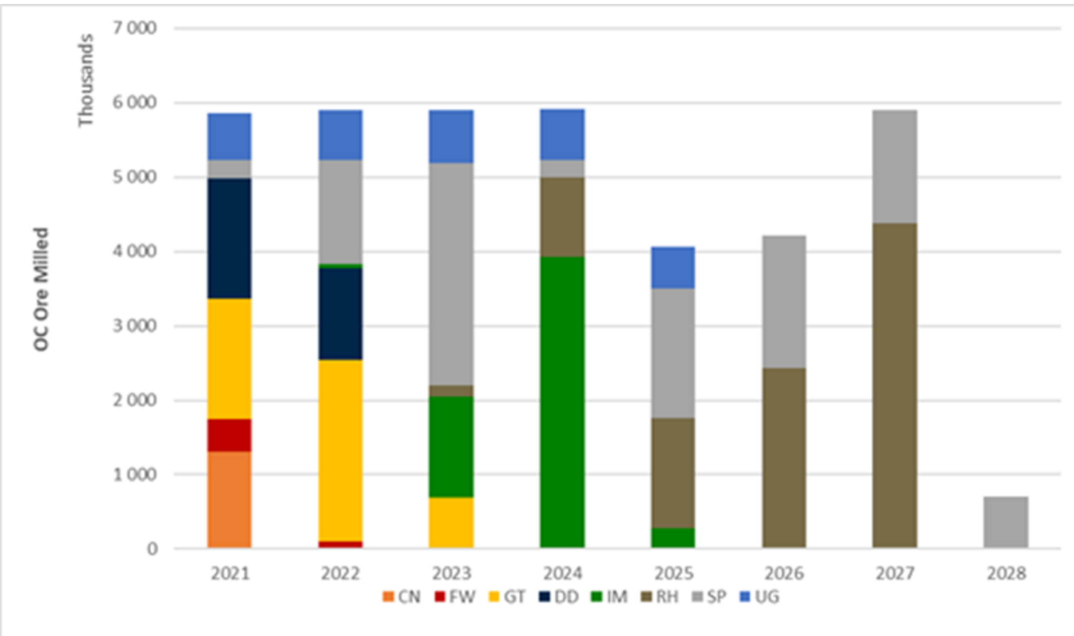

Figure 16-4: Ore milled by sources

Ore processing continues at 5.9Mt per annum until 2025 and 2026, when it is reduced due to limited early ore exposure at Round Hill. For these years, part of the processing plant is converted to process oxide stockpiles, while the remainder of the plant continues to process sulphide ore. The annual mill throughput reduces to approximately 4.1Mt during this period. The plant converts back to 100% sulphide ore in 2027 and returns to 5.9Mtpa.

Stockpile movements are shown in Figure 16-5. The mine scheduling strategy is to maximise the gold grade to the process plant and hence process plant gold cut-off grades are elevated when the pits have large ore exposures. The material below the current process plant gold cut-off grade is stockpiled and then reclaimed in later schedule periods.

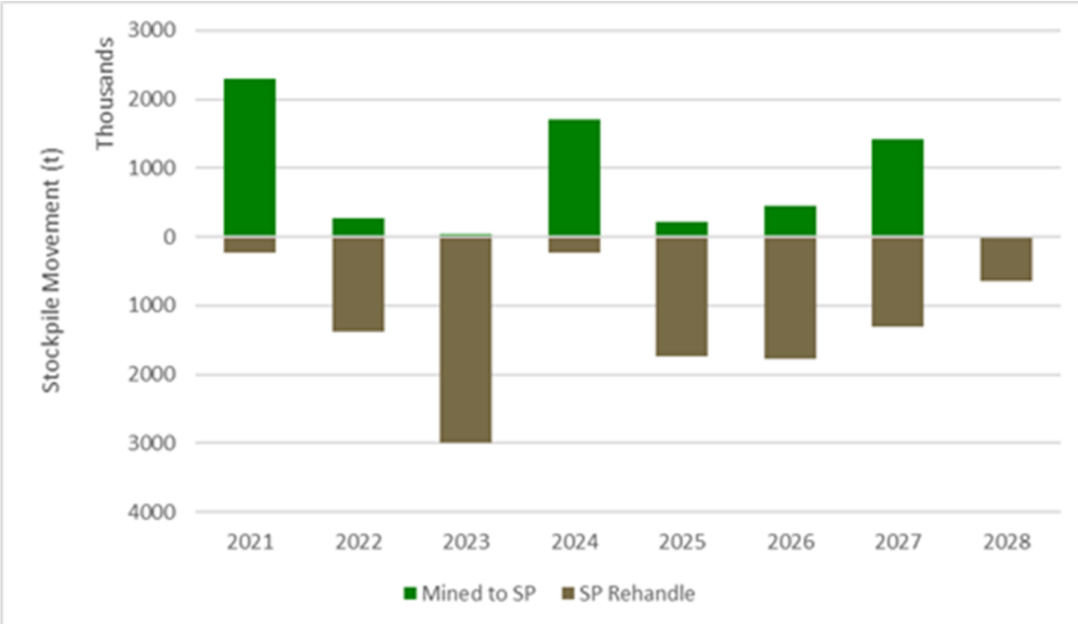

Figure 16-5: Stockpile movements

16.2.7 Mining Fleet and Requirements

General Requirements and Fleet Selection

The mine fleet used in this schedule assumes no change to the existing fleet configuration aside from replacements and adding additional trucks to account for longer haul distances from Round Hill. This fleet configuration has been refined over the 30 years that the mine has been in operation.

Drilling and Blasting

Drilling and blasting requirements differ depending on the material zone. Ore zone material includes all material within the main hanging wall shear zone including all ore grade material and the waste zone is the overlying overburden waste rock.

Summary drill and blast parameters are shown in Table 16.8.

Table 16.8: Open pit drill and blast parameters

Parameter	Unit	Ore Zone	Waste Zone
Drill type (model) used		Top hammer percussion (Montabert CPA X-Tend)	Rotary (Sandvik D45KS)
Hole diameter	mm	102	200
Sampling frequency	t	128	No sampling
Bench height	m	7.5	15.0
Burden x spacing	m x m	4.3 x 4.5	7.4 x 8.5
Blasting powder factor	kg/m3	0.31	0.52

Loading

The primary mine loading fleet consists of three Hitachi EX3600 hydraulic excavators (22m^3 capacity) and one Hitachi EX2500 hydraulic excavator (15m^3 capacity).

These machines are rated at 2,800 dry tph and 1,850 dry tph respectively.

Hauling

A single haulage fleet consisting of Caterpillar 789C and 789D mechanical drive rear-dump trucks are used for all mine haulage duties. These trucks match up with the 22m3 and 15m3 hydraulic excavators with a nominal four and six passes per truck respectively. Truck rated payload is 178 dry tonnes (182 wet tonnes).

The mine scheduling software dynamically accumulates the truck hours for every source/destination increment and is constrained by the number of available trucks.

Crusher Feed

Cat 992- and 988-wheel loaders are used to re-handle ore from the ROM blending stockpiles into the crushers.

Ancillary Equipment

A fleet of other equipment is used to support the primary production fleet. This consists of:

- Caterpillar D10 track dozers;
- Caterpillar 16 & 18 motor graders;
- Caterpillar 844-wheel dozers; and
- Caterpillar 773, 777 & 785 water trucks.

Ancillary equipment allocations are made based on historic actual usage and is either a fixed allocation per time interval or factored from the total truck hours.

Open pit equipment requirements by year are shown in Table 16.9.

Table 16.9: Major open pit equipment fleet by year

Equipment Model	2020	2021	2022	2023	2024	2025	2026	2027
Drill – Montabert CPA	3	3	3	3	3	3	3	3
Drill – Sandvik D45	2	2	2	2	2	2	2	
Excavator – Hitachi EX2500	1	1	1	1	1	1	1	
Excavator – Hitachi EX3600	3	3	3	3	3	3	3	2
Truck – Cat 789C/D	20	20	21	22	22	21	20	9
Track dozer – Cat D10	5	5	5	5	5	5	5	4
Wheel dozer – Cat 844	1	1	1	1	1			
Grader – Cat 16	3	2	1	1	1	1	1	
Grader – Cat 18		1	2	2	2	2	2	1
Water carts (785/777/773)	3	3	3	3	3	3	3	1
Wheel loader – Cat 992	1	1	1	1	1	1	1	1
Wheel loader – Cat 988	2	2	2	2	2	2	2	2

Some equipment replacements and additions are required during the term of the mine schedule. These are noted in Table 16.10.

Table 16.10: Major open pit equipment replacements/additions

Equipment Model	2020	2021	2022	2023	2024	2025	2026
Drill – Montabert CPA				1			
Drill – Sandvik D45							
Excavator – Hitachi EX2500							
Excavator – Hitachi EX3600	1						
Truck – Cat 789C/D		1	1	1	2		
Track dozer – Cat D10		1		2			
Wheel dozer – Cat 844							
Grader – Cat 16							

16.2.8 Mine Water

Groundwater

Open pits at Macraes produce only a small quantity of groundwater. Dewatering wells are not used, with the occasional exception of depressurisation bores to reduce the risk of slope instability. Groundwater is managed by pumping from pit sumps to the surface water management network.

Surface Water

Surface water is managed by:

- diverting clean water away from active working areas; and
- collecting runoff water in pit sumps or silt ponds and either using it for dust suppression or pumping into the site water network where it is used as process water in the mill.

16.3 Frasers Underground Mining Methods

16.3.1 Mining Methods

The Frasers underground orebody encompasses the down dip continuation of the Hangingwall shear mined in the Frasers open pit. The orebody is relatively shallow dipping (15 – 20 degrees) to the east. The orebody is tabular with undulations and has a thickness varying between 5 to 30 metres.

The Frasers underground mine targets the high-grade ore zone at the top of the Hangingwall shear.

The mining method used underground involves 15-metre-wide open stopes with 6 metre yielding pillars between stopes. Mining areas are separated by 20 metres to 60 metres wide regional pillars. The mining areas are generally restricted to about 120 metres width and 160 metres length. Mine production targets the high-grade ore at the top of the 30 metres thick mineralisation. Stope heights vary between drive height (5 metres) and up to 25 metres.

16.3.2 Parameters relevant to Underground Mining

Mine Design Strategy

The resource model presents the orebody in regular 5 x 5 x 1 metre rectangular blocks. Working from the top of the mineralisation down, blocks were progressively added to the bottom of a "stack" of blocks to create a column of ore. Stacking is continued to satisfy:

- minimum mining height of 4.5 m;
- minimum cumulative grade of 1.5 g/t Au; and
- minimum grade of 0.5 g/t Au of the block cell.

Within the modelled resource an area for mining called the mining resource target was identified. Mining constraints require pillars between the stopes, transverse pillars, regional pillars, ore loss factors, dilution, and recovery assumptions. The mined tonnes and ounces are consequently less than the mining resource target. For a typical panel layout recovery is 62% of the tonnes and 50% of the ounces.

Mining Dilution and Recovery

The following definitions describe the modifying factors applied in the stope evaluation process and presented in Figure 16-6.

Ore Loss

Ore that is not recovered from the designed stope solid. This consists of in-situ ore loss (ore that was not blasted) and broken-ore loss (ore that was blasted but not recovered).

Dilution

Waste material that gets mixed with the ore targeted in the stope design solid. This may include over-break from the stope backs either though blast damage or the presence of unstable wedges. In addition, some waste material may be inadvertently blasted due to uncertainty around the location of the hanging wall contact.

Enrichment

Ore additional to that which was blasted which reports to the draw point. This is a result of over break of the yielding pillars that are left between stopes, either through blast damage or fallout along existing structures.

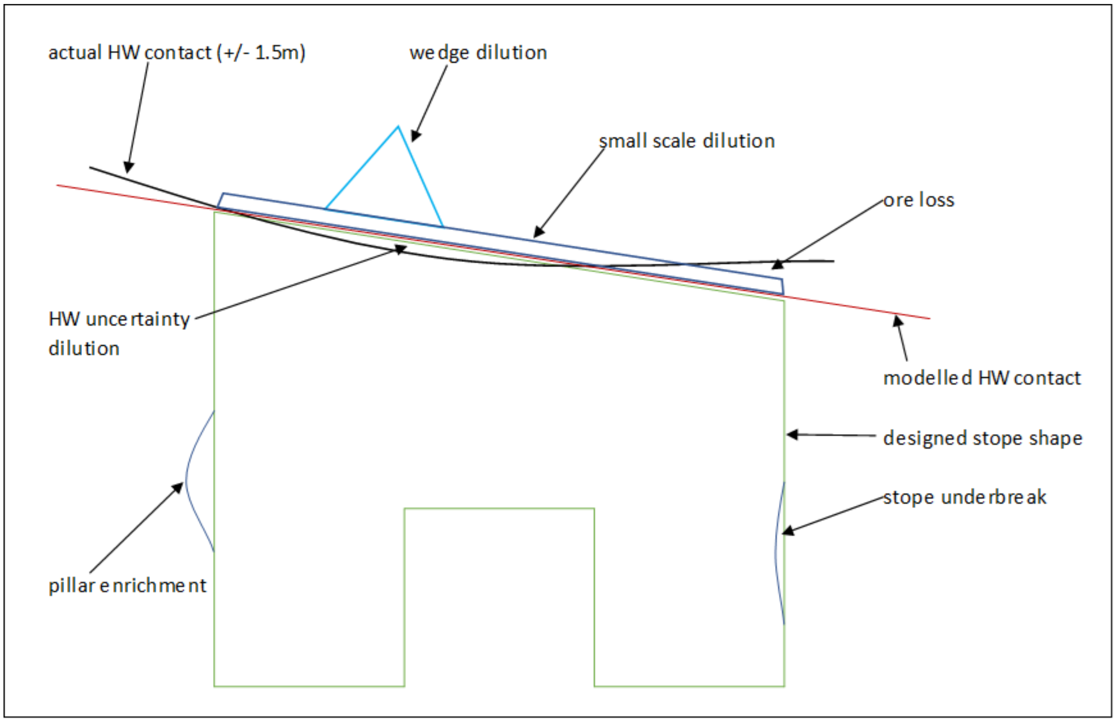

Figure 16-6: Open stope ore loss, dilution and enrichment

Assumptions

The assumptions used for dilution and ore loss, to apply to designed stope shapes, were as follows:

Ore loss (in-situ)

- Hangingwall uncertainty = 1.5% (Redden, 2005);
- Re-slots due to stope collapses (5m pillar for every 100m of ore drive) = 5%; and
- Stope underbreak = 4% (from 2Q panel recon).

Total in-situ losses = **10.5%**

Dilution

- Wedge failures = 10% (Redden, 2005);
- HW uncertainty = 1.5% (Redden, 2005); and
- Small scale dilution = 1.8%.

Total Dilution = **13.3%** (from 2B and 2Q panel recons)

Enrichment

- Pillar failures = 5.7% @ 2.5g/t average grade (2B panel recon showed 4% enrichment. 2Q recon showed 7.4% enrichment).

This results in a combined dilution and enrichment value of 19% @ 0.75g/t.

Ore loss (broken ore)

- Ore not able to be cleaned up on stope edges or due to rough floors = 4.3%; and

- Ore lost through excessive waste cover if stope backs fail = 3.7% (Redden, 2005).

Total broken ore loss = **8%**

Application of Ore Loss and Dilution Factors to Designed Stope Shape

Example:

Starting with:	100% of the tonnes at 2.5 g/t Au
In-situ ore loss:	= 10.5%
	= 89.5% 2.50 g/t Au
Adding dilution	= 19% @ 0.75 g/t Au
	= 106.5% @ 2.22 g/t Au
Discounting broken ore loss	= 8%
	= 98% @ 2.22 g/t Au

The net result is diluted tonnes equalling 98% of the design tonnes and diluted grade equalling 89% of the design grade.

16.3.3 Cutoff Grade Calculations

Three cut-off grades are used at Frasers Underground:

- minimum grade to warrant ore drive development;
- minimum grade to warrant stoping if the ore drive development drive is already in place; and
- minimum grade to warrant processing for development material that has been hauled to surface.

These cut-off grade scenarios are shown in Table 16.11.

Table 16.11: Frasers underground cut-off grade calculations

Parameter	Unit	Ore Drive Development Cut-off	Stoping Cut-off when Development in Place	Process Cut-off When Material is at Surface
Mining Cost	NZD/t	52.42	47.28	0
Ore Re-handle Cost (portal to mill, including ROM loader)	NZD/t	3.08	3.08	3.08
Processing (including tails dam construction)	NZD/t	11.44	11.44	11.44
Sustaining capital	NZD/t	1.32	1.32	1.32
Gold price	NZD/oz Au	2,113	2,113	2,113
	NZD/g Au	67.92	67.92	67.92
Plant Recovery	%	84.4	84.4	82.0
Selling Cost (refining & royalty)	NZD/g Au	0.86	0.86	0.86
Calculated Cut-off Grade	g/t Au	1.29	1.21	0.35
Cut-off Grade Used	g/t Au	1.29	1.21	0.50

16.3.4 Mine Design Criteria

The most utilised mining method at FRUG is retreat long hole open stoping. In addition, sub-level caving is used to recover some of the regional pillars after they are no longer required. Declines and access drives are mined to a 5.0mW x 5.5mH arched profile. Ore drives are mined to a 5.0mW x 5.0mH profile. This allows enough space for services, secondary fans, vent ducts and mobile equipment.

Stoping panels were designed based on the main considerations below:

- Ore drives placed at 21m centres to allow for 15m wide stopes with 6m yielding pillars between them. There are no secondary stopes designed to be extracted following the mining of the primaries;
- Ore drives positioned such that they will have a gentle uphill gradient for water drainage but not orientated directly north-south, parallel to the strike of many of the faults present, to maintain drive stability;
- Regional pillars maintained between panels of 30m width if they contained no development and 60m wide if they contained development drives. In some cases, pillars containing access drives were reduced to a width of 40m if the contained drives were no longer needed following stoping of the surrounding areas;
- The stoping panels should be retreated towards a solid abutment rather than towards an internal regional pillar; and
- Panel accesses designed in conjunction with primary ventilation return loops and secondary egress routes and positioned such that they will stay intact following stoping of nearby areas.

The assumptions made for ore loss and dilution in stopes are noted in Section 16.2.3.

16.3.5 Mine Ventilation Requirements

The ventilation requirements for the key mobile equipment used are shown in Table 16.12. This assumes a minimum air quantity requirement of 0.05m^3/s per kW of maximum engine power.

Table 16.12: Mine ventilation requirements

Equipment Item	Engine Power (kW)	Number Utilised	Ventilation Requirements (m^3/s)
Toro 50D+	429	2	42.9
Sandvik TH550	429	2	42.9
Sandvik TH551	515	1	25.8
Caterpillar R2900	333	2	33.3
Caterpillar R1700	243	2	24.3
Caterpillar Grader	104	1	5.2
Volvo 120E (IT)	180	3	27
Total			**201**

16.3.6 Areas of Expected Poor Mining Recovery

Mining recovery was expected to be poor in some areas included in the mine plan. Reasons for this were the use of sub-level caving mining method or open stope instability during regional pillar extraction. In these cases, mining recoveries were factored down further after in-situ recovery and dilution factors were applied. Table 16.13 summarizes the reduction factors applied to the areas of expected poor mining recovery.

Table 16.13: Mining recovery reduction factors

Reason for Reduction Factor	Mining Recovery Factor Applied
Sub-level caving stopes	0.75
Regional pillar extraction	0.60

16.3.7 Mine Production Schedule

Scheduling Method

Underground mine scheduling is undertaken using *Deswik Sched* software. After establishing mining dependencies, mining priorities and capacity constraints the schedule is generated using the software's auto-scheduler. The Deswik scheduling model was implemented at Frasers Underground in 2019 and replaces the Xpac scheduling model that has been used at Frasers Underground since 2006.

Scheduling Objectives

Schedules aim to:

- ensure that the development drills and cable bolter are fully utilised;
- ensure monthly development advance is consistent; and
- ensure a consistent supply of stope ore tonnes to the ROM.

Scheduling Parameters and Assumptions

Key schedule assumptions are noted in Table 16.14.

Table 16.14: Key underground schedule assumptions

Parameter	Units	Value
Maximum single heading advance rate	m/month	72
Advance rate per development jumbo	m/week	81
Cut-off grade	g/t Au	0.5
Maximum productivity from a single stope draw point	t/day	1000

16.3.8 Underground Mining Schedule Results

A summary of the scheduled physicals is presented Table 16.15.

Table 16.15: Schedule physicals

Schedule Physical	Units	Year 2020	Year 2021	Year 2022
Total Ore Tonnes	T	386,145	550,386	338,695
Total Ore Grade	g/t Au	1.92	1.80	1.74
Total Mined Ounces	Oz	23,823	31,893	18,960
Total Mill Ounces	Oz	20,106	26,918	16,003
Total Waste Tonnes	T	80,570	4,013	0
Total Movement Tonnes	T	438,397	571,142	350,271
Stope Ore Tonnes	T	282,520	558,526	350,779
Stope Ore Grade	g/t Au	1.94	1.77	1.69
Stope Ore Ounces	Oz	17,665	31,761	19,082
Development – Lateral	M	2,377	197	0
Devt Ore Tonnes	T	75,964	7,438	0
Devt Ore Grade	g/t Au	2.40	1.31	0.00
Devt Ore Ounces	Oz	5,855	312	0
Production Drill	M	90,866	145,340	86,651
Cable Drill	M	19571	30831	25089
Total Haulage	tkm	1,530,922	1,898,450	697,470

16.3.9 Mining Fleet and Requirements

General Requirements and Fleet Selection

The mine fleet used in this schedule is based on the existing operation and utilizes existing equipment items.

Drive Development

Development is done by two Sandvik D420 and one Tamrock 205D twin boom drill jumbos, taking 3m rounds and installing friction bolts and mesh for ground support. A Normet Spraymec and Normet Concrete Agitator truck are used to apply shotcrete in areas of friable ground. A Normet Charmec is used to load development face blast holes.

Stope Drilling & Blasting

A Sandvik DS420 Cable Bolter is used to install cable bolts at planned brow positions in ore drives. A Tamrock Solo 7 and Solo 5 are used to drill blind up holes for stope production. A Normet Charmec is used to load production blast holes.

Summary drill and blast parameters are shown in Table 16.16.

Table 16.16: Underground drill and blast parameters

Parameter	Unit	Open Stope	Cave Stope
Drill type (model) used	-	Tamrock Solo 7-7V Tamrock Solo D05	Tamrock Solo 7-7V
Hole diameter	mm	76	89
Ring Burden	m	1.8	2.1
Toe Spacing	m	2.2	2.3

Loading

The primary mine loading fleet consists of two Caterpillar R1700 LHDs on remotes to remove ore from open stopes, and two Caterpillar R2900 LHDs to bog out development headings, load trucks and bog cave stopes.

Hauling

The underground haulage fleet consists of five articulated rear dump trucks. These include Toro 50D+, Sandvik 550 & Sandvik 551 trucks.

Ancillary Equipment

A fleet of other equipment is used to support the primary production fleet. This consists of:

- a Caterpillar 12H motor grader;
- Volvo L120 integrated tool carriers, and
- Jacon flat deck truck.

Underground equipment requirements by year are shown in Table 16.17.

Table 16.17: Major underground equipment fleet by year

Equipment Model	2020	2021	2022
Drill – Sandvik DD420	2	1	0
Drill – Tamrock Solo	2	2	2
Drill – Sandvik DS420	1	1	1
LHD – Caterpillar R2900	2	2	2
LHD – Caterpillar R1700	2	2	2
Truck – Toro 50D+	2	2	0
Truck – Sandvik TH550	2	2	1
Truck – Sandvik TH551	1	1	1
Charge Vehicle – Normet Charmec	2	1	1
Shotcrete Sprayer – Normet Spraymec	1	0	0
Concrete Transmixer – Normet Utimec	1	0	0
Grader – Caterpillar 12H	1	1	1
Integrated Tool Carrier – Volvo L120	3	3	3
Service Truck – Jacon Flat deck	1	1	1

16.3.10 Mine Services

Water

Mine water is supplied from either the Frasers pit sump or from settling dams on the surface. Water services are run into the portal via a single 110mm PN16 polyethylene pipe. Pressure reducers are placed along the length of the pipe where required. Panel accesses are serviced by 110mm PN16 pipe branching off the decline, ore drives are serviced by 63mm polyethylene pipe branching off the access.

The pumping system consists of 5 x WT103 helical rotor pumps placed in series along the decline, pumping to an underground pump station. The pump station houses 5 x WT88 pumps connected to a single rising main to surface. The pump station capacity is 62L/sec at 47bar. Pumped water can be directed to the surface settlings dams or the tailings storage facility.

Compressed Air

Compressed air is supplied to the portal via a 110mm PN16 polyethylene pipe from a compressor and receiver on the surface. 110mm pipes are used in declines and access and 63mm pipes used in ore drives to distribute compressed air to the working areas.

16.4 Golden Point Underground

16.4.1 Mining Methods

The Golden Point underground orebody encompasses the down dip continuation of the Hangingwall shear mined in the Golden Point and Round Hill open pits. The orebody is relatively shallow dipping (15 – 20 degrees) to the east. Most of the orebody is tabular with undulations and has a thickness varying between 5m - 10m. In addition, some concordant lodes are present parallel to the main shear. The Golden Point Underground mine targets the higher-grade zone at the top of the main tabular orebody and within the concordant lodes.

The mining method used is based on the method that has been successfully used at Frasers underground – retreat uphole stoping. At Golden Point this method involves 11m and 15m wide open stopes with 5m yielding pillars between stopes. Mining areas are separated by 25m - 60m wide regional pillars. The mining areas are generally restricted to hydraulic radius of 25m - 30m. Mine production targets the higher-grade zones within the mineralized zone. Stope heights vary between minimum drive height (4.5m) and 10m.

16.4.2 Parameters relevant to Underground Mining

Mine Design Strategy

The main steps in determining a mineable target area were as follows:

- Grade shells were generated from the resource model of all material above 1.5 g/t Au and all material above 2.0 g/t Au;
- Section planes were placed through the grade shells at regular intervals;
- Contiguous regions of material inside the 2 g/t Au shells with a height of at least 3m were identified; and
- For each contiguous region the mining floor and mining backs were traced on the sections to allow the creation of mining floor and back surfaces.

Once the mining floors were defined, contours were placed on the floor surfaces to guide the placement of ore drives. Ore drives were placed on the 'mining floors' at centre-centre intervals of 16m or 20m and orientated such that the development was driven at a gentle uphill gradient wherever possible. The decline, accesses and vent return were placed to best service the ore drives while minimising the development distance required. A minimum separation of 30m was maintained between permanent accesses and stopes. Permanent accesses between stoping panels were avoided due to damage that could be reasonably expected to occur to the accesses due to stress redistribution during stoping.

For a typical panel layout recovery is 71% of the tonnes and 65% of the ounces.

Mining Dilution and Recovery

The following definitions describe the modifying factors applied in the stope evaluation process and presented in Figure 16-7 and summarized in Table 16.18.

Table 16.18: GPUG modifying factors

	Insitu Recovery (%)	Stope Dilution %	Stope Dilution Grade (g/t Au)	Mining Recovery (%)
LHOS (Long Hole Open Stope)	89.5%	19.0%	0.75	92.0%
RFOS (Reverse Fire Open Stope)	88.0%	23.7%	0.6	92.0%
PRLHOS (Pillar Robbing Long Hole Open Stope)	89.5%	19.0%	0.75	60.0%

Ore Loss

Ore that is not recovered from the designed stope solid. This consists of in-situ ore loss (ore that was not blasted) and broken-ore loss (ore that was blasted but not recovered).

Dilution

Waste material that gets mixed with the ore targeted in the stope design solid. This may include over-break from the stope backs either though blast damage or the presence of unstable wedges. In addition, some waste material may be inadvertently blasted due to uncertainty around the location of the hanging wall contact.

Enrichment

Ore additional to that which was blasted which reports to the draw point. This is a result of over break of the yielding pillars that are left between stopes, either through blast damage or fallout along existing structures.

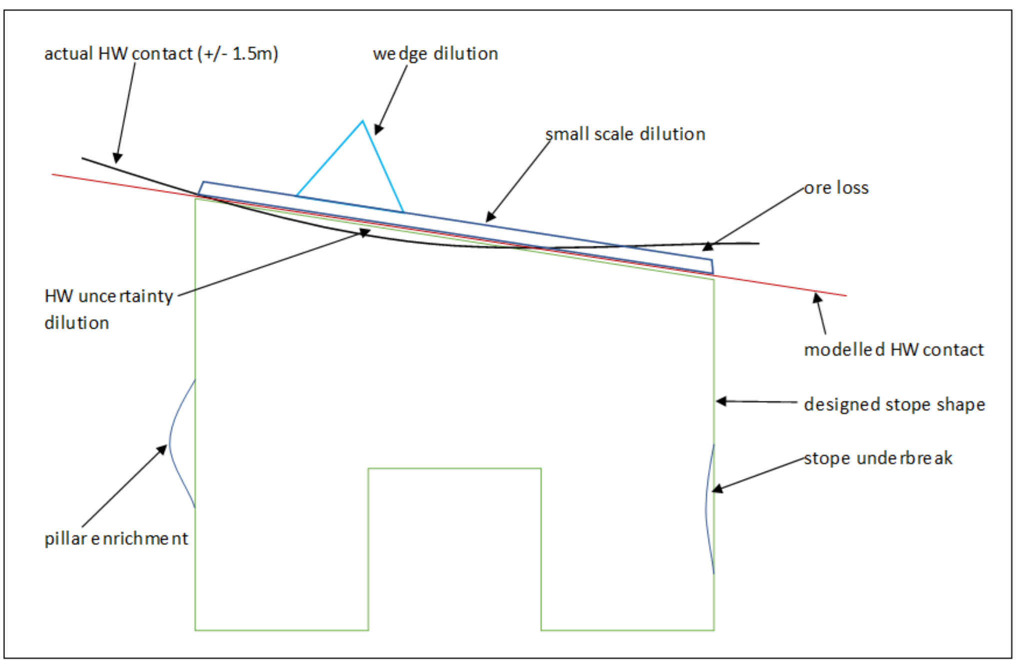

Figure 16-7: Open stope ore loss, dilution and enrichment

Assumptions

The assumptions used for dilution and ore loss, to apply to designed LHOS and PRLHOS stope shapes, were as follows:

- Hangingwall uncertainty = 1.5% (Redden, 2005);
- Re-slots due to stope collapses (5m pillar for every 100m of ore drive) = 5%; and
- Stope underbreak = 4% (from 2Q panel recon).

Total in-situ losses = 10.5%

Dilution

- Wedge failures = 10% (Redden, 2005);
- HW uncertainty = 1.5% (Redden, 2005); and
- Small scale dilution = 1.8%.

Total Dilution = 13.3% (from 2B and 2Q panel recons)

Enrichment

Pillar failures = 5.7% @ 2.5 g/t Au average grade (2B panel recon showed 4% enrichment. 2Q recon showed 7.4% enrichment).

This results in a combined dilution and enrichment value of 19% @ 0.75 g/t Au

Ore loss (broken ore) - LHOS

- Ore not able to be cleaned up on stope edges or due to rough floors = 4.3%; and
- Ore lost through excessive waste cover if stope backs fail = 3.7% (Redden, 2005).

Total broken ore loss = 8%

Ore loss (broken ore) - PRLHOS

- Ore not able to be cleaned up on stope edges or due to rough floors = 4.3%; and
- Ore lost through excessive waste cover if stope backs fail and within transverse pillars = 35.7%.

Total broken ore loss = **40%**

Application of Ore Loss and Dilution Factors to Designed Stope Shape

Example:

Starting with:	100% of the tonnes at 2.5 g/t Au
In-situ ore loss:	= 10.5%
	= 89.5% 2.50 g/t Au
Adding dilution	= 19% @ 0.75 g/t Au
	= 106.5% @ 2.22 g/t Au
Discounting broken ore loss	= 8%
	= 98% @ 2.22 g/t Au

The net result is diluted tonnes equalling 98% of the design tonnes and diluted grade equalling 89% of the design grade.

The assumptions used for dilution and ore loss, to apply to designed RFOS stope shapes, were as follows:

Ore loss (in-situ)

- Hangingwall uncertainty = 1.5% (Redden, 2005);
- Unfired rings lost due to back-break from previous blast = 6.5%; and
- Stope underbreak = 4% (from 2Q panel recon).

Total in-situ losses = **12%**

Dilution

- Wedge failures = 14.7%;
- HW uncertainty = 1.5% (Redden, 2005); and
- Small scale dilution = 1.8%.

Total Dilution = **18%**

Enrichment

Pillar failures = 5.7% @ 2.5 g/t Au average grade (2B panel recon showed 4% enrichment. 2Q recon showed 7.4% enrichment).

This results in a combined dilution and enrichment value of 23.7% @ 0.6 g/t Au

Ore loss (broken ore) **-** RFOS

- Ore not able to be cleaned up on stope edges or due to rough floors = 4.3%; and
- Ore lost through excessive waste cover if stope backs fail = 3.7% (Redden, 2005).

Total broken ore loss = **8%**

Application of Ore Loss and Dilution Factors to Designed Stope Shape

Example:

Starting with:	100% of the tonnes at 2.5 g/t Au
In-situ ore loss:	= 12%
	= 88% 2.50 g/t Au
Adding dilution	= 23.7% @ 0.60 g/t Au
	= 109% @ 2.14 g/t Au
Discounting broken ore loss	= 8%
	= 100.1% @ 2.14 g/t Au

The net result is diluted tonnes equalling 100% of the design tonnes and diluted grade equalling 85% of the design grade.

16.4.3 Cut-off Grade Calculations

Three cut-off grades are used at Golden Point Underground:

- minimum grade to warrant ore drive development;
- minimum grade to warrant stoping if the ore drive development drive is already in place; and
- minimum grade to warrant processing for development material that has been hauled to surface.

These cut-off grade scenarios are shown in Table 16.19.

Table 16.19: Golden point underground cut-off grade calculations

Parameter	Unit	Ore Drive Development Cut-off	Stoping Cut-off when Development in Place	Process Cut-off When Material is at Surface
Mining Cost	NZD/t	60.85	51.76	0
Ore Re-handle Cost (portal to mill, including ROM loader)	NZD/t	1.84	1.84	1.84
Processing (including G&A and tails dam construction)	NZD/t	11.44	11.44	11.44
Sustaining capital	NZD/t	1.32	1.32	1.32
Gold price	NZD/oz Au	2,113	2,113	2,113
	NZD/g Au	67.92	67.92	67.92
Plant Recovery	%	83.7	83.7	83.7
Selling Cost (refining & royalty)	NZD/g Au	0.86	0.86	0.86
Calculated Cut-off Grade	g/t Au	1.54	1.42	0.41
Cut-off Grade Used	g/t Au	1.54	1.42	0.50

16.4.4 Geotechnical Considerations

In areas where the RDQ is less than 50, stope widths are reduced from 15m to 11m to improve stability.

Drives have been orientated to reduce the likelihood and severity of any wedge failures in the backs and walls.

16.4.5 Mine Design Criteria

The proposed mining method at GPUG is retreat long hole open stoping. The decline is mined to a 5.5mW x 6.0mH arched profile and access drives to a 5.0mW x 5.5mH arched profile. Ore drives are mined to a 5.0mW x 5.0mH profile. This allows enough space for services, secondary fans, vent ducts and mobile equipment.

Stoping panels were designed based on the main considerations below:

- Ore drives placed at 20m centres to allow for 15m wide stopes with 5m yielding pillars between them. In areas of RQD<50 ore drives are placed at 16m centres, allowing for 11m wide stopes with 5m yielding pillars between them. There are no secondary stopes designed to be extracted following the mining of the primaries;
- Ore drives positioned such that they will have a gentle uphill gradient for water drainage but not orientated for a long distance on a 350° bearing, parallel to the strike of many of the faults present, to maintain drive stability;
- Regional pillars are maintained between panels of 25m width with no development in them. A 60m regional pillar maintained around the main decline;
- The stoping panels are retreated towards a solid abutment rather than towards an internal regional pillar; and

- Panel accesses designed in conjunction with primary ventilation return loops and secondary egress routes, and positioned such that they will stay intact following stoping of nearby areas.

The assumptions made for ore loss and dilution in stopes are noted in Section 16.4.2.

16.4.6 Mine Ventilation Requirements

The ventilation requirements for the key mobile equipment used are shown in Table 16.20. This assumes a minimum air quantity requirement of 0.05 m^3/s per kW of maximum engine power.

Table 16.20: Mine ventilation requirements

Equipment Item	Engine Power (kW)	Number Utilised	Ventilation Requirements (m^3/s)
Sandvik TH551	515	2	52
Sandvik LH517	310	3	47
Caterpillar 12H Grader	104	1	5
Volvo 120E (IT)	180	3	27
Total		**9**	**131**
Sandvik TH551	515	2	52
Sandvik LH517	310	3	47
Total		**9**	**131**

16.4.7 Areas of Expected Poor Mining Recovery

Mining recovery is expected to be poor during regional pillar extraction. In these areas the mining recovery factor was reduced from 0.92 to 0.60.

16.4.8 Mine Production Schedule

Scheduling Method

Underground mine scheduling is undertaken using *Deswik Sched* software. After establishing mining dependencies, mining priorities and capacity constraints the schedule is generated using the software's auto-scheduler. The Deswik scheduling model was implemented at Frasers Underground in 2019 and replaced the Xpac scheduling model that has been used at Frasers Underground since 2006.

Scheduling Objectives

Schedules aim to:

- ensure that the development drills and cable bolter are fully utilised;
- ensure monthly development advance is consistent; and
- ensure a consistent supply of stope ore tonnes to the ROM by maintaining at least 10 active stopes.

Scheduling Parameters and Assumptions

Key schedule assumptions are noted in Table 16.21.

Table 16.21: Key underground schedule assumptions

Parameter	Units	Value
Maximum single heading advance rate with independent firing	m/month	180
Maximum single heading advance rate with no independent firing	m/month	90
Advance rate per development jumbo	m/week	65
Cut-off grade	g/t Au	0.5
Maximum productivity from a single stope draw point	t/day	1000

16.4.9 Underground Mining Schedule Results

A summary of the scheduled physicals is presented Table 16.22.

Table 16.22: Schedule physicals

Schedule Physical	Units	Year 2020	Year 2021	Year 2022	Year 2023	Year 2024	Year 2025
Total Ore Tonnes	T	0	78,942	337,369	707,371	680,129	577,932
Total Ore Grade	g/t Au	0.00	2.82	2.24	2.37	1.91	1.96
Total Mined Ounces	Oz	0	7,149	24,332	53,828	41,666	36,453
Total Mill Ounces	Oz	0	5,984	20,366	45,054	34,874	30,511
Total Waste Tonnes	T	5,678	170,083	187,615	210,356	61,994	12,688
Total Movement Tonnes	T	5,557	245,859	522,943	917,348	744,747	593,702
Stope Ore Tonnes	T	0	0	141,372	455,865	549,118	537,991
Stope Ore Grade	g/t Au	0.00	0.00	1.99	2.50	1.77	1.96
Stope Ore Ounces	Oz	0	0	9,064	36,618	31,268	33,908
Development – Lateral	M	80	3,235	5,608	6,954	2,880	823
Devt Ore Tonnes	T	0	78,611	195,419	251,243	131,416	40,709
Devt Ore Grade	g/t Au	0.00	2.72	2.36	2.13	2.50	2.35
Devt Ore Ounces	Oz	0	6,868	14,837	17,215	10,572	3,076
Production Drill	M	0	6,455	63,338	151,081	122,826	106,393
Cable Drill	M	0	7380	48315	64919	54506	18853
Total Haulage	Tkm	8,278	275,920	620,457	1,355,688	1,240,755	973,383

16.4.10 Mining Fleet and Requirements

General Requirements and Fleet Selection

The mine fleet used in this schedule is a mix of new plant and plant relocated from Fraser’s underground as this mine nears completion and plant becomes available.

Drive Development

Development will be done by two Sandvik DD421 twin boom drill jumbos, taking 3m rounds and installing friction bolts and mesh for ground support. A third DD420 jumbo will be used from 2023-2024. A Normet Spraymec and Normet Concrete Agitator truck will be used to apply shotcrete in areas of friable ground and a Normet Charmec will be used to load development face blast holes.

Stope Drilling & Blasting

A Sandvik DS420 Cable Bolter will be used to install cable bolts at planned brow positions in ore drives. A Tamrock Solo 7 and Sandvik DL432 are proposed to drill blind up holes for stope production, and a Normet Charmec is used to load production blast holes.

Summary of the designed drill and blast parameters are shown in Table 16.16.

Table 16.23: Underground drill and blast parameters

Parameter	Unit	Open Stope 11m wide	Open Stope 15m wide
Drill type (model) used	-	Tamrock Solo 7-7V Sandvik DL432	Tamrock Solo 7-7V Sandvik DL432
Hole diameter	mm	64	76
Ring Burden	m	1.4	1.8
Toe Spacing	m	1.8	2.2
Blasting powder factor	kg/m3	0.35	0.30

Loading

The primary mine loading fleet will consist of three Sandvik LH517 LHDs. These will remove ore from stopes on remotes, bog out development headings and load trucks.

Hauling

The underground haulage fleet will consist of Toro 50D+ and Sandvik 551 articulated rear dump trucks.

Ancillary Equipment

A fleet of other equipment consisting of the following will be used to support the primary production fleet:

- a Caterpillar 12H motor grader;
- Volvo L120 integrated tool carriers, and
- Jacon flatbed truck.

The underground equipment requirements by year are shown in Table 16.24.

Table 16.24: Major underground equipment fleet by year

Equipment Model	2021	2022	2023	2024
Drill – Sandvik DD420/DD421	1	2	2	3
Drill – Tamrock Solo/Sandvik DL432	0	0	2	2
Drill – Sandvik DS420	0	0	1	1
LHD – Sandvik LH517	1	1	2	2
Truck – Toro 50D+	1	1	0	0
Truck – Sandvik TH551	0	1	2	2
Charge Vehicle – Normet Charmec	0	1	2	2
Shotcrete Sprayer – Normet Spraymec	1	1	0	0
Shotcrete Transmixer and Sprayer – Jacon Transmix Combo	0	0	1	1
Concrete Agitator Truck – Isuzu	1	1	1	1
Grader – Caterpillar 12H	1	1	1	1
Integrated Tool Carrier – Volvo L120	1	1	2	3
Service Truck – Jacon flat deck	0	1	1	1

16.4.11 Mine Services

Water

Mine water is supplied from the Round Hill pit sump. Water services are run into the portal via a single 110mm PN16 polyethylene pipe. Pressure reducers are placed along the length of the pipe where required. Panel accesses are serviced by 110mm PN16 pipe branching off the decline, ore drives are serviced by 63mm polyethylene pipe branching off the access.

The pumping system consists of three pump locations placed in series along the decline, pumping out the portal to the processing plant. At each pump location are 2 x WT103 helical rotor pumps running into a 160mm PN16 polyethylene pipe.

Compressed Air

Compressed air is supplied to the portal via a 110mm PN16 polyethylene pipe from a compressor and receiver on the surface. 110mm pipes are used in declines and access and 63mm pipes used in ore drives to distribute compressed air to the working areas.

16.5 Combined Open Pit and Underground Production Schedule

The combined open pit and underground ore processing schedule is shown in Table 16.25.

Table 16.25: Combined open pit and underground ore processing schedule

	Units	2020	2021	2022	2023	2024	2025	2026	2027	2028	LoM
Open Pit Schedule											
Total Ore Milled Quantity	Mt	2.67	5.23	5.22	5.19	5.24	3.50	4.21	5.90	0.71	**37.87**
Total Milled Gold Grade	g/t Au	0.81	0.99	0.76	0.61	1.08	0.87	0.83	1.28	0.59	**0.92**
Total Milled Contained Gold	Koz	70	167	128	102	183	98	113	243	13	**1,116**
Underground Schedule											
Total Ore Milled Quantity	Mt	0.39	0.63	0.68	0.71	0.68	0.57	-	-	-	**3.65**
Total Milled Gold Grade	g/t Au	1.92	1.93	1.99	2.37	1.90	1.98	-	-	-	**2.03**
Total Milled Contained Gold	Koz	24	39	43	54	42	36	-	-	-	**238**
Combined Open Pit and Underground											
Total Ore Milled Quantity	Mt	3.06	5.86	5.90	5.90	5.92	4.07	4.21	5.90	0.71	**41.53**
Total Milled Gold Grade	g/t Au	0.95	1.09	0.90	0.82	1.18	1.03	0.83	1.28	0.59	**1.01**
Total Milled Contained Gold	koz	93	206	171	156	224	134	113	243	13	**1,354**

17 Recovery Methods

17.1 Ore Mineralogy

Gold is mostly present as microbleb particles <10um in sulphide grains or adjacent to grain boundaries, principally within pyrite and arsenopyrite. This gold is partially refractory with up to 20% not readily recoverable by standard cyanidation methods when reground to 15 microns. Up to 90% of the gold can be readily recovered to a sulphide flotation concentrate with the flotation losses associated with poorly liberated sulphide particles or locked in non-sulphide gangue. Pressure oxidation in an autoclave is used to break down the sulphide grain structure to make the contained gold particles amenable to cyanidation with leach recoveries on the autoclaved concentrate typically 95%.

The Macraes ore also contains a carbonaceous fraction. Coarse grained ores tend to contain less organic carbon, while finer grained ores contain higher levels of carbon. The carbonaceous material has a negative impact in the CIL circuit, adsorbing some of the dissolved gold from the CIL circuit liquor; this effect is not uncommon and is termed 'preg-robbing'. The carbonaceous material is typically recovered to the flotation concentrate, although its flotation kinetics are slower than those of the sulphide minerals, so that carbon recovery is generally lower than sulphide recovery. The soft carbonaceous material also tends to smear on the gangue components of the ore, imparting some degree of hydrophobicity increasing the recovery of non-sulphides in the flotation concentrate. Experience at Macraes and at other plants worldwide indicates that the autoclave pressure oxidation under normal oxidising conditions tends to further activate the carbonaceous material. Macraes has adopted technology developed by Newmont Limited of the US that allows passivation of the carbonaceous material by introducing limestone into the feed to the autoclave. This, along with the use of kerosene in the CIL circuit and judicious management of the activated carbon in the CIL circuit has provided an effective means of controlling and mitigating the preg-robbing effect.

17.2 Plant Description

The Macraes Process Plant recovers gold by concentrating the metal into a relatively small fraction of flotation concentrate, regrinding the concentrate to a P80 of 15 microns, oxidising the reground concentrate in a pressure oxidation autoclave, washing the oxidised residue and then utilising a carbon-in-leach process to recover gold from the residue. The overall process flowsheet is shown in Figure 17-4.

In detail the plant comprises the following components and stages:

- Two single stage jaw crushing circuits, which reduce the ore to a top size of approximately 200mm; the products from these two circuits are directly fed to the two SAG mills and an emergency feeder on the conveyor system feeding the higher capacity circuit provides continuity of feed to the grinding circuit if the jaw crusher feed is interrupted;
- A complex grinding circuit to reduce the particle size of the ore to 80% passing at 130 µm; the original, higher capacity crushing circuit feeds a 2,300kW SAG mill and the new crushing circuit feeds a 1,500kW SAG mill; discharge from the two SAG mills is combined with the discharge from one of the two ball mills (2,300kW) and directed to the primary cyclone cluster. Discharge from the higher capacity ball mill (2,500kW) is fed to the secondary cyclone cluster. The underflows from both cyclone clusters are combined and fed in parallel to the flash flotation circuit and two ball mills (2,300kW and 2,500kW);
- A flash flotation circuit made up of roughing and cleaning stages. The circuit is fed from the circulating load of the grinding circuit via cyclone underflows to recover the bulk of fast floating sulphide minerals containing high gold content in the coarser size fraction;

- The main flotation circuit made up of roughers, scavengers, cleaners, recleaners and cleaner scavenger flotation cell trains to produce a gold bearing sulphide concentrate at optimum sulphur grade for the downstream pressure oxidation circuit;
- Regrind of the flotation concentrate is performed in a 900kW ball mill to 80% passing of 15 µm to improve pressure oxidation kinetics; limestone is added to the regrind circuit discharge to control net acid generation in the pressure oxidation circuit;
- Washing and thickening of the reground flotation concentrate is conducted in a high rate thickener to remove chloride ions present in the liquor and increase pulp density prior to being fed to pressure oxidation circuit for optimum autoclave performance;
- Pressure oxidation is performed in a 77 m3 autoclave operating at 3,150kPa and 225°C to achieve greater than 90 % oxidation of the sulphide component of the Macraes concentrate; oxygen is supplied to the autoclave from a cryogenic plant operated by BOC;
- Washing and thickening of the oxidised residue post the pressure oxidation (POX) process is performed in a two-stage counter current decantation thickener circuit to cool the temperature and dilute acidity of the hot oxidised residue, remove presence of irons and arsenic, and increase pulp density in preparation for downstream CIL process;
- Neutralisation of the acidic, cooled oxidised residue is conducted using quicklime in an agitated opened tank; solvent is also added to passivate the carbonaceous surfaces of oxidised residue;
- Leaching of the gold from the oxidised residue is performed in the CIL circuit using cyanide. The leached gold liquor is adsorbed by high concentrations of activated carbon to mitigate the impact of preg-robbing by the carbonaceous species in the ore;
- Destruction of the cyanide ions prior to CIL tailings disposal is performed using the INCO process with chemical reagents of sodium metabisulphite, source of sulphur dioxide (SO2); and chemical reaction catalyst, copper sulphate;
- Tailings disposal after further neutralisation of the acidic liquor from the pressure oxidation process performed using flotation tailings and lime and then combined with CIL tailings after the INCO cyanide detoxification process and discharged into the tailings storage facility; and
- Recovery of concentrated, adsorbed gold from the loaded activated carbon is performed using the AARL elution process and single pass electrowinning circuit, followed by smelting to produce gold bullion.

The pressure oxidation process uses technology that minimises formation of gold chloride complexes in the autoclave. Formation of these soluble gold complexes in the presence of naturally occurring carbonaceous species has the potential to preg-rob soluble gold prior to contact with cyanide in CIL circuit. Washing the concentrate with water in a thickener reduces chloride levels present in the flotation concentrate. The acidity of the oxidised residue is controlled by the addition of limestone in the regrind circuit. The sulphur oxidation extent was designed to about 75% of the total sulphide present but more recently test work indicated that oxidation extent greater than 75% has enabled increased gold extractions in CIL to be achieved with increased throughput at high oxidation extents through the autoclave.

17.3 Plant Performance

Recent plant performance is summarized in Figure 17-1 and Figure 17-2.

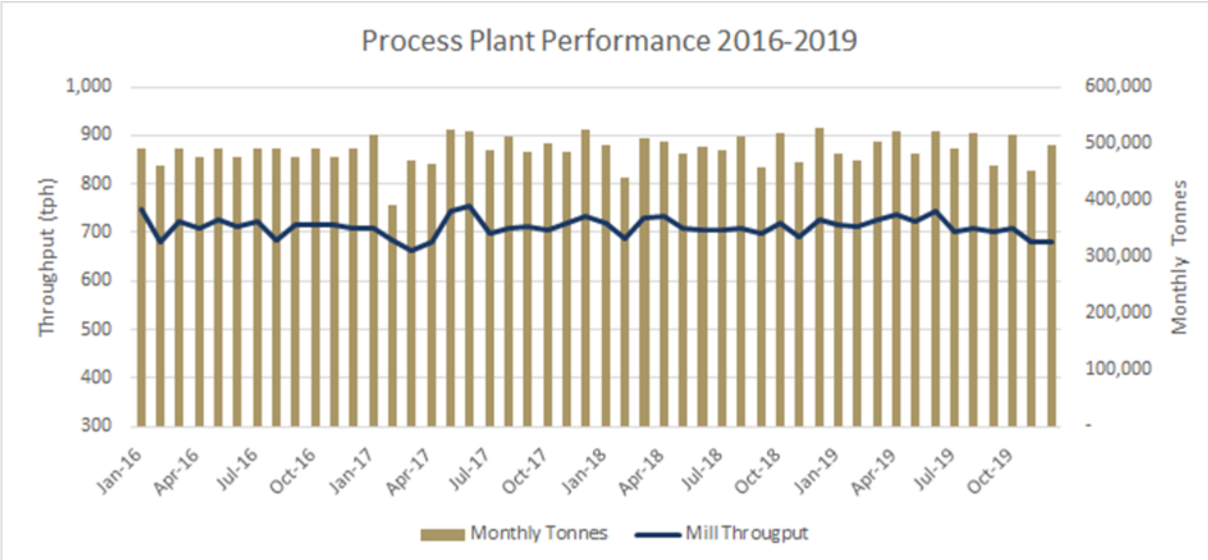

Figure 17-1: Actual milled tonnages & combined mill throughput

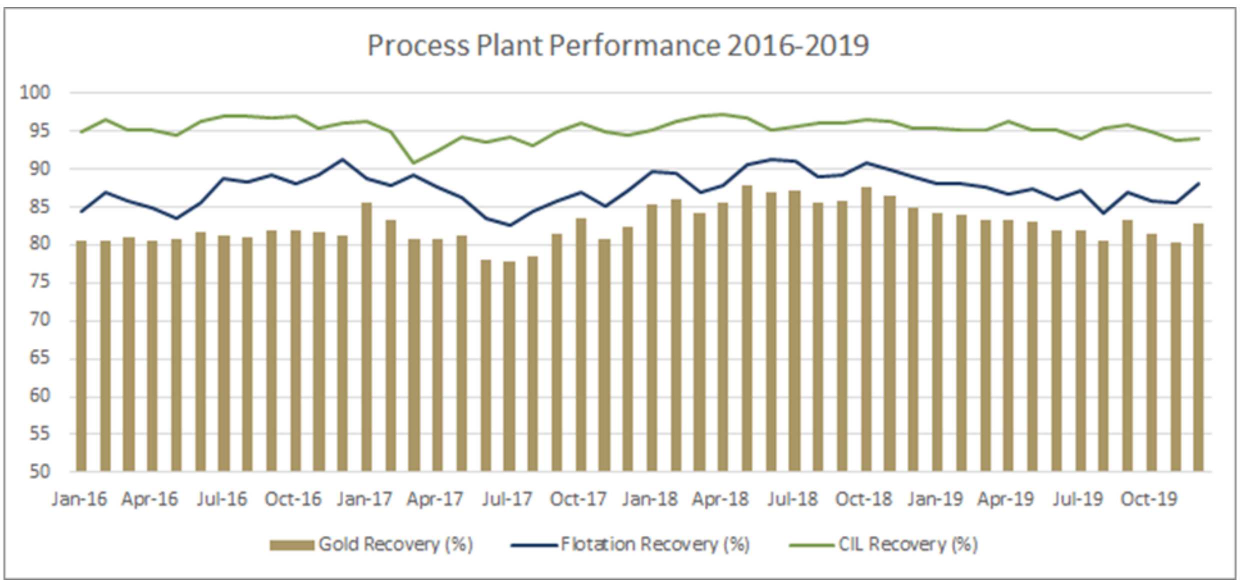

Figure 17-2: Actual overall circuit, flotation and CIL recoveries

Overall mill utilization is above 94% and is calculated on the tonnage weighted utilization of the two primary SAG mills. Unit costs over the last 24 months has averaged NZD10.50/tonne of ore milled with a slight downward improvement over the last 4 years from improved optimization of autoclave maintenance strategies matching the concentrate treatment requirements. Mill utilization and unit cost trends are shown in Figure 17-3.

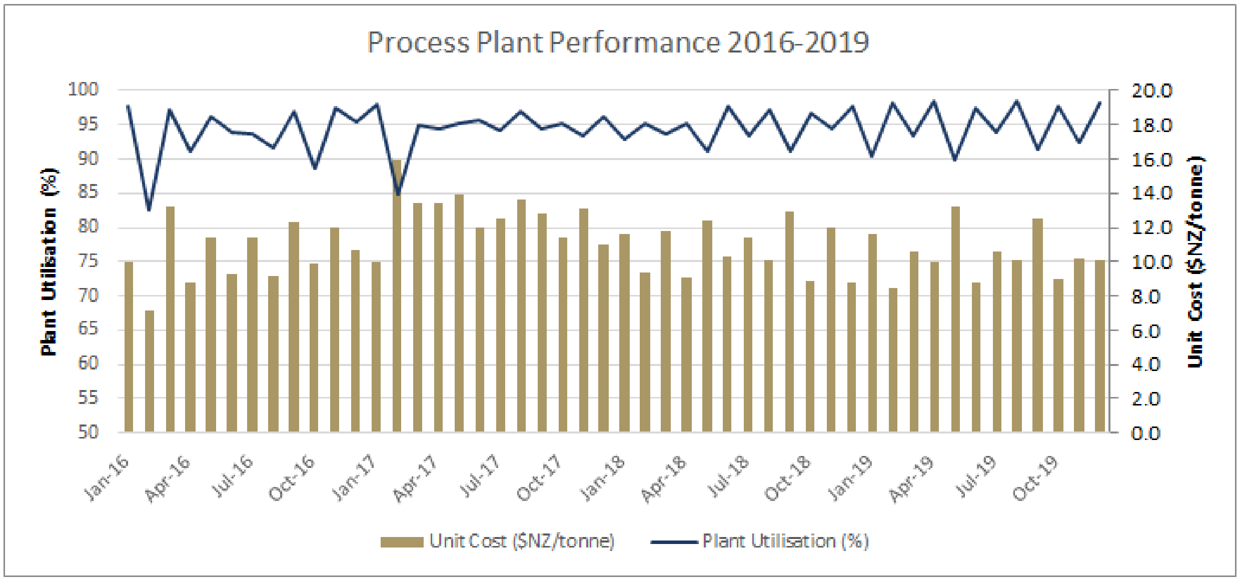

Figure 17-3: Actual unit processing cost averaged at NZD10.53/t in producing 5.8 - 5.9 Mtpa and mill utilisation

17.4 Oxide Ore Milling

Over the life of mine approximately 1.5 Mt of stockpile ore classified as oxide material at an average grade of 0.82 g/t Au will be processed. Historically oxide ore at Macraes was treated primarily in dedicated campaigns with ore fed to the grinding circuit sent direct to the CIL circuit. This was the case up to 2003 when the second SAG mill was installed as a dedicated oxide circuit as the overall primary milling capacity when dedicated to oxide exceed the CIL circuit regeneration and carbon management capacity. From 2003-2005 oxide ore was milled by the ML-500 SAG mill in closed circuit and the product send direct to CIL with three of the CIL tanks dedicated to the oxide ore and three to POX material with a combined final tank to provide 18 hours of residence time. ML-500 was then converted to operate in an open circuit configuration on sulphide ore increasing the plant capacity from 5.4 Mtpa to the current 5.9 Mtpa.

In the current life of mine plan, the ML-500 circuit will be modified to return to its original closed-circuit configuration for the 2025/26 years allowing processing of oxide ore at a rate of 100t/h direct to the CIL circuit. With the reduced overall concentrate treatment rates and available tankage 12 hours of residence time for oxide material can be maintained and is sufficient based on historical testwork and oxide processing experience to achieve the targeted recovery of 79.7%.

Consumables required for the parallel milling of oxide ore in the ML-500 circuit have been estimated from historical laboratory testwork and benchmarks from plant operational data from the 2003-2005 period. A capital cost estimate of NZD600,000 has been included in the sustaining capital budget in 2024 to support the conversion of the ML-500 circuit to operating in closed circuit again.

17.5 Process Costs

Process costs are derived from a first principals model based on drivers developed against milled tonnes, operating hours and fixed cost components. Drivers for key consumables are benchmarked against plant consumption rates and unit prices are derived from current supply contracts and exchange rate assumptions.

A long-term maintenance schedule is used to forecast relines and major rebuilds of equipment and to calculate plant operating hours. Contractor hours and maintenance consumables are calculated for each process area based on operating hours.

The key processing metrics over the life of mine plan are outlined in Table 17.1. Mill throughput is maintained at 5.9 Mtpa up until the end of 2024, with a drop-in processing rate from 2025 as the rate of mined sulphide ore and existing stockpiles are below mill capacity. The reduced mill feed along with higher reagent costs associated with the milling of oxide ore in the ML-500 circuit lead to an increase in unit costs in 2025/26 but over the life of mine the combined unit cost of milled ore is maintained at NZD11/t.

Table 17.1: Life of Mine Processing Metrics

		2020	2021	2022	2023	2024	2025	2026	2027	2028	LOM
Milled Tonnes	kt	3,032	5,875	5,900	5,917	5,916	4,071	5,087	4,690	1,041	41,523
Sulphide Feed	kt	3,060	5,859	5,900	5,900	5,916	3,215	4,411	4,690	1,041	39,992
Oxide Feed	kt	0	0	0	0	0	855	676	0	0	1,531
Feed Grade	g/t Au	0.94	1.09	0.90	0.82	1.18	1.05	1.10	1.16	0.58	1.02
Gold Recovery	%	83.6	82.4	81.5	81.4	83.1	79.9	79.7	82.7	81.7	81.8
Unit Cost	NZD/t	10.18	10.70	10.33	10.15	10.44	13.21	12.48	11.44	9.40	11.00

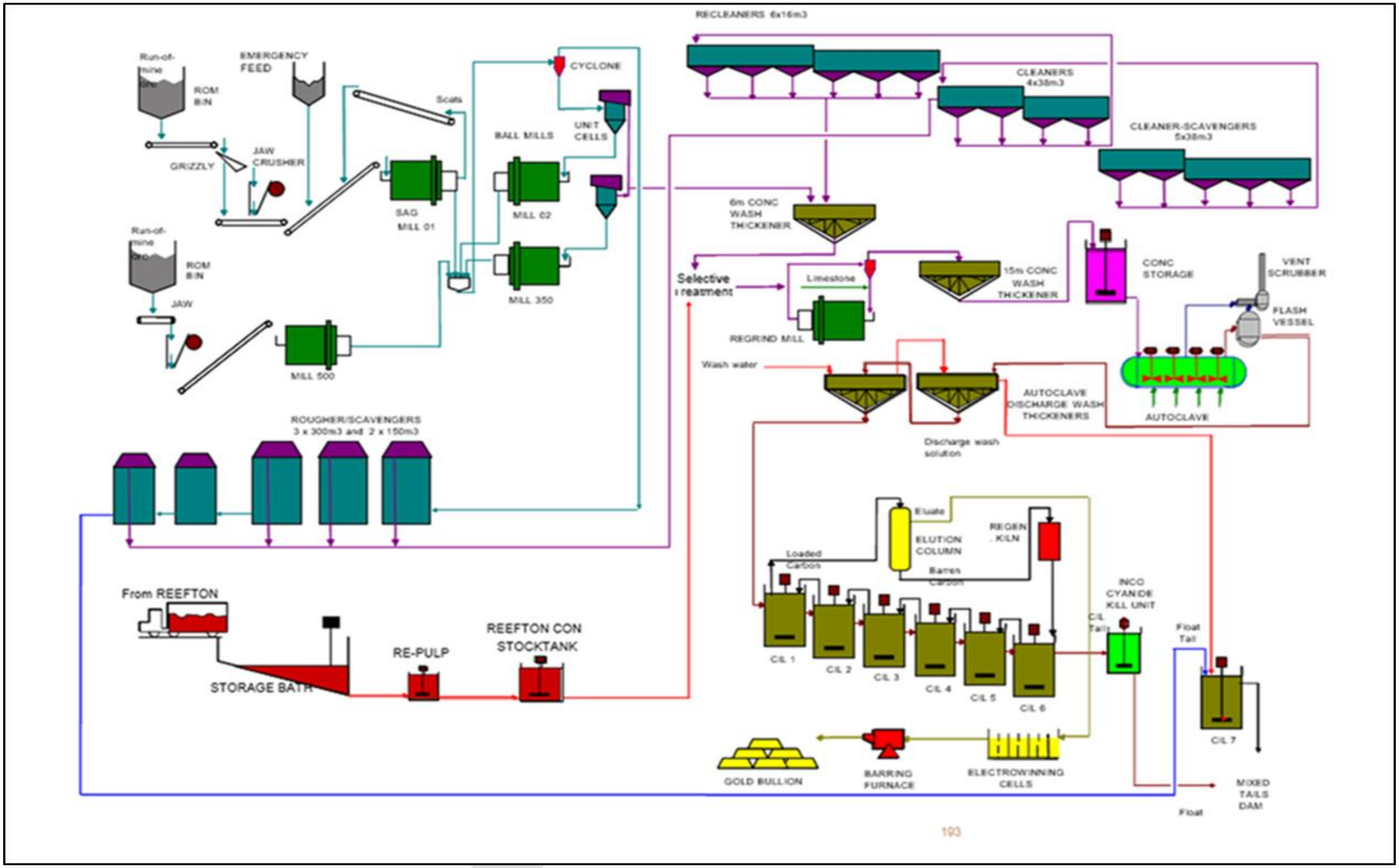

Figure 17-4: Macraes process plant flowsheet

18 Project Infrastructure

18.1 Roads

18.1.1 Site Access Roads

The site is well serviced with existing bitumen road connections to the west (Middlemarch & Ranfurly) and to the east (Palmerston, Dunedin, Christchurch).

The Macraes-Dunback Road, which is the main road into the site, is being realigned during 2020 to allow access to a new open pit stage, Frasers West. This realignment consists of a new bridge to cross the mine haul road and about 2.4km of new public road pavement.

18.1.2 Mine Haul Roads

The site already has an established haul road network to connect the pits to the waste rock stockpiles, ore stockpiles and the process plant. Some additions to this network will be required when new mining areas are developed, like Deepdell.

Haul roads are generally constructed from materials already available on site and using the site mining equipment.

18.2 Mine Services Facilities

18.2.1 Open Pit Mine

All major facilities are in place and no significant new construction is required during the current mine life. Minor support infrastructure will be required for new pits, for example lunchrooms for operators and portable fuel tanks.

Maintenance Workshops

The primary maintenance facility is located about 1.3 km south of the processing plant. This facility consists of a fully enclosed multi-bay heavy vehicle workshop, boilermaker bay, light vehicle workshop, parts and component storage, tyre maintenance and repair facility, wash-down facility and offices.

A satellite workshop is available at the Coronation site. This facility consists of an open workshop and basic store and is used for excavator maintenance and breakdown support.

Offices

Open pit management and technical services staff are located at the main administration office located on Golden Point Road.

18.2.2 Underground Mine

During 2020 the underground infrastructure located at the top of the Frasers pit will be relocating to a site approximately 800m to the north. The new site will continue to be adequately serviced by roads and other services and is located between the Frasers and Golden Point underground mines.

Maintenance Workshops

The maintenance facility consists of an enclosed three bay workshop with a pit, boilermaker bay, parts storage and a wash-down facility.

Concrete Batching Plant

The site includes a self-contained Simen Zingo Plus 50m^3/hr concrete batching plant. This plant is portable and is primarily used for shotcrete, aggregates are sourced from suppliers within Otago.

Offices

Management and technical services staff are located within the main underground infrastructure area.

Electricity

The underground mine requires electricity for ventilation, pumping and for underground drilling. Electricity is supplied underground at 11kV and this is stepped down to 1,000V for the underground equipment with a series of transformers located at various points within the underground workings.

Frasers Underground electrical supply is reticulated underground from two sources, via the portal and via the ventilation shaft. The Frasers Underground mine requires about 2.2MW of electricity.

Golden Point Underground electrical supply will be reticulated underground from the portal. Golden Point Underground will have a similar installed power requirement to Frasers but is expected to consume less electricity due to shallower depths and less extensive workings.

Ventilation

The ventilation within the Frasers Underground mine uses one 550 kW primary fan located underground, which exhausts via a dedicated ventilation shaft. Fresh air is drawn into the mine through the primary decline and secondary egress shaft.

Golden Point Underground will use one 800kW primary fan on a variable speed drive located immediately outside the ventilation portal. Fresh air will be drawn in the primary decline and exhausts via the ventilation decline and portal.

Secondary and auxiliary ventilation uses a series of axial fans and ventilation ducts to achieve a minimum of 6.1 m^3/s of fresh air at each working face.

18.2.3 Assay Laboratory

An on-site assay laboratory is operated by SGS and is accredited to ISO standards. This facility consists of sample preparation and fire assay capabilities. The lab runs on a 24hr /7 day a week basis and can process a nominal 900 samples per day.

18.2.4 Fuel Storage and Dispensing

Diesel fuel is transported to site using road tankers. Total site diesel storage capacity is about 400,000 L, which represents about 6 days of consumption. Substantial diesel supplies are available at Port Chalmers in Dunedin and this is the primary buffer to supply chain disruptions.

Site dispensing is primarily through an electronic tag system for each authorised equipment item. Secondary dispensing occurs via the site fuel trucks.

18.2.5 Explosives

Red Bull Powder Company Ltd have an on-site emulsion plant, with a capacity of 10,000 tonnes of emulsion per year. Other precursor ingredients and ready-made explosives are delivered and stored on-site per Table 18.1.

Table 18.1: Explosives used on site

Explosive Type	Where Used	Origin
Blast initiation	OP & UG	Delivered ready-made, stored on site
Bulk emulsion	OP	Manufactured on-site
Heavy ANFO	OP	Manufactured at the delivery point from AN prill and site sourced emulsion
ANFO	UG	Pre-mixed bulk bags
Packaged (various types)	Primarily UG	Delivered ready-made, stored on site

18.2.6 Electrical Power

Electricity requirements on site are serviced by the national grid. Most power comes from Ranfurly on a 66kV line, and a secondary connection is available from Palmerston on a 33kV line. Incoming power is transformed down to 11kV for distribution around the site.

The incoming transmission line capacity is currently 37MVA but is currently limited to 28MVA due to upstream equipment limits. The Macraes site currently requires 22MVA, most of the site demand is from the process plant and underground mine.

18.2.7 Communications

The site has various communications connections:

- Fibre optic connections for voice and data;
- Mobile phone coverage to offices; and
- Mobile radio network that covers the entire open pit mining area and the underground mine via a leaky feeder system.

18.3 Tailings Storage

18.3.1 Design Criteria

All tailings embankments and impoundments at the Macraes site are designed and operated in accordance with the New Zealand Society on Large Dams (NZSOLD) criteria. Design requirements are related to the Potential Impact Classification (PIC). The Top Tipperary TTSF (TTTSF) has been previously assessed as ‘medium’, which is the 2nd highest classification of a four-step scale. While the Lower Tipperary TSF (LTTSF) detailed design and PIC has not yet been completed, it is likely that this will also be a medium classification.

NZSOLD require a minimum factor of safety of 1.5 under static loading conditions and this is adopted for design.

For earthquake design, NZSOLD state that medium and high impact potential dams must be designed to two levels of earthquake, the Maximum Design Earthquake (MDE) and the Operating Basis Earthquake (OBE). For the TTTSF, the OBE has been taken to be the 1 in 150-year return period earthquake and the MDE as the 1 in 2,500-year return period earthquake.

In terms of flood protection, the storage facilities are required to be designed and operated to completely contain the runoff from a 48-hour probable maximum precipitation (PMP) rainfall event with a 1.0m freeboard. The PMP for this site if 0.7m.

Settled tailings bulk density has been observed to increase over time as the tailings consolidate, and the void space reduces. Density parameters adopted for design purposes are:

- Year 1: 1.25 dry t/m3';
- Year 2-4: 1.30 dry t/m3; and
- Year 5 onwards 1.35 dry t/m3.

18.3.2 Existing Facilities

There are currently three tailings storage facilities (TSF) at Macraes. Two of the TSF's are in the process of being closed, namely the Mixed Tailings Impoundment and the SP11 Impoundment as shown in Figure 18-1.

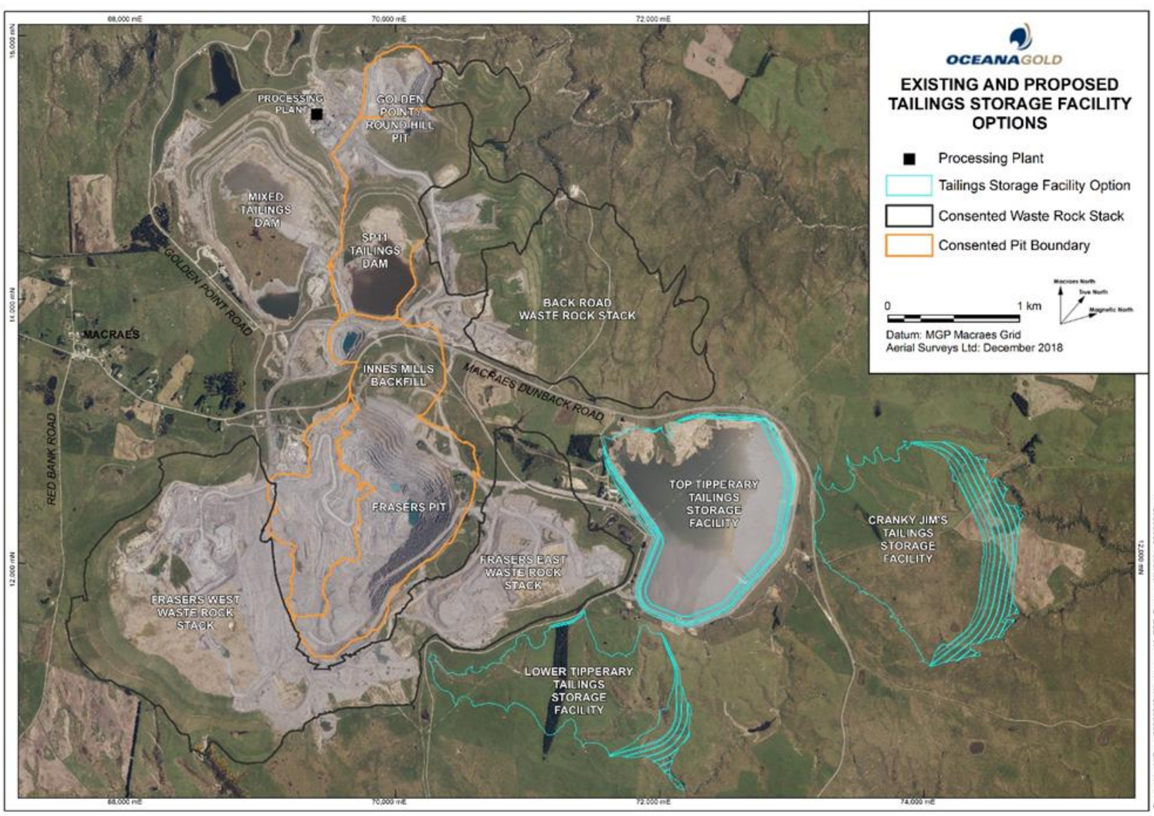

Figure 18-1: Existing and proposed tailings storage facilities

The currently active facility is the Top Tipperary TSF (TTTSF), which has been the primary point of discharge since 2011. The currently consented crest height of this facility is 560mRL.

The TTTSF crest height was approximately 555mRL at the end of 2019, the company is in the process of designing and consenting an extension to 568mRL. The extended TTTSF is expected to have sufficient storage volume to 2024.

18.3.3 New Facilities

Several options are available for future tailings storage at Macraes. In the long term the Frasers open pit void will be used, however an interim facility may be required prior to this facility becoming available.

Figure 18-1 shows and Table 18.2 summarizes the available future TSF options. Both the Lower Tipperary and Cranky Jim's options are within the Shag River catchment like the existing TTTSF.

Table 18.2: Future tailings storage options

Name	Crest Level (mRL)	Volume Capacity (Mm^3)	Tonnage Capacity (Mt)	Comment
Lower Tipperary	550	21.4	29	Immediately south of TTTSF, return water to use TTTSF as a staging pond.
Cranky Jim's	515	28.0	37	Immediately east of TTTSF, return water to use TTTSF as a staging pond.
Frasers Open Pit	500	97+	130+	High initial head for return water pumping. Timing reliant on mining completion

None of these potential TSF options have progressed to detailed design or have had consent applications lodged. This Technical Report has assumed the Cranky Jim's TSF succeeds the TTTSF because Cranky Jim's is:

- Independent from mining activities at Frasers;
- Has sufficient capacity for the proposed tailings volumes and scope to expand; and
- Has not had any fundamental permitting issues identified.

18.3.4 Tailings Deposition Plan

The deposition plan for this schedule is two-fold:

- complete the TTTSF; then
- construct the Cranky Jim's TSF and store tailings there until the end of the mine life.

There is potential to store some of the drier re-mined tails from the top of the SP11 TSF with waste rock within the Back Road WRS, however this study assumes they all need to be stored within a fully engineered TSF and hence Cranky Jim's has been assumed.

For the planned tailings deposition quantities, the deposition quantities are shown in Table 18.3.

Table 18.3: Tailings deposition plan

Year	Source			Destination	
	Milled Tails (Mt)	Re-Mined Tails (Mt)	Total Tails (Mt)	TTTSF (Mt)	Cranky Jim's TSF (Mt)
2020 H2	3.1		3.1	3.1	
2021	5.9		5.9	5.9	
2022	5.9		5.9	5.9	
2023	5.9	6.5	12.4	5.9	6.5
2024	5.9	11.2	17.1	1.6	15.5
2025	4.1		4.1		4.1
2026	4.1		4.1		4.1
2027	5.8		5.8		5.8
2028	1.0		1.0		1.0
Total	**41.5**	**18.5**	**60.0**	**22.4**	**37.1**

Constuction of the Cranky Jim's TSF is planned to commence at the start of 2023, and this facility will initially receive re-mined tailings. Once the TTTSF is completed the milled (fresh) talings will then be discharged into the Cranky Jim's TSF in 2024.

18.4 Water

18.4.1 Surface Water Management

Water used for mining purposes is predominantly dust suppression water for the site haul roads. This water is typically sourced from pit and waste rock stack runoff water that is collected in sumps and pumped to storage ponds.

Stormwater runoff water is diverted away from the active mining areas where possible. All water that cannot be diverted is collected and used for dust suppression as a priority. Excess water is pumped into the overall site water system.

Where there is excess water on site, this is disposed of in two ways:

- evaporated with surface sprinklers during summer months; or
- discharged into local waterways during periods of high flow in order to dilute any elevated sulphate or nitrate levels.

18.4.2 Underground Water Management

Water used for mining activities flows under gravity back to sumps or is pumped using portable submersible electric pumps. From the sumps water is pumped to high head helical rotor pumps, which in turn direct water to the underground pump station.

At Frasers Underground, the pump station sends water up the main escapeway shaft. On the surface at the top of the shaft, water can be directed to the settling dams or the tailings storage facility. Water sent to the settling dams is directed back towards the portal into holding tanks as needed for re-use underground.

At Golden Point Underground, the pump station will send the water up the main decline. Once the water is at surface it will be sent directly to the process plant as process water.

18.4.3 Process Plant Water Management

Water required for processing purposes is primarily sourced from the decant pond at the tailings storage facility. Additional make-up water is required to allow for water contained within the tailings and that lost in evaporation. Most make-up water is sourced from the Taieri River and this is stored in a large reservoir, sufficient to last during a summer drought period. Additional make-up water is sourced from various seepage collection ponds around the site.

19 Marketing Studies and Contracts

19.1 General

The mine has been operational continuously for the last 30 years and has current contracts in place for doré refining and other goods and services required to operate an underground mine and open pit mine.

Contracts are in place covering the provision of goods and services to support open pit and underground mining, transportation and refining of bullion, and the purchase and delivery of fuel, electricity supply, water supply, explosives and other commodities. These agreements conform to industry norms.

19.2 Bullion Production and Sales

A contract to refine the produced doré is with Perth Mint. This contract sets prices for transporting and refining the doré under conditions which comply with industry norms.

OceanaGold has agreements at typical industry benchmark terms for metal payables and refining charges for doré produced from the Macraes operations. Gold and silver bearing doré are shipped to an Australian refinery for further processing under a toll refining agreement.

19.3 Commodity Price Projections

Metal price assumptions are provided by OceanaGold Corporation. Prices used for the economic analysis in this Technical Report are shown in Table 19.1.

Table 19.1: Commodity Price Projections

		2020	2021	2022	2023	2024 onward
Gold price	USD/oz	1,700	1,600	1,550	1,550	1,500
Silver price	USD/oz	17	17	17	17	17
Exchange rate	NZD/USD	0.65	0.65	0.65	0.65	0.65
Gold price	NZD/oz	2,615	2,462	2,385	2,385	2,308

19.4 Hedging and Forward Sales Contracts

OceanaGold has periodically entered short and long-term hedges, both on a company wide basis and directly for Macraes. Current hedging represents 65% of the 2020 production (9,900ozs per month at NZD2,000-2,100 per oz and runs until December 2020.

19.5 Contracts and Status

19.5.1 Open Pit Mining

Open pit and underground mining at Macraes are carried out by OceanaGold personnel using mining equipment leased or owned by OceanaGold. Leasing facilities are supplier by Caterpillar Financial. Mining equipment is maintained by OceanaGold and is supported by several OEMs or dealers:

- Terra Cat;
- Sandvik; and

- Cable Price Hitachi.

Tyres for rubber-tyred mobile mining equipment are sourced directly from local suppliers Tyreline Distributors Ltd (Michelin brand) and Bridgestone Firestone New Zealand Limited with a minimum number of branded tyres secured by a long-term supply agreement.

All the mining contracts in place and under negotiation are structured, and include terms and conditions and pricing arrangements, which comply or are expected to comply with industry norms.

19.5.2 Explosives

The supply and mixing of explosives for mining is provided by Redbull Powder Company Limited under a contract through to September 30, 2022.

19.5.3 Diesel

Diesel is supplied by BP under a long-term contract. BP has been the supplier to the operation since 2012.

19.5.4 Power Supply

Electricity is supplied by Genesis Energy Limited. The current contract expires 30 September 2021 and negotiations for the next contract term are expected to be undertaken in early 2021.

19.5.5 Water Supply

Water supply is provided via a water right take off agreement.

19.6 Bonds

Rehabilitation bonds are provided through the Oceana Gold Corporate Banking facilities. All bond values are approved by the relevant authority.

19.7 Comments on Market Studies and Contracts

In the opinion of the Qualified Persons:

- OceanaGold can market the doré products produced from the Project; and
- The terms contained within the sales contracts are typical and consistent with standard industry practice and are like contracts for the supply of doré elsewhere in the world.

20 Environmental Studies, Permitting and Social or Community Impact

20.1 General

Macraes currently has 200 permits which are operational or partially operational dating back to 1996. Table 20.1 summarises the type of permits and the relevant issuing authority.

Table 20.1: Operational Permits at Macraes Mine

Type of Resource Consent	Number of Resource Consents	Issuing Authority
Land Use Consents	55	Waitaki District Council
	2	Waitaki District Council & Dunedin City Council
Water Permits	79	Otago Regional Council
Discharge Permits	67	Otago Regional Council
Building Consents	152	Waitaki District Council
Heritage Authority	2	Heritage New Zealand
Wildlife Permits	3	Dept. of Conservation
Mineral Rights (Mining/Exploration Permits)	3	New Zealand Petroleum and Minerals

Permits are managed in the Corporate database, Inform, which includes tracking of obligations associated with issued permits and expiry dates. Where activities have not been completed within the life of the permit, renewals are sought from the relevant Authority.

20.2 Required Permits and Status

In order to achieve the current Life of Mine several major permits and renewals will be required. Table 20.2 provides a summary of these permits and the current status.

Table 20.2: Required Permits and Status

Activity Description	Types of Permits required	New/ Renewal	Status
Mining – Deepdell North Pit	Land Use Consent, Discharge Permit, Water Permit, Wildlife Permit	New	Submitted Q1 2020
Mining – Fraser West Pit	Land Use Consent, Discharge Permit	New	Submitted Q2, 2020
Golden Point Underground	Land Use Consent, Discharge Permit, Water Permit	New	Submitted, Q2, 2020
Tailings Storage Embankment Lift	Land Use Consent, Building Consent	New	Required by end of Q2, 2021
New Tailings Storage Facility	Land Use Consent, Discharge Permit, Water Permit, Building Consent, Wildlife Permit	New	Requiired by end 2022

The key risks identified with future permitting at Macraes pertains to the evolving expectation of the New Zealand Government. Currently the Central Government is proposing several reforms which have the potential to significantly change land use across New Zealand, and affect industries such as farming, forestry and mining. These reforms are broadly related to water, biodiversity and carbon (or Climate Change).

Reform on water and biodiversity are intimately linked and pose more immediate changes on how resource consent applications are assessed. The proposed changes do allow for some activities (i.e. activities deemed National Critical such as hydro-electric dams) to access forms of mitigation for environmental effects to water and biodiversity, which would allow these activities to obtain resource consents. Macraes has a recent history of utilising these forms of mitigation to obtain overall net positive effects to biodiversity and water and thus can put a strong case towards continuing to operate at a high level of environmental performance. Consultation on these reforms is currently underway and OceanaGold has already provided a submission on the water reform and is preparing submission on the biodiversity reform.

20.3 Environmental Study Results

On-going permitting dictates the need for environmental studies to be required. The nature and scale of an activities requiring permitting determines the complexity of studies needed to fulfil the requirements of Assessment of Environmental Effects (AEEs).

For relatively large-scale activities, such as the recently lodged Deepdell North consent application studies are required in the following fields.

- Surface Water;
- Groundwater;
- Terrestrial Ecology;
- Aquatic Ecology;
- Geotechnical Stability;
- Noise and vibrations assessment;
- Air Quality assessment;
- Economic Effects;
- Traffic Effects;
- European Heritage & Archaeology; and
- Maori Heritage & Archaeology.

For smaller scale activities will require one or number of the studies outlined above depending on the location and complexity of the activity. Typically, these studies are not as comprehensive as those required for the large-scale consent applications.

In almost all cases specialists are engaged to undertake the environmental studies. In cases where there is the potential to be challenged on issues, a third-party specialist is used to add further rigour to the studies outcome.

20.4 Environmental and Social Issues

There are two material issues related to environmental and social management currently experienced by the Macraes Mine:

20.4.1 Land Use

With evolving expectations around the management of effects to biodiversity, OceanaGold has remained ahead of compliance with the establishment of covenants (i.e. parcels of land) for the purposes of conservation since 2012. Although these covenants are viewed as having a positive impact on biodiversity, the local farming community do not share this view and in 2017 chose to appeal the Coronation North consent, in part due to the establishment of covenants. Although the appeal was negotiated through mediation there remains an underlying tension between farming and conservation.

In 2018/2019 the University of Otago conducted a stakeholder study which sought the views of the farmers, the Councils, Dept of Conservation and the Mining Company, and endeavoured to draw out the fundamental values associated with land use held by each stakeholder. The study found that there are basically three views on land use (land as economic, land as biodiverse and hence protected, land as multifaceted), and although stakeholder groups aligned with values as expected, there was also a fluidity for individual stakeholders crossing into values that they were not traditionally aligned to.

With the Government reform outlined in section 20.2, it is likely that there will be ongoing friction with regards to land use in Macraes. Further stakeholder engagement is planned in 2020 on land use.

20.4.2 Long Term Water Quality

A recent focus from central and regional governments on managing effects on water quality from the dairy industry has led to targets being established for a range of contaminants including nitrate. Monitoring of nitrate in mine water discharges from waste rock stacks began and it was soon found that elevated nitrate was present in older waste rock stacks. Modelling of long-term nitrate concentrations has subsequently been undertaken and the results suggest that downstream nitrate concentrations may not be met for the regional governments target, but it will meet the central government's target.

Studies are currently underway to understand the source of the nitrate (i.e. residual unburnt explosives from the drill and blast operation or the host rock). In addition, OceanaGold taking a two-pronged management strategy for this water quality issue. Firstly, it is working with the University of Otago to establish irrigation trials for mine water. Secondly it is working with private research organisation to investigate accelerated passive treatment of mine water.

20.5 Operating and Post Closure Requirements and Plans

Resource consents dictate operational requirements which are then translated to management plans. Currently at Macraes, operational management plans include the following items.

- Dust Management Plan;
- Noise, Vibration and Air Blast Management Plans;
- Operations, Maintenance and Surveillance Management Plans for Tailings Storage Facilities;
- Emergency Action Plans for Tailings Storage Facilities;
- Dam Safety Assurance Plan for the Top Tipperary Tailings Storage Facility;
- Closure Plan for the Top Tipperary Tailings Storage Facility;
- Waste Rock Stack Operations, Maintenance and Surveillance Plans;
- Erosion and Sediment Control Plans;
- Heritage Management Plan;

- Ecology Management Plans;
- Weed and Pest Management Plans; and
- Water Quality Management Plan.

These management plans are reviewed annually and updated on issue of new resource consents.

Post Closure requirements a detailed in resource consents and covered in the Assurance Bond (see section 20.6). A Contingency Closure Plan covers actions to be undertaken in the event of unplanned or forced closure.

20.6 Post-Performance or Reclamations Bonds

The Assurance Bond for Macraes is based on a calculation which includes the following:

- reclamation works to make good the site and comply with resource consent conditions. Reclamation works include all works outstanding for the next 12-month period;
- environmental monitoring to be conducted during the period of reclamation works and a period of 10 years after the cessation of works; and
- closure risks which have been identified through a collaborative process and are based on current uncertainties or gaps in knowledge, including poor long-term water quality and geotechnical instability.

Assurance Bonds are held as bank guarantee for the quantum of the bond. Councils can draw on the bond facility at any time should it be deemed necessary. The bond quantum is divided between the three Councils with the territorial Councils (Waitaki District and Dunedin City) having responsible for most of the reclamation works, whilst Otago Regional Council being responsible for the environmental monitoring.

The current bond for the Macraes Site is NZD42.3 million.

20.7 Stakeholder Engagement

Stakeholder engagement is an integral part of the Resource Management Act (RMA), and hence the resource consenting process. Although the RMA does not require engagement be conducted prior to the lodging of resource consent applications, it does require the Council's to engage with parties affected by the application.

At Macraes stakeholder engagement is undertaken, where possible, pro-actively i.e. prior to lodging of resource consent applications, in order to ensure that affected parties can voice their concerns and there is sufficient time to integrate these concerns into the Project Design.

Key Stakeholders for Macraes Gold Project are:

- The local farming community;
- The local and regional councils;
- The Maori tribes with custodial ownership over the land, and their representative agents;
- Fish and Game, a community-based organization responsible for managing fishing and hunting resources;
- Department of Conservation; and
- Heritage New Zealand.

Aside from resource consent-based engagement, OceanaGold also endeavours to collaborate with stakeholders on areas where mutual benefits can be derived. Examples of such engagement include:

- Research on water, ecology and social science undertaken by University of Otago;

- Restoration of heritage sites in partnership with Middlemarch Historical Society and Heritage New Zealand;
- Foundational Sponsorship of the Waitaki Whitestone Geopark, with the Waitaki Whitestone Geopark Trust; and
- Partnership with the Macraes Community Incorporated on maintenance of the Macraes Village assets.

20.8 Mine Closure

Although a contingency closure plan has been developed, detailed calculations have been made formulated for the purposes of the Assurance Bond (including risks associated with Closure) and the Rehabilitation Provision (see section 20.11), and closure concerns have been identified by the local community, a closure plan for Macraes Gold Project has not been finalized at this stage.

It is planned to pull the various work done to date into a detailed Closure Plan during 2020/21.

20.9 Reclamation Measures During Operations and Project Closure

Rehabilitation activities are conducted annually. To date approximately 540ha of land has been rehabilitated to its final land use, which in most cases is land for pastoral purposes, while the remaining area requiring rehabilitation is 1,128ha.

In 2019, a three year plan was initiated to reduce the rehabilitation liability. The plan includes rehabilitation of the closed Mixed Tailings Impoundment, Southern Pit Tailings Storage Facility and several sections of waste rock stacks which are no longer required.

The current Rehabilitation Provision which allows for additional disturbance as part of Life of Mine activities has an estimated 920ha of land required to be rehabilitated over a period of four years during Closure.

20.10 Closure Monitoring

A closure monitoring calculation has been developed as part of the Assurance Bond/Rehabilitation Provision. The calculation includes identifying resources and supervision needed for undertaking monitoring of surface water, groundwater, aquatic biota, dust, vegetation/rehab, geotechnical stability, tailing storage surveillance monitoring and review, and administration and miscellaneous costs. Cost estimates are updated annual and consider changes in consent conditions.

20.11 Reclamation and Closure Cost Estimate

The Rehabilitation Provision is updated annually for internal purposes to determine the financial liability associated with operations and closure. The Rehabilitation Provision differs from the Bond in that it estimates costs based on the Life of Mine of the operation, whereas the Bond assumes unplanned closure within the next 12 months.

A key area of difference between how the estimates are determined is that the Councils have insisted that the unit rate for hauling materials is estimated using a third-party contractor with available equipment, rather than equipment available at the Mine. Given that the scale of earth moving equipment at Macraes Gold Project is substantially larger than Construction Contractors on the South Island of New Zealand, the unit rate using the mine's equipment is significantly less than can be offered by the Contractors. Although OceanaGold has endeavoured to provide some level of comfort to the Councils, through investigating legal mechanisms to transfer ownership of equipment in the unlikely event that the Mine would move into unplanned closure, the Council remains resistant to the use of OceanaGold equipment.

Despite these differences, the quantum for the Rehabilitation Provision is currently NZD46.0 million (this contains a contingency of 10%, or NZD4.2 million).

21 Capital and Operating Costs

21.1 Introduction

The capital and operating costs have bene generated to deliver the LOM production schedule and the process plant production. This section of the report presents and details the basis of the Capital and Operating costs estimates. All estimates are based on annual inputs of physicals and all financial data is first quarter CY 2020, all currency is in NZ dollars (NZD), unless otherwise stated.

21.2 Capital Cost Estimates

21.2.1 Basis of Estimate

The range of accuracy for the capital cost estimate is +/- 15%.

The capital expenditure is required for the open pit, underground and processing activities to generate the ounces from the mineral reserve. Most of the capital expenditure relates to pre strip mining, underground capitalised decline costs, public road realignment and new or refurbished mobile equipment costs. The capital cost estimate is based on a combination of equipment supplier quotations, supplier pricing and estimates based on previous costs for similar activities.

The cost to rehabilitate the site as well as the sale of excess landholdings are included in the estimates.

21.2.2 Labour Assumptions

The construction labour and equipment costs were included in the factors that were used in the estimation to account for installation costs or in the unit costs when applied.

21.2.3 Material Costs

All materials required for facilities construction are included in the capital cost estimate. Material costs include freight to the site. Material costs related to the Processing Plant such as concrete, structural steel, piping and fittings, and electrical cable were included within the installation factors applied to the mechanical equipment costs.

Material cost related to the Processing Plant platform, TSF, road relocations, and planned access roads were determined by material-take off quantities from sketches/drawings and installation unit costs.

All earthworks quantities were assumed to be insitu volumes, with allowance for swell, waste or compaction of materials. Industry-standard allowances for swell and compaction were incorporated into the unit rate.

21.2.4 Mine Capital Costs - Underground

This item accounts for the capital costs associated with the underground mine development, mining equipment fleet leases, mine backfill plant, haul roads and support mine infrastructure and services.

The GPUG site preparation, establishment and haul roads costs were mainly based on earthworks quantities estimated from the preliminary general site layout and sketched sections and unit costs sourced from OceanaGold’s internal database.

The underground mine development costs were estimated based on the development quantities obtained from the LoM mine design and schedule and unit costs estimated by OceanaGold based on prior underground mining adjusted for the specific site conditions.

Mine equipment costs were estimated based on previous budgetary quotations sourced from OceanaGold's internal database and converted to an operating lease. For estimating purposes, it was assumed that the mine will be run by the owner.

The underground mine ventilation capital cost was estimated based on a preliminary sizing of the ventilation system composed of drifts, raises and ventilation fans and costs obtained from OEM quotes.

The underground mine electrical distribution capital cost was estimated based on a conceptual outline of the electrical distribution system to the mine and costs sourced from the OceanaGold's internal database.

Resource drilling for Measured and Indicated definition and Infill drilling has been included. Costs for conversion of Inferred Resources, not included in Mineral Reserve have not bene included in the analysis.

21.2.5 Mine Capital Costs – Open Pit

This item accounts for the capital costs associated with the surface mine development, pre-stripping, mining equipment fleet, haul roads and support mine infrastructure and services. The initial capital costs for surface mining are shown in Table 24.2.

The site preparation and haul roads costs were mainly based on earthworks quantities estimated from the preliminary general site layout and sketched sections and unit costs sourced from OceanaGold's internal database.

The open pit pre-stripping costs were estimated based on the pre-strip quantities obtained from a preliminary conceptual mine design and schedule and costs estimated by OceanaGold based on prior surface mining.

Mine mobile plant costs were estimated based on previous budgetary quotations sourced from OceanaGold's internal database and converted to an operating lease. For estimating purposes, it was assumed that the mine will continue to be run by the owner.

21.2.6 Infrastructure Costs

Infrastructure areas include:

- TSF embankment and water management system;
- Waste rock stack;
- Site electrical substation and distribution;
- Internal access roads;
- On-site general facilities;
- External access road; and
- Land acquisitions.

The costs associated with the internal access roads were based on earthworks quantities estimated from the preliminary general site layout and sketched sections and unit costs sourced from OceanaGold's internal database.

The other general facilities cost accounts for the costs associated with items such as the general office building, and warehouses.

The cost associated with the external access road was based on earthworks quantities estimated from the preliminary general site layout and sketched sections and unit costs sourced from the internal database.

The sustaining capital costs for general and administrative functions have been estimated based on previous years expenditures.

21.2.7 Sustaining Capital

OceanaGold developed the sustaining capital cost estimate to account for underground mine development, mine equipment and TSF construction capital costs through the LOM, by applying the same estimating methodology.

21.2.8 Capital Cost Summary

Capital costs include the direct costs for project execution, as well as the indirect costs associated with design, construction and commissioning.

Indirect project capital costs include third-party consultants, construction facilities and services, equipment freight, vendor support. Percentage factors based on OceanaGold's experience with similar projects were used to determine indirect project costs, based on the project direct cost.

The capital costs including sustaining capital is outlined in Table 21.1 and shown by year in Figure 21-1.

Table 21.1: Capital Costs Initial and Sustaining

Capital Expenditure	LoM Total (NZD M)	LoM Total (USD M)
Pre Strip	199.3	129.5
Tailings	62.5	39.8
Tailings Remining	30.1	19.5
Mining Rehab	29.7	19.3
Underground Decline	58.9	38.5
Processing	13.0	8.4
Exploration	17.7	11.5
General Capital	26.9	18.2
Asset Sales	-27.6	-17.9
Total Capital Expenditure	**410.6**	**246.6**
Leased Vehicles		
Open Pit mobile Equipment	28.9	18.8
Underground Mining Equipment	18.0	9.7
Total Leased Mobile Equipment	46.9	**28.4**

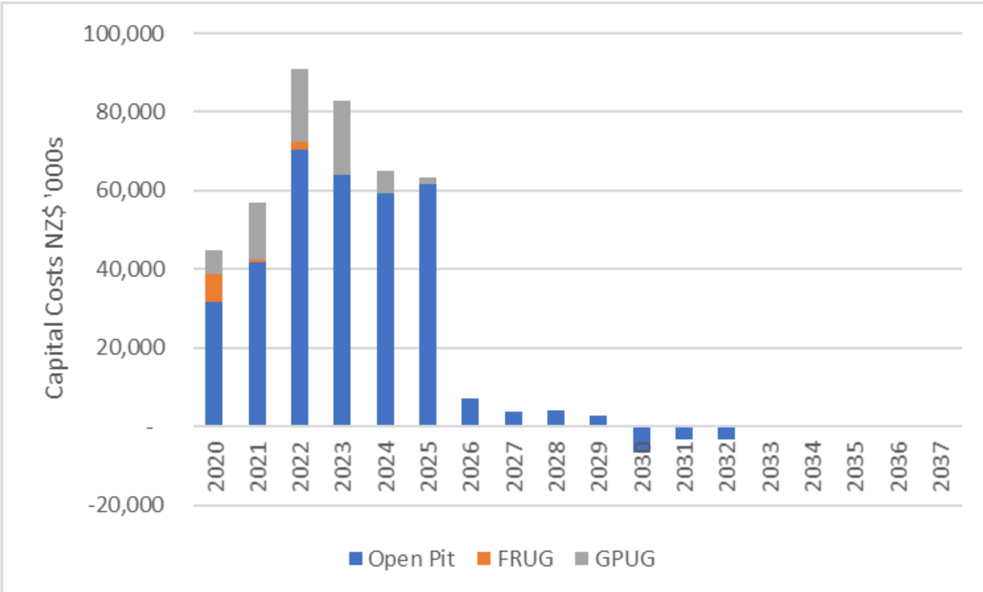

Figure 21-1: Capital Costs for Project LoM

21.3 Operating Cost Estimates

21.3.1 Basis of Estimate

The operating cost estimate is based on the historical operating costs and continuation of the current operating practices and procedures. It has an expected accuracy range of ±15%, attributed to the site operating history over a range of conditions and is expressed in 2020 NZD.

Separate cost models were developed for open pit and underground mining and processing, based on unit costs from historical performance and first principles using physical inputs as drivers and demonstrated unit rates sourced from site and suppliers.

The cost structure is based on fixed costs and variable / driver derived costs and was used to estimate operating costs.

The estimate includes the underground mining, open pit mining, processing and G&A operating costs. It excludes costs associated with escalation beyond 2020, currency fluctuations, off-site costs, interest charges and taxes. No contingency has been included in the operating costs.

21.3.2 Mining Operating Costs

Operating costs for open pit mining include:

- Drill and Blast, Load, Haul, Ancillary and mine overheads;
- Operating costs for underground mining include:
- Lateral and vertical ore and waste development, stoping costs, backfilling costs, mine services and mine overheads.

21.3.3 Processing Operating Costs

Operating costs associated with Process Plant include Crushing, SAG and Ball mill crushing and grinding, Flotation, CIL, Autoclave, Gold Room, operating and maintenance, water treatment and tailings disposal.

The process operating cost estimate accounts for the operating and maintenance costs associated with the 5.9 Mtpa process plant operation, water treatment, supporting services infrastructure, and tailings disposal to the various TSF's.

Process plant operating costs were estimated using the following cost categories: power, labour, reagents and consumables, maintenance supplies and services. In general, the process operating cost estimate is based on the following preliminary documentation: conceptual process flowsheet, conceptual mass balance, mechanical equipment list, list of reagents and consumables, and a referential staffing plan.

Power consumption was estimated based on the power requirements by the major and secondary Processing Plant equipment (excluding stand-by equipment) and adjusted using benchmark factors to account for auxiliary and minor equipment power demand. Assumptions included:

- 96% annual availability; and
- A unit power cost of NZD0.09/kWh.

Reagent consumptions and crushing / grinding consumables were estimated based on the results of metallurgical testwork and previous experience at the Macraes plant.

General consumables for the process plant (personnel protective equipment, metallurgical laboratory, chemical laboratories, maintenance, office supplies and others) were estimated from the total consumable and reagent costs.

Labour costs are estimated based on ongoing staffing plan for the operation and maintenance of the process plant based on OceanaGold's experience at the site. The estimate accounts for management personnel, plant operators and supervisors, as well as WTP operators and maintenance personnel.

Services costs include the following areas: chemical assays, maintenance services by contractors, personnel mobilisation, as well as water and compressed air supply and distribution and other general services.

The chemical assay costs were estimated based on a preliminary testwork program for control of the process plant and unit costs for laboratory tests.

The maintenance services costs associated with the replacement of mill liners and grinding media were estimated based on previous experience at the process plant. The costs associated with the personnel mobilisation, scheduled maintenance services for plant shutdowns (carried out by contractor companies) and other general services are included as a percentage of the total direct capital process plant cost, while the water and compressed air supply and distribution costs were assumed as a percentage of the direct capital cost of these systems, based on historical performance.

21.3.4 General and Administrative Operating Costs

The G&A operating cost was estimated, based on previous costs at the Macraes Operation and include general on-site infrastructure operating costs.

21.3.5 Operating Cost Summary

Table 21.2 summarizes the estimated operating costs per tonne of ore processed and the operating costs by year are shown in Figure 21-2.

Table 21.2: Operating Costs Summary

Operating Expenditure	NZD		USD	
	Total $M	$/t	Total $M	$/t
Open Pit Mining	486.9	1.96	316.5	1.27
FRUG Underground Mining	86.5	67.12	56.2	43.63
GPUG Underground Mining	120.7	56.99	78.5	37.04
Processing Costs	457.0	11.02	297.0	7.16
General and Administration Costs	125.5	3.02	81.6	1.96
Total Direct Costs	**1,276.7**		**829.8**	

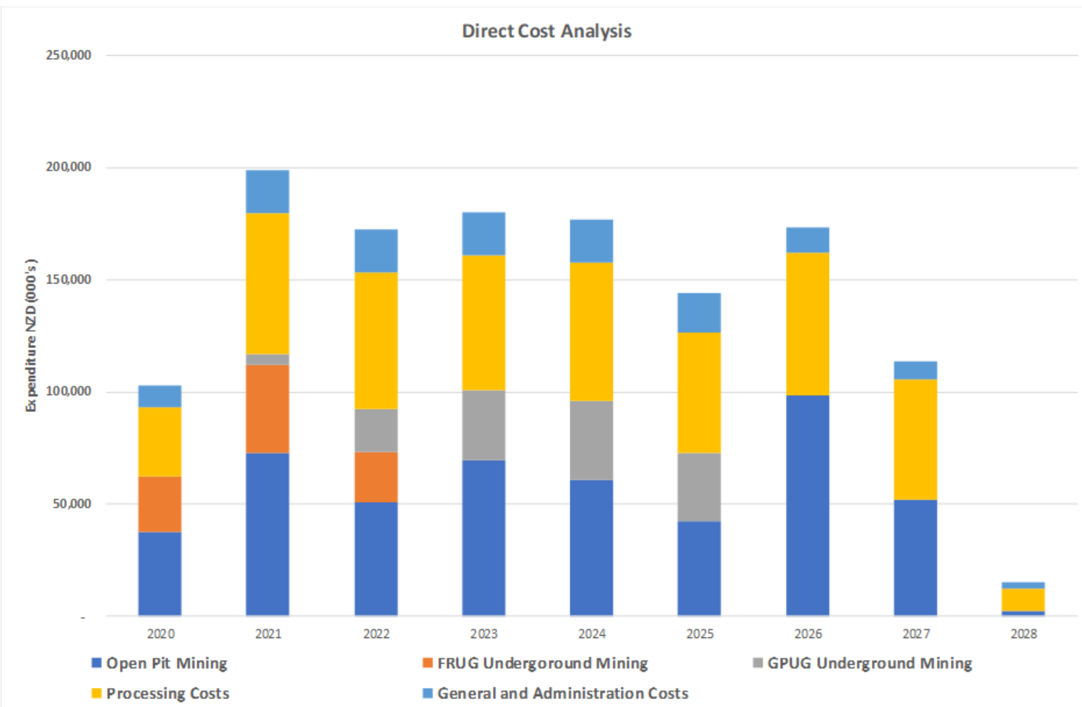

Figure 21-2: LoM Direct Operating Costs

21.4 Comments

No contingency was applied to the capitalised mine development, pre-strip, mobile equipment leases and site surface and underground infrastructure costs.

Other capital cost items include appropriate contingency.

Sustaining capital cost accounting for underground mine development, sustaining mine infrastructure, TSF.

22 Economic Analysis

OceanaGold is a producing issuer, the Macraes Mine is currently in production and there is no material expansion of the current production at Macraes based on the reported Mineral Reserves. The production schedule is being implemented through to completion of the open pits and underground operations.

22.1 Economic Assumptions

22.1.1 Revenue

The revenue assumptions are based on the assumptions in Chapter 19 and further summarised below.

- Open pit mining pit rates have been scheduled at a maximum rate of 57 Mtpa;
- Processing plant production rate of a maximum 5.9 Mtpa has been scheduled;
- Gold Price Assumptions as shown in Chapter 19;
- Metallurgical recovery assumptions ranging from 80% to 83% have been used;
- Revenue is recognised at the time of production;
- Royalty payments include are based on the New Zealand Government Royalties which are either 1 % of sales revenue or 5% of accounting profits whichever is the higher. In addition to the New Zealand Government royal there is a small parcel of land which a private group has a revenue royalty over; and
- The operating cost estimates are considered reasonable and consistent with demonstrated costs.

22.1.2 Cost

The basis of the capital and operating cost assumptions is described in Chapter 21 and further summarized below.

Capital and operating costs are well known from the 30 years of operations and have been appropriately applied to develop cut-off grades and inputs into economic analysis.

- The operating cost estimate has an expected accuracy range of ±30% and is expressed in CY 2020 NZD;
- The estimate includes the underground mining, open pit mining, processing and G&A operating costs derived from historical data and forward cost estimates; and
- The capital cost estimates have an expected accuracy of +30% that includes direct and indirect costs and, owner's costs associated with the mine and process facilities and on-site infrastructure.

Engineering work, in the range of 5–10% of total engineering for the project, was carried out to support the estimate. Where possible costs were estimated from similar constructions at Macraes, sourced from OEM or otherwise factored, end-product units and physical dimensions methods were used to estimate costs. The main items in included in the capital cost estimate are listed below:

- Underground mine development, pre-strip, equipment fleet leases, infrastructure and services;
- Process plant throughput of 4.9 Mtpa with and supporting infrastructure and services;
- TSF and Waste Rock Dump;
- On-site infrastructure;
- Off-site infrastructure (water and power supply, and new external access);
- Land acquisition and property divestment; and

- Mine site rehabilitation.

The following have been excluded from the economic analysis

- Finance costs and interests during construction;
- Costs due to fluctuations in exchange rates;
- Cost of working capital;
- Changes in the design criteria;
- Changes in scope or accelerated schedule;
- Changes in New Zealand legislation;
- Provisions for force majeure; and
- Wrap-up insurance.

22.2 Taxation and Royalties

OceanaGold hold a 100% interest on Mining Permits

Royalties payable include the higher of a 1.0% royalty on net sales revenue from gold and silver or 5% accounting profits is payable to the Crown.

The corporate taxation rate included in the analysis is 28%.

22.3 Cash Flow Analysis

The key economic results using 30 June 2020 as the reference commencement date, and reflecting the LOM projections and gold price assumptions, are shown in Table 22.1.

Table 22.1: Project Economics

	Unit	NZD	USD
Average Gold Price	$/oz	2,396	1,541
Free Cashflow (pre-tax)	$M	854	555
NPV (5% discount rate, pre-tax)	$M	663	431
Free Cashflow (after-tax)	$M	649	422
NPV (5% discount rate, after-tax)	$M	499	324

A simplified US$ cash flow model by year is shown in Table 22.2.

Table 22.2: Annual US$ Cash Flow

Physicals	Unit	TOTAL	2020 H2	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037
Process Plant Feed	kt	41,523	3,032	5,875	5,912	5,900	5,917	4,071	5,087	4,690	1,041									
Process Plant Grade	g/t Au	1.02	0.94	1.09	0.90	0.82	1.18	1.05	1.10	1.16	0.58									
Contained Gold	'000 oz	1,362	92	207	172	156	224	137	180	175	20									
Process Recovery	%	81.8%	83.6%	82.4%	81.5%	81.4%	83.1%	79.9%	79.7%	82.7%	81.7%									
Gold Production	'000 oz	1,114	77	170	140	127	186	109	143	145	16									
Gold Sales	'000 oz	**1,116**	**76**	**170**	**141**	**127**	**186**	**110**	**143**	**146**	**18**									
Gold Price	US$/oz	1,541	1,700	1,600	1,550	1,550	1,500	1,500	1,500	1,500	1,500									
FX	NZ$:US$		0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65
Revenue	US$ '000	**1,719,791**	**129,483**	**272,549**	**217,778**	**196,699**	**278,699**	**164,968**	**214,279**	**218,466**	**26,870**									
Operating Costs	US$ '000	872,046	69,960	128,350	118,069	127,793	116,369	100,617	121,280	75,410	14,199									
Adjustments	US$ '000	-14,100	-844	6,311	-1,822	-7,653	4,841	-6,195	-9,282	2,588	-2,043									
Operating Cash Flow	US$ '000	**861,844**	**60,367**	**137,888**	**101,532**	**76,558**	**157,489**	**70,546**	**102,280**	**140,468**	**14,714**									
Sustaining Capital	US$ '000	230,455	22,954	27,549	55,147	53,509	42,181	41,022	4,063	1,950	0	-7,313	-5,363	-2,622	-2,622					
Non-sustaining capital	US$ '000	36,427	6,136	9,502	4,033	444	34	198	660	497	2,640	9,092	904	361	351	335	315	309	309	309
Finance lease principal	US$ '000	39,692	1,310	3,194	5,511	8,051	7,127	7,756	3,134	2,508	1,103									
Pre-Tax Free Cash Flow	US$ '000	**555,270**	**29,968**	**97,644**	**36,841**	**14,554**	**108,148**	**21,570**	**94,425**	**135,513**	**10,972**	**-1,780**	**4,459**	**2,261**	**2,271**	**-335**	**-315**	**-309**	**-309**	**-309**
Tax Payable	US$ '000	133,675	11,589	25,563	13,987	3,234	29,716	7,048	15,664	25,860	1,014									
Post-Tax Free Cash Flow	US$ '000	**421,594**	**18,379**	**72,081**	**22,854**	**11,320**	**78,432**	**14,522**	**78,761**	**109,653**	**9,958**	**-1,780**	**4,459**	**2,261**	**2,271**	**-335**	**-315**	**-309**	**-309**	**-309**
All-In Sustaining Cost	US$ '000	**1,144,111**	**94,363**	**159,365**	**178,995**	**189,598**	**165,920**	**149,639**	**128,679**	**80,070**	**15,402**	**-7,313**	**-5,363**	**-2,622**	**-2,622**					
AISC	US$/oz	1,025	1,239	936	1,274	1,494	893	1,361	901	550	860									
NPV (5%) Pre Tax	US$M	$431																		
Post Tax	US$M	$324																		

23 Adjacent Properties

There are no other historical or operating hard rock gold mines of comparable size in the district.

24 Other Relevant Data and Information

24.1 Topography

The surface topography used for the Coronation North, Coronation, Deepdell, Golden Point, Round Hill, Innes Mills, Frasers West, Gay Tan and Golden Bar resource estimates was a combination of 2.5m contour information derived from a detailed aerial survey completed in early 1994 by the Department of Survey and Land Information (DOSLI) on behalf of OceanaGold, surveyed drill hole collars and the June 30, 2020 end of month mine survey.

The surface topography for Nunns, Ounce, Taylors and the Stoneburn estimates was derived from the 20m DOSLI contour data and drill hole collars. This topography is very coarse and needs to be resurveyed at 2.5m contours prior to any mining.

24.2 Bulk Density

A bulk density of 2.5 t/m³ is assigned to oxide blocks and 2.65 t/m³ to sulphide (fresh) blocks. These are the accepted standard values for the Macraes Goldfield and have been applied everywhere to ensure consistency between resource estimation, grade control and mine planning. They are slightly lower than the experimentally determined SG's but are thought to more accurately reflect the bulk density of the overall rock mass. The experimental measurements are determined on small pieces of core, which do not include the joints, fractures, and faults present in the overall rock mass. Long-term reconciliation of truck volumes against milled tonnes has confirmed the validity of these bulk density values.

Table 24.1: Bulk Density Data by Area

Prospect	Oxide Ore		Oxide Waste		Sulphide Ore		Sulphide Waste	
	No.	Mean	No.	Mean	No.	Mean	No.	Mean
Nunns	-	-	-	-	-	-	-	-
Coronation North	-	-	-	-	14	2.63	15	2.65
Coronation	-	-	-	-	-	-	-	-
Deepdell	4	2.55	7	2.49	9	2.64	18	2.68
Golden Point	-	-	-	-	-	-	-	-
Round Hill	6	2.61	2	2.58	54	2.68	64	2.68
Southern pit	-	-	-	-	4	2.67	3	2.66
Innes Mills	-	-	6	2.45	32	2.71	37	2.70
Frasers pit	2	2.32	10	2.47	62	2.69	73	2.67
Frasers underground	-	-	-	-	211	2.70	100	2.68
Golden Ridge	-	-	-	-	-	-	-	-
Ounce	-	-	-	-	-	-	-	-
Golden Bar	-	-	-	-	3	2.63	3	2.57
Stoneburn Group	-	-	--	-	-	-	-	-
Total/Average	**12**	**2.54**	**25**	**2.48**	**389**	**2.69**	**313**	**2.68**

24.3 Macraes Gold-Tungsten Project

24.3.1 Background

Many of the lodes in the district contains some tungsten in the form of scheelite and small quantities have been mined in the past in response to periods of high demand such as World War One. Williamson (1939) estimated total production of 1,000 tonnes of scheelite of which 800 tonnes came from Golden Point.

Renewed exploration interest in the 1970s and 1980s was initially for tungsten, particularly in the Round Hill/Golden Point area. Routine sampling for tungsten at Macraes ceased in around 1990 but sampling of gold mineralised intervals for tungsten continued until 1995 (Robinson, 2008). A 1993 resource estimate for Round Hill, Golden Point and Southern Pit included tungsten as well as gold.

In 2005 metallurgical testwork was conducted on core from the Frasers open pit and underground drilling and identified scheelite was present but never went any further.

Interest was shown in trying to recovery tungsten from the tailings dam in 2008 and grab sampling of the Mixed Tailings and SP11 Tailings Dams was conducted. This was followed up by an air-core drilling programme. On the Mixed Tailings Dam. Values of up to 1%WO_3 were recorded though the average was 0.062% (Grant, 2010).

Interest in tungsten waned until 2013 when a programme to analyse old drill pulps from Round Hill for tungsten using a portable XRF analyser commenced. This enabled a tungsten resource estimate to be completed for Round Hill though this was never published.

A scheelite study in 2015 identified 5 scheelite types based on paragenesis and appearances include a grey scheelite which is not visually obvious in ordinary light but makes up a significant proportion of the scheelite at Round Hill. Re-logging of diamond holes to classify scheelite types commenced in 2017.

In 2015 a scoping study on Macraes Gold-Tungsten project was positive and led to a Feasibility study. The scenario involved re-locating and re-designing the processing plant and mining part of the tailings dams in order to create a large open pit to mine and recover the gold and tungsten. The project economics at the time were unfavourable and the project was shelved in 2016. There was also insufficient metallurgical testwork completed and tens of thousands of samples without tungsten assays still to analysed.

In 2017 a version of the study looking at a gold only scenario was completed but again results were unfavourable.

24.3.2 Current Macraes Gold-Tungsten Project

In late 2018 the 2016 study was revived to address some of the deficiencies identified in the earlier studies:

- lack of tungsten assays for all samples;
- lack of a resource estimate incorporating both gold and tungsten;
- plant design; and
- metallurgical testwork.

Tungsten Sampling

At the start of 2019 there were an estimated 134,000 gold assays at Round Hill/Golden Point/Southern Pit and Innes Mills without corresponding tungsten assays. It would be impossible get tungsten assays for all these samples because many of the pulps no longer exist and the sheer number of samples would make it impossible to achieve in a realistic timeframe. Therefore, it was decided to focus on Round Hill/Golden Point first, target samples with gold assays >= 0.1g/t and get as many done as possible in 2019, within the constraints imposed by personnel and equipment availability. This was later extended to include Innes Mills.

By the end of 2019 the end some 29,000 samples were analysed. A further 3,400 samples from drilling at Golden Point in 2019 were also analysed.

Tungsten Pricing Model

The tungsten pricing model was revised for use in the gold equivalence resource estimate. This includes assumptions on tungsten price, gold price and tungsten recoveries. The tungsten pricing model as used for the Innes Mills gold equivalence resource estimate is shown in Table 24.2.

Table 24.2: Example off Tungsten Pricing Model for Gold Equivalence

Description	Value	Step	Comment
Base case APT USD/mtu	250	(a)	Note 1 mtu = 10 kgs
Discount APT to WO3 in Wolframite Con (100% WO3 basis)	22.5	(b)	APT to 100% WO3 processing costs
WO3 price in Wolframite Con (100% WO3 basis) USD/mtu	194	(c)	c= a* (1-b)
W to WO3 conversion by weight	1.2611	(d)	
W price in Wolframite Con (100% W basis) USD/mtu	244	(e)	e = c*d
Discount W in Wolframite Conc to W in Scheelite Con	2.0%	(f)	Processing cost: scheelite is harder to process
W price in Scheelite Con (100% W basis) USDmtu	259	(g)	Price of W in scheelite conc [g=e*(1-f)]
W price USD/t	25,861	(l)	l = g * 100
Au price USD/oz	1,300	(m)	
Au price USD/g	41.8	(n)	n = m/31.10348
W price USD/%	258.6	(o)	o = l/100
Au recovery	84%	(p)	
W recovery	45%	(q)	
Au price NZD/resource gram	35.1	(r)	r = n*p
W price NZD/resource %	129.3	(s)	s= o*q
W:Au multiplier (W/Au)	3.31	(t)	t=s/r

The tungsten pricing model will be adjusted as necessary over time to reflect changes in the input data, notably gold and tungsten prices and tungsten recovery.

Resource Estimates

Despite all the extra sampling there are still around 110,000 gold assays in both areas without tungsten assays. The gold equivalence estimation process requires all the gold values to have a corresponding tungsten value.

In order to overcome this issue, the missing tungsten values were generated through simulation in the GS3M modelling software using the weak gold-tungsten correlation and enabled gold equivalence resource estimates to be generated for use in mine design. In order to calculate gold equivalence values some assumptions had to be made on tungsten pricing and tungsten recoveries for use in the tungsten pricing model. As these metallurgical studies are still in progress and the recoveries have yet to be finalized it has been decided not to release gold equivalence estimates at the present time.

Metallurgical Testwork

Bulk samples made of drill core was sent for testing by Gekko in Australia. Testwork was completed for the Round Hill and Golden Point samples with the Innes Mill sample testing still to be completed. Ore characterization studies were also undertaken, and further work is planned.

A proposal has been discussed to bring a small pilot plant to Macraes for further testwork in 2020 or 2021.

Plant Design

The plant design has been re-configured so that only a single ore stream is utilized for both gold and tungsten recovery. This has reduced the capital and operating costs. A 4Mtpa capacity has been assumed.

Mine Design

An optimised pit shell using the 2019 gold equivalence resource estimate was completed in July 2019 and was then used to produce a schedule for cashflow analysis. This resulted in positive discounted cashflows and satisfactory internal rate of returns.

The Innes Mills gold equivalence estimate was updated in November 2019 and the Round Hill/Golden Point estimate in December 2019. The mine design and cashflow analysis will continued to be re-run and refined in 2020 and it is too early to publish any results arising from this work.

25 Interpretation and Conclusions

25.1 Geology

The Macraes area is a mature exploration province and much of the near-surface, along-strike exploration potential has been tested. Numerous studies have been completed on the mineralisation and the geological setting and controls are generally well understood.

The immediate resource potential is downdip/plunge of the known resources in the open pits and that has been the focus of exploration in recent times. Exploration potential exists between the Coronation North and Nunns deposits to the north. The areas to the south of Golden Bar contain several known gold deposits that have seen little exploration since 2003. Further work on these areas may be warranted. The 2020 exploration/resource budget of NZD9-10M is focused on the drill -out of the potential Golden Point Underground resource, down dip extensions to Deepdell and Round Hill and completion of the infill drilling at Gay Tan.

While the geological setting and mineralisation styles are well understood the current limit on immediate expansion to know resources is the extent of drilling. The nature of the mineralisation at Macraes means there is a significant alignment to the gold price, as the price increases more resource becomes an economic mining target. In many of the current or previously mined areas the resource estimates have reached the limits of the drill data. There is significant opportunity with increased drilling in targeted areas to increase the potentially minable resources and thereby the mine life both short and long term.

The OceanaGold sampling procedures adopted for the drilling activities are considered appropriate and the programmes are well supervised by suitably qualified technical personnel.

After review of the database and available data quality, and considering the reconciliation data, which is also available, the drilling data is considered to meet accepted industry standards. However, the quality control database is incomplete as much of the historical information is missing.

The later OceanaGold managed dry RC percussion drilling and diamond drilling is considered to represent the highest quality drilling as quality control records are available for review. Earlier open hole percussion drilling and cross over RC percussion drilling is of lower confidence given the opportunity for down-hole contamination which is inherent in these drill methods. The open hole percussion drilling methods are particularly at risk for this contamination. While this is the case, most of the drill hole database is considered to represent high quality data.

The wet RC percussion drilling that remains in the exploration/resource database represents a significant risk. The factoring approach applied by OceanaGold to reduce the impact of the remaining wet RC percussion drilling is reasonable although it does not account for local variability and down-hole contamination (i.e. artificially extended ore zone widths.) This issue mainly affects the remaining resources at Round Hill and Innes Mills. The standard practice in recent years of stopping RC drilling when samples become wet and to finish off these holes with diamond tails has largely reduced the impact of this issue.

Available reconciliation data indicates the resource models represent robust estimates of metal and are generally acceptable estimators of tonnage and grade. The standard practice for resource estimation now is to exclude the pre 1990 assays from the estimation process to mitigate any data quality issues. The resource modelling process is well established and a process for internal review and sign-off was implemented in 2018.

The Mineral Resource statement determined as at June 30, 2020 has been prepared and reported in accordance with Canadian National Instrument 43-101, 'Standards of Disclosure for Mineral Projects' of June 2011 (the Instrument) and the classifications adopted by CIM Council in December 2011. Furthermore, estimation and classification are consistent with the Australasian Code for the 'Reporting of Identified Mineral Resources and Ore Reserves' of December 2012 (the Code) as prepared by the Joint Ore Reserves Committee of the Australasian Institute of Mining and Metallurgy, Australian Institute of Geoscientists and Minerals Council of Australia (JORC).

25.2 Mining

Macraes is mined by a combination of conventional open pit and underground retreat uphole stope methods along the line of strike.

The open pit mining operation utilises hydraulic excavators and rear dump diesel trucks to extract both overburden and ore. Blasting requires relatively light powder factors compared with some other operations due to the comparatively weak and fractured rock mass. Ore is blasted in 7.5m high benches and excavated in three, nominally 2.5m high flitches. Waste is blasted in 15m benches and excavated in four flitches.

The underground retreat uphole stope mining operation utilises electro-hydraulic development jumbos, diesel load-haul-dump units, diesel haul trucks and longhole drill rigs to extract both waste and ore. The uphole retreat stope voids are not backfilled. Instead the mine design utilises yielding pillars between adjacent extracted stopes to gradually deform over a timeframe that permits ore extraction.

The open pit operation and the underground operation is owner-operated by OceanaGold. A range of other contracts support the mining operations.

OceanaGold's performance at Macraes has shown that the mining equipment and mining methods are suited to the required mining rates and deposit geometry. Open pit and underground mine design procedures are appropriate and have been conducted in accordance with established industry standards and with input from appropriately qualified geotechnical specialists, hydrological specialists and consultants. Historical productivity and safety records are generally in line with or better than industry standards.

The open pit and underground life of mine plan schedule has been prepared to 2027. The schedules rely only on reserves, and are considered appropriate and reasonable

The mining and ore processing schedules have factors applied to account for poor weather, public holidays, equipment availability, equipment utilisation, historically justified limitations on mine production and historically justified limitations on mill throughput.

The mining schedules contain several ore sources that are not currently in production. The Round Hill open pit is fully permitted and consented. The Frasers West, Deepdell open pits and the Golden Point underground are under resource consent application as at the Effective Date.

There is one study underway which has the potential to enhance the production schedule from 2022 onwards:

- Round Hill Gold-Tungsten Project. This is a continuation of studies which commenced in 2015 to unlock over 1 Mozs of gold that is currently compromised due to the proximity to the Processing Plant and Tailings Storage Facilities. The potential extraction of tungsten as a by-product is included in the study. This project alone has the potential to add 10 or more year's mine life to Macraes in addition to what has already been identified.

There is an additional opportunity to lower the open pit cut-off grade with recent strengthening of the gold price providing this lower grade material can be successfully recovered in the process plant. Currently low grade (0.3-0.4 g/t Au) material is being stockpiled. This low grade in-situ material and stockpiles are not included in the Mineral Reserves.

25.3 Mineral Processing

Over the last twenty-nine years OceanaGold has developed considerable experience in development and operation of the complex ore processing technology required to optimise gold recovery from the Macraes refractory ores.

Emphasis is placed on the control of costs. The relatively high tonnage processed, the simple flotation reagent regime and economies resulting from concentration of the gold into a flotation product comprising between 1.5% and 3% of the ore mass treated reduce operating cost. Labour costs are also lower than in most comparable developed countries. The operating cost of the core sulphide process is due to low comminution costs (contributed to by the coarse grind, and relatively soft ore).

Plant utilisation has been maintained at about 95% which is at the high end of typical industry benchmarks. Gold recovery on open pit ore and underground combined, for 2019 averaged 83.4%. Overall, recoveries are considered reasonable given the refractory nature of the ores.

The Processing Plant has the capacity to treat 5.9 Mt of ore per annum. However forecast mill throughput drops to 4.1 Mt from 2025-2026 as mine production reduces due to the conclusion of underground mining. Possibilities for covering this shortfall include expanding GPUG, increasing open pit prestrip by mobilising additional resources or feeding low grade stockpiles.

25.4 Project Infrastructure

OceanaGold continues to maintain appropriate infrastructure at Macraes, including road access, power, water supplies and administration facilities.

Environmental management and mitigation measures are maintained at Macraes, including ongoing monitoring to ensure compliance with resource consent conditions and permit requirements. These consents and permits are issued by the Ministry of Business, Innovation and Employment (MBIE), the Otago Regional Council (ORC) and the Waitaki District Council (WDC). Tailings and waste rock disposal facilities are maintained and managed on an ongoing basis. Progressive rehabilitation is ongoing.

There is sufficient tailings storage capacity in the present consented facilities to store tailings until mid-2021. An extension to the current facility is in the process of being designed and permitted which will extend the life of this facility until 2024. The final site selection, detailed design and resource consenting of an additional storage facility is scheduled for 2021.

The project reserves, plant site, tailings dams and waste dumps are located on land that is covered by mining permits, and which OceanaGold owns or has access to mine. All material tenements and landholder agreements are in good standing.

25.5 Environmental Studies, Permitting and Tenement Status

The mineral permits are in good standing and there is one mineral permit application underway at the Effective Date which could impact the operation:

- an application for the extension of MP 52 738 for a further 20 years to allow future mining of the resource within this permit.

As the Macraes Gold Project has a history of achieving relevant approvals, OceanaGold has every confidence that this application will be successful.

The Macraes gold mine is fully consented for current operations, with actual and potential environmental effects regularly monitored and reported to the relevant agencies. Resource Consent applications have been lodged for the Deepdell North and Frasers West open pits and for the Golden Point underground.

Resource consent application will need to be lodged in 2020 for the planned Top Tipperary Tailing Storage Facility extension and in 2021 for the next Tailings Storage Facility.

The site is achieving environmental compliance, with good internal reporting of environmental issues and performance. The site environmental documentation is appropriate and follows Environment Management Strategy (EMS) principles, although a full EMS is not in place. Documentation is reviewed and updated regularly.

There are no material compliance issues relating to the principal mining and processing operations. OceanaGold is in partnership with Otago Fish and Game, a semi-government organisation, to manage a Trout Hatchery on the Macraes mine site.

A contingency closure plan has been developed for Macraes and a detailed Closure Plan will be completed during 2020/21.

Overall, no material environmental issues have been identified to limit the ongoing operation of the mine within the planned schedule.

The project reserves, plant site, tailings dams and waste dumps are located on land that is covered by mining permits, and which OceanaGold owns or has access to mine. All material tenements and landholder agreements are in good standing.

25.6 Production

OceanaGold has prepared life of mine production plans from reserves only which cover 2020-2027 for Macraes. This schedule sees a new open pit at Frasers West and the re-opening of the Deepdell North open pit starting in 2020 and the re-opening of Innes Mills pit in stages from 2020 to 2024. Re-opening of the Round Hill pit occurs later in the schedule in 2023. Underground production from FRUG ceases in 2022. Initial development of the Golden Point underground commences at the end of 2020 and this deposit will be in full production in 2022. The production rates forecast is consistent with recent performance and the anticipated grades. The mine production plans are considered reasonable for the purpose of long-term scheduling.

The open pit fleet is held to a consistent size from 2020 to 2026. The fleet includes three Hitachi EX3600 and one Hitachi EX2500 backhoe excavators to load 20-22 Caterpillar 789C/D haul trucks. Multiple equipment replacements are scheduled for the 2020-2026 period as equipment reaches the end of its' economic life. OceanaGold is satisfied that there are enough working areas for the excavators to operate.

The current underground fleet will be maintained in 2020. Some of this fleet will transition to GPUG but several units will be replaced as they have reached the end of their economic life. GPUG will essentially have the same fleet configuration as FRUG but load-haul-dump units will standardize at the 17t class and fewer trucks are required due to the decreased depth compared with FRUG.

The underground ore is dumped at an in-pit stockpile for periodic re-handling by the open pit fleet to the process plant's run of mine stockpile. OceanaGold is satisfied with the accuracy of the dilution factors, ore loss factors and constraints placed upon the mining schedule.

25.7 Capital and Operating Costs

Capital cost estimation and forecasting are considered reasonable and consistent with proposed development programmes and ongoing requirements. In practice, capital expenditures over the duration of the schedule may be more variable than forecast due to unforeseen problems, modifications, upgrades and introduction of new technology.

Capital expenditure provisions (2020 to 2027) include expenditures for capitalised mining costs and sustaining capital (excluding exploration) of NZD367.5 million and are considered accurate to within ±15%.

Plant operating cost estimates for Macraes are generally considered reasonable and consistent with recent experience and trends and are regarded as accurate to ±15%.

25.8 Economic Analysis

There is no material expansion of the current production at Macraes based on the reported Mineral Reserves. The production schedule is being implemented through to completion of the open pits and underground operations. The mine plan is cashflow positive.

26 Recommendations

26.1 Recommended Work Programs

26.1.1 Exploration & Resource Conversion

- Complete the infill and extension drilling at Golden Point, Round Hill, Deepdell and Gay Tan as planned in 2020 for a total cost of around NZD10 million.
- Maintain annual exploration investment to define viable resources made available by an increasing gold price, to replacing mining depletion and adding additional ore sources.
- Almost all resource estimates in current or previously mined deposits have reached the limits of drilling data. Targeted drilling campaigns will define additional minable resources which will extend the mine life.

26.1.2 Mineral Processing and Metallurgical Testing

Complete testwork on metal recoveries for low grade (0.3-0.4 g/t Au) material so these low-grade stockpiles can be included in future production schedules.

26.1.3 Mining and Reserves

- Continue with the Round Hill Gold-Tungsten project which has the potential to add 10 or more years to mine life with tungsten as a by-product. Complete study by end 2021; and
- Include low grade stockpiles (0.3-0.4 g/t Au) in the production schedule once the metallurgical testwork is completed to fill in production shortfalls.

26.1.4 Project Infrastructure

Confirm the next tailings storage facility in order to progress detailed design and lodge permit applications in 2021.

26.1.5 Environmental Studies and Permitting

- Keep the current permits and consents in good standing by continuing with the established monitoring and compliance practices;
- Complete and lodge the Tipperary Tailing Storage Embankment Lift consent application in 2020; and
- Commence identification and permitting process for the new Tailings Storage Facility by the end of 2020.

26.2 Recommended Work Programmes Costs

The recommended work programme costs are included in the operating and capital costs for Macraes and are not listed separately.

Exploration programmes and budget are determined annually for the following year as part of the annual budgeting process. The approved budget for 2020 is NZD10 million and exploration costs are currently not included in the site operating or capital costs.

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28 Glossary

The Mineral Resources and Mineral Reserves have been classified according to CIM (CIM, 2014). Accordingly, the Resources have been classified as Measured, Indicated or Inferred, the Reserves have been classified as Proven, and Probable based on the Measured and Indicated Resources as defined below.

28.1 Mineral Resources

A **Mineral Resource** is a concentration or occurrence of solid material of economic interest in or on the Earth's crust in such form, grade or quality and quantity that there are reasonable prospects for eventual economic extraction. The location, quantity, grade or quality, continuity and other geological characteristics of a Mineral Resource are known, estimated or interpreted from specific geological evidence and knowledge, including sampling.

An **Inferred Mineral Resource** is that part of a Mineral Resource for which quantity and grade or quality are estimated based on limited geological evidence and sampling. Geological evidence is sufficient to imply but not verify geological and grade or quality continuity. An Inferred Mineral Resource has a lower level of confidence than that applying to an Indicated Mineral Resource and must not be converted to a Mineral Reserve. It is reasonably expected that most of the Inferred Mineral Resources could be upgraded to Indicated Mineral Resources with continued exploration.

An **Indicated Mineral Resource** is that part of a Mineral Resource for which quantity, grade or quality, densities, shape and physical characteristics are estimated with sufficient confidence to allow the application of Modifying Factors in sufficient detail to support mine planning and evaluation of the economic viability of the deposit. Geological evidence is derived from adequately detailed and reliable exploration, sampling and testing and is sufficient to assume geological and grade or quality continuity between points of observation. An Indicated Mineral Resource has a lower level of confidence than that applying to a Measured Mineral Resource and may only be converted to a Probable Mineral Reserve.

A **Measured Mineral Resource** is that part of a Mineral Resource for which quantity, grade or quality, densities, shape, and physical characteristics are estimated with confidence sufficient to allow the application of Modifying Factors to support detailed mine planning and final evaluation of the economic viability of the deposit. Geological evidence is derived from detailed and reliable exploration, sampling and testing and is sufficient to confirm geological and grade or quality continuity between points of observation. A Measured Mineral Resource has a higher level of confidence than that applying to either an Indicated Mineral Resource or an Inferred Mineral Resource. It may be converted to a Proven Mineral Reserve or to a Probable Mineral Reserve.

28.2 Mineral Reserves

A **Mineral Reserve** is the economically mineable part of a Measured and/or Indicated Mineral Resource. It includes diluting materials and allowances for losses, which may occur when the material is mined or extracted and is defined by studies at Pre-Feasibility or Feasibility level as appropriate that include application of Modifying Factors. Such studies demonstrate that, at the time of reporting, extraction could reasonably be justified.

The reference point at which Mineral Reserves are defined, usually the point where the ore is delivered to the processing plant, must be stated. It is important that, in all situations where the reference point is different, such as for a saleable product, a clarifying statement is included to ensure that the reader is fully informed as to what is being reported. The public disclosure of a Mineral Reserve must be demonstrated by a Pre-Feasibility Study or Feasibility Study.

A **Probable Mineral Reserve** is the economically mineable part of an Indicated, and in some circumstances, a Measured Mineral Resource. The confidence in the Modifying Factors applying to a Probable Mineral Reserve is lower than that applying to a Proven Mineral Reserve.

A **Proven Mineral Reserve** is the economically mineable part of a Measured Mineral Resource. A Proven Mineral Reserve implies a high degree of confidence in the Modifying Factors.

28.3 Definition of Terms

The following general mining terms may be used in this report.

Table 28.1: Definition of Terms

Term	Definition
Assay	The chemical analysis of mineral samples to determine the metal content.
Capital Expenditure	All other expenditures not classified as operating costs.
Composite	Combining more than one sample result to give an average result over a larger distance.
Concentrate	A metal-rich product resulting from a mineral enrichment process such as gravity concentration or flotation, in which most of the desired mineral has been separated from the waste material in the ore.
Crushing	Initial process of reducing ore particle size to render it more amenable for further processing.
Cut-off Grade (CoG)	The grade of mineralized rock, which determines as to whether it is economic to recover its gold content by further concentration.
Dilution	Waste, which is unavoidably mined with ore.
Dip	Angle of inclination of a geological feature/rock from the horizontal.
Fault	The surface of a fracture along which movement has occurred.
Footwall	The underlying side of an orebody or stope.
Gangue	Non-valuable components of the ore.
Grade	The measure of concentration of gold within mineralized rock.
Hangingwall	The overlying side of an orebody or slope.
Haulage	A horizontal underground excavation which is used to transport mined ore.
Hydro cyclone	A process whereby material is graded according to size by exploiting centrifugal forces of particulate materials.
Igneous	Primary crystalline rock formed by the solidification of magma.
Kriging	An interpolation method of assigning values from samples to blocks that minimizes the estimation error.
Level	Horizontal tunnel the primary purpose is the transportation of personnel and materials.
Lithological	Geological description pertaining to different rock types.
LoM Plans	Life-of-Mine plans.
LRP	Long Range Plan.

Term	Definition
Material Properties	Mine properties.
Milling	A general term used to describe the process in which the ore is crushed and ground and subjected to physical or chemical treatment to extract the valuable metals to a concentrate or finished product.
Mineral/Mining Permit	A lease area for which mineral rights are held.
Mining Assets	The Material Properties and Significant Exploration Properties.
Ongoing Capital	Capital estimates of a routine nature, which is necessary for sustaining operations.
Ore Reserve	See Mineral Reserve.
Pillar	Rock left behind to help support the excavations in an underground mine.
RoM	Run-of-Mine.
Sedimentary	Pertaining to rocks formed by the accumulation of sediments, formed by the erosion of other rocks.
Shaft	An opening cut downwards from the surface for transporting personnel, equipment, supplies, ore and waste.
Sill	A thin, tabular, horizontal to sub-horizontal body of igneous rock formed by the injection of magma into planar zones of weakness.
Smelting	A high temperature pyrometallurgical operation conducted in a furnace, in which the valuable metal is collected to a molten matte or doré phase and separated from the gangue components that accumulate in a less dense molten slag phase.
Stope	Underground void created by mining.
Stratigraphy	The study of stratified rocks in terms of time and space.
Strike	Direction of line formed by the intersection of strata surfaces with the horizontal plane, always perpendicular to the dip direction.
Sulfide	A sulfur bearing mineral.
Tailings	Finely ground waste rock from which valuable minerals or metals have been extracted.
Thickening	The process of concentrating solid particles in suspension.
Total Expenditure	All expenditures including those of an operating and capital nature.
Variogram	A statistical representation of the characteristics (usually grade).

28.4 Abbreviations

The following abbreviations may be used in this report.

Table 28.2: Abbreviations

Abbreviation	Unit or Term
%	percent
°	degree (degrees)
°C	Temperature in Degrees Centigrade
2D	two-dimensional

Abbreviation	Unit or Term
3D	three-dimensional
AGP or AP	acid generating potential
ARD	acid rock drainage
AT	after tax
Au	gold
BT	before tax
BTS	Brazilian tensile strength
cfm	cubic feet per minute
CIL	Carbon-In-Leach
CoG	cut-off grade
CPS	Coastal Plan Sand
CRF	cemented rock fill
DSS	direct shear strength
ELOS	equivalent linear overbreak/slough
EPCM	Engineering, Procurement and Construction Management
FF/m	frequency fracture per meter
GPa	gigapascal
HDPE	height density polyethylene
hp	horsepower
IRR	initial rate of return
IRS	intact rock strength
ISRM	International Society of Rock Mechanics
Ja	joint alteration
Jn	joint number
Jr	joint roughness
kN	kilonewton
kN/m3	kilonewton per cubic meter
koz	thousand troy ounce
kt	thousand tonnes
kV	kilovolt
kW	kilowatt
LHD	long-haul-dump
LoM	life-of-mine
m	metre
m3	cubic metre
ML	metal leaching

Abbreviation	Unit or Term
MPa	megapascal
Mt	million tonnes
MW	million watts
NGO	non-governmental organization
NI 43-101	Canadian National Instrument 43-101
NNP	net neutralization potential
NPV	net present value
OP	open pit
OSA	overburden storage area
oz	troy ounce
PAG	potential acid generating
PEA	preliminary economic assessment
PLT	point load test
PMP	Probable Maximum Precipitation
ppb	parts per billion
ppm	parts per million
Q	rock mass rating (according to the Barton 1974 criteria)
Q’	Barton’s (1974) Q with the JW and SRF both set to a value of 1
QA/QC	Quality Assurance/Quality Control
RMR	rock mass rating (according to the Bieniawski 1989 criteria)
RoM	run-of-mine
RQD	rock quality designation
S.G.	Specific Gravity
sec	second
SRF	stress reduction factor
STD	standard deviation
t/d	metric tonnes per day
TCC	total cash costs
TCR	total core recovery
TCS	triaxial compressive strength
TSF	tailings storage facility
UCS	uniaxial compressive strength
UG	underground
USD	United States Dollar
V	volts
VFD	variable frequency drive

Abbreviation	Unit or Term
W	watt
y	year

Appendices

Appendix A: Certificates of Qualified Persons

Appendix B:

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Peter Edwards peter.edwards@oceanagold.com Security Level: Email, Account Authentication (None)	DocuSigned by: Peter Edwards 4B3B28A051F3404... Signature Adoption: Pre-selected Style Using IP Address: 122.56.104.166	Sent: 9/25/2020 3:48:42 PM Viewed: 9/28/2020 8:13:12 AM Signed: 9/28/2020 8:15:45 AM

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Tom Cooney tom.cooney@oceanagold.com GM Project Development and Studies Security Level: Email, Account Authentication (None)	 Signature Adoption: Pre-selected Style Using IP Address: 124.19.58.126	Sent: 9/25/2020 3:48:42 PM Resent: 9/28/2020 11:34:23 AM Viewed: 9/28/2020 12:39:10 PM Signed: 9/28/2020 12:39:35 PM

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