



Specialist **E**nvironmental **S**ervices **L**td

15 Fort Pl, R.D.2 Wanaka 9382 Ph. 027 437 9044

22 April 2020

Otago Regional Council
Private Bag 1954
Dunedin 9054
Attention: Ms Elyse Neville
Senior Consents Officer

Dear Elyse

Re: Review of Application to Discharge to Air – Oceania Gold Deepdell North Stage 3

Thank you for your instructions to undertake a technical review of the application by Oceania Gold Ltd (**Oceania Gold**) to discharge contaminants to air from the Deepdell North Stage 3 expansion proposed at Macraes Flat. I have reviewed the Air Discharge Assessment of Effects (**Air Discharge AEE**) prepared by Beca (Appendix L of the primary AEE submitted with the application) and the further information provided in response to a request made under section 92 of the Resource Management Act 1991 (**RMA**).

The review addresses the following matters in relation to the discharge to air:

- Background
- Sensitivity of the receiving environment
- Local wind conditions
- Assessment of effects of particulate matter
- Monitoring
- Conditions of consent
- Concluding remarks.

Background

Oceania Gold propose an expansion to the existing mining operation at Macraes Flat. The Deepdell North Stage 3 expansion has a total material movement rate of 57 million tonnes and will require up to 2 years to complete. The application states that the proposed expansion is of smaller scale and duration than existing mining activities at Macraes Flat. Nevertheless, I note that the scale of works is large and has potential to generate significant dust emissions if appropriate mitigation measures are not implemented.

Dust generating activities will include open pit mining, backfilling and construction of a waste rock stack. The mining will involve drilling and blasting. Particulate matter will also be discharged from the stripping of overburden and soil and from the construction of a noise bund.

An AEE of the discharge to air was prepared by Beca. Following review of the AEE, further information was requested in relation to:

- Monitoring undertaken at the Oceania Gold site for Respirable Crystalline Silica (RCS) and PM₁₀/PM_{2.5};
- Assessment of dust effects associated with construction activities, notably construction of the large bund on the western side of the haul road;
- Consideration of the merit of employing continuous particulate monitoring methods, particularly in relation to the Howard residence; and
- Proposal of specific conditions of consent that are relevant to the Deepdell proposal, including any revised monitoring proposed.

The requested further information was provided in a letter from Beca dated 11 March 2020. I have reviewed that information and considered the responses provided when undertaking this review.

It is important to note that I have not had opportunity to undertake a site visit at this stage, due to the Covid-19 Alert Level travel restrictions. Therefore, the advice contained herein is provisional and subject to amendment based on observations from a future site visit.

Sensitivity of the Receiving Environment

Beca have analysed the location of neighbouring dwellings in relation to the proposal. The dwellings and separation distances from the Deepdell proposal are shown in Figure 2-2 of the Air Discharge AEE. The separation distances given to dwellings are:

- C & M Howard, 1.5km to pit boundary, 1.1km to haul road;
- O'Connell 3.6km;
- Vanderley (Deepdell Station) 4.8km;
- N & M Roy 5.5km;
- Tisdall 5.5km.

With the exception of the Howard residence, separation distances to dwellings from the Deepdell expansion are relatively large. I agree with Beca that the only sensitive receptor with potential to be adversely affected by particulate matter (PM) emissions from the proposal is the Howard residence located to the southwest of the Deepdell expansion.

Local Wind Conditions

Beca have compiled a wind rose for the site using local meteorological data collected from 2012 to 2018 (Figure 2-3 of the Air Discharge AEE). The wind rose indicates that prevailing winds are from the southwest and northwest quarters. The strongest winds also come from these quarters. Winds from the northeast quarter (blowing towards the Howard residence) are also relatively frequent but include a lesser percentage of strong winds (greater than 5m/s).

The analysis of local wind conditions by Beca indicates that winds will blow from the Deepdell expansion to the Howard residence for approximately 12% of the time. Winds from this direction with greatest potential to transport dust (wind speed greater than 5m/s) occur for only 0.8% of the time during a typical year.

I agree with Beca that wind speeds of greater than 5m/s have the greatest potential to transport dust for significant distances. However, I note that some activities undertaken will generate relatively fine particulate matter with potential to be transported significant distances, even at lower winds speeds, when dry conditions prevail. These activities include stripping of overburden and topsoil, vehicle movements on the haul road, and formation of the large bund to the west of the haul road. The proposed waste rock stack is also a potential significant source of dust, but has greater separation from the Howard residence.

I note that the low annual rainfall and relatively high average wind speeds contribute to the dust generating potential of mining activities in this area.

Assessment of Effects of Particulate Matter Emissions

I agree with Beca that the primary contaminant discharged from mining and associated activities is total suspended particulate matter (**TSP**), including PM₁₀ (inhalable particles less than 10 microns in diameter). Larger particles have potential to cause nuisance dust effects, whereas fine particles (including the PM₁₀ and smaller PM_{2.5} size fractions) have potential to cause adverse health effects.

Beca has undertaken a qualitative assessment of the effects of particulate matter, based on experience of the effects of the existing Macraes Flat mining operation. I consider

that this approach is appropriate, noting that the monitoring information available covers a period of several years.

Health Effects

The AEE concludes that the discharge will not cause adverse health effects. To support that conclusion, the applicant was requested to provide further information regarding the monitoring of PM₁₀, PM_{2.5} and RCS undertaken in accordance with Consent 96785 at four sites around the Oceania Gold mine during the summers of 1998-2000. Based on the summary of results provided, I agree with Beca that the 24-hour average RCS concentrations reported indicate that annual average RCS concentrations at sensitive receptors are unlikely to exceed the OEHHA¹ 2019 long-term reference exposure level of 3µg/m³. I note that the “Suttons” monitoring site was located approximately 1km from mining activities at the time and can be considered as indicative of the approximate magnitude of particulate matter concentrations that may be experienced at the Howard residence, 1.1km from the Deepdell expansion activities.

The available PM₁₀ monitoring around the existing mine for the summers of 1999 and 2000 observed concentrations of up to 17µg/m³ (24-hour average). The maximum result reported for the Howard monitoring site was 15µg/m³ (24-hour average). These values are well within the National Environmental Standard (NES) for PM₁₀ of 50µg/m³ (24-hour average).

PM₁₀ has also been continuously monitored at Site 15 at Macraes Village and the results show concentrations that are well below the NES.

Taking into account the separation distance from the proposed activity to the Howard residence and other sensitive receptors, I consider that the discharge of PM₁₀ and RCS over the two-year period of operation is not likely to cause adverse health effects. This conclusion is subject to the diligent application of appropriate dust controls.

Dust Nuisance Effects

The AEE states that properties located within 1-2km of mining activities have potential to be affected by dust emissions, particularly if appropriate mitigation measures are not applied. I note that the proposal includes large areas of exposed surfaces and significant vehicle movements, both potential sources of significant dust emissions during dry and windy conditions. In addition, the formation of the bund approximately 1km east of the Howard residence and stripping of overburden and topsoil are activities with potential to cause significant dust discharges if not carefully managed.

¹ Office of Environmental Health Hazard Assessment, California Environmental Protection Agency.

Compliance Record and Complaints

The AEE states that some complaints have been received from the public regarding dust discharges from the existing Macraes mine site. The ORC has recorded five complaints since 2009, the majority of which related to dust coming from the Mixed Tailings Facility. Beca note that Oceania Gold has recorded 15 complaints since 2006, the majority of which were also related to the Mixed Tailings Facility.

The AEE reports that only one dust related complaint has been received by ORC or Oceania Gold relating to existing operations at the mine between 2014 and 2019. The complaint was received on 15 September 2018 and involved dust from the vicinity of Coronation coming down Camp Creek and affecting a residence on Horse Flat Road. The incident occurred on a relatively still cool day and it appeared that the source of the dust was activities on the stockpiles. The AEE states that the cause of the dust was a malfunctioning water truck which was repaired as soon as the fault was identified.

The record of complaints indicates that the Mixed Tailings Facility has been the most significant source of complaints regarding dust, with complaints typically occurring as a result of high wind conditions. Beca notes that complaints tend to occur most frequently in the spring, summer and autumn months, which correspond to the windiest times of the year. The dust incidents were identified by Oceania Gold to occur primarily when no tailings were being deposited and the edges of the impoundment had dried out. The AEE states that Oceania Gold has instituted a dust control procedure specifically to control dust from the edges of the tailings impoundment during these conditions.

A considerable amount of dust monitoring has been undertaken in relation to the existing mining operation and is summarised at pages 18-22 of the Air Discharge AEE. Dust deposit gauge monitoring indicates that for the majority of the time deposition has been within the consent limit of 3g/m²/30 days above background. Continuous TSP monitoring has been undertaken at Macraes Village (Site 15). The results indicate TSP concentrations at the village that are generally well within the consent limit of 120µg/m³ (24-hour average).

The complaint and monitoring records indicate that Oceania Gold has generally achieved an acceptable level of compliance with the conditions of consent for the existing Macraes Flat mining operation. Dust complaints have primarily related to issues experienced with the Mixed Tailings Facility. In response, the applicant has developed a specific dust control manual for tailings storage facilities. Overall, I consider that the compliance record for the existing consents indicates that Oceania Gold is capable of implementing dust control measures to reduce dust nuisance effects to an acceptable level.

Mitigation Measures

The applicant proposes to continue to employ the dust mitigation measures that are used for the existing mining operation at Macraes Flat. It is proposed that an updated Dust Management Plan will be prepared in relation to the Deepdell North expansion.

The mitigation measures include:

- Application of water to haul roads;
- Limiting vehicle speeds on haul roads;
- Planning overburden stripping activities for days when weather conditions are favourable;
- Minimising drop heights from trucks and excavation equipment;
- Minimising haul distances;
- Revegetation of exposed surfaces, including the outer walls of the waste rock stack; and
- Undertaking blasting within the pit.

These measures are contained in the existing Dust Management Plan for the mining operations and are generally appropriate. However, I note that a speed limit of 60 kilometres per hour is indicated for haul roads. This limit is very high and trucks moving on haul roads at this speed would generate significant dust emissions. The Good Practice Guide for Assessing and Managing Dust² states that industrial sites in New Zealand commonly apply a speed limit of 10–15 kilometres per hour. My experience is that speed limits of up to 20 kilometres per hour are typically imposed for large quarry sites.

The Dust Good Practice Guide notes that vehicles travelling over paved or unpaved surfaces pulverise any surface particles. These particles are lifted and dropped from the rolling wheels, and the road surface is exposed to strong air currents due to turbulent shear between the wheels and the surface. Dust particles are also sucked into the turbulent wake created behind the moving vehicles. The guide states that speed controls on vehicles have an approximately linear effect on dust emissions, meaning that a speed reduction from 30 to 15 kilometres per hour would achieve about a 50 per cent reduction in dust emissions.

The pulverising action of heavy vehicles travelling at speed can generate significant emissions of relatively fine particulate matter that has potential to travel a substantial distance, even under the predominantly light to moderate north-easterly winds that blow towards the Howard residence. The resultant dust deposition can also adversely affect grazed vegetation west of the haul road. I recommend that a 20 kilometre per hour speed limit be imposed for the section of haul road to the east of the Howard property. If real-time TSP monitoring is adopted, as suggested later in this review, vehicle speed limits could be adjusted based on observed results.

² Ministry for the Environment, 2016. Good Practice Guide for Assessing and Managing Dust. Wellington, 2016.

Overburden stripping and bund construction activities have potential to generate significant dust. I recommend that these activities should be specifically restricted at times when winds from the northeast quarter (blowing towards the Howard residence) exceed 5m/s. Meteorological data indicates that these wind conditions occur for less than 1% of the time during most years.

Cumulative Effects

The application states that there is a separation distance of approximately 1km between the Deepdell North expansion and the existing Coronation project. Beca predicts that, due to the separation between mining activities, the proposal is unlikely to result in increased cumulative effects of particulate matter. I agree that cumulative effects are not expected to be significant in this case.

Effects on Vegetation

The AEE states that high levels of dust deposition have the potential to adversely affect vegetation by interfering with plant photosynthesis, promoting weed or disease incidence and impacting on the application of pesticides or fertilisers. In addition to potentially impacting on vegetation, dust may also affect agricultural activity through the promotion of disease or health problems in stock animals.

Beca note that the proposed Deepdell North Stage III mine area will be bounded by the properties leased by the Peddies, Howards and O'Connells. The activities associated with the project will be of similar nature and scale as the activities carried out in the existing Coronation Project area. The AEE adds that Oceania Gold owns and farms the land surrounding the existing Macraes Gold Project and has not experienced any adverse effects on vegetation or animal health on this land.

Provided appropriate dust control measures are undertaken in relation to the Deepdell North Stage 3 proposal, I am satisfied that adverse effects on vegetation on adjacent farmland are likely to be minor.

Proposed Monitoring

The applicant proposes to continue the existing dust monitoring programme at the mine, with no specific changes in relation to the Deepdell expansion. Deposited dust monitoring would continue to occur near the Howard residence (DG07) and background monitoring would occur at site DG24. Meteorological conditions would continue to be measured at sites DG3 and DG15. Continuous TSP monitoring will continue to occur at Macraes Village (Site 15). Due to the separation distance for the Deepdell North expansion, Site 15 is unlikely to be significantly affected by the proposed discharge.

The further information requested under Section 92 of the RMA sought comment on the value of continuous TSP monitoring, specifically in relation to effects on the Howards. Beca responded that, given the separation distance to the Howard residence and the analysis of wind conditions, TSP monitoring was not considered to be necessary.

There is a separation distance of over 1km to the Howard residence from the primary dust generating activities. However, the AEE acknowledges that the nature and scale of activities can cause dust effects at 1-2km from the source. Specific activities proposed, notably haul road movements, bund construction and overburden stripping, can cause significant finer particulate matter emissions that are subject to transport for significant distances, even under light to moderate wind conditions. Given that north-easterly winds will blow towards the Howard residence for approximately 12% of the time, I consider that there is merit in using cost-effective real-time TSP monitoring techniques to ensure that mitigation measures are effectively applied. Such methods could be employed during the initial period of development, particularly while bund construction and overburden stripping occur, with ongoing use re-assessed thereafter based on monitoring results for the initial period.

The Good Practice Guide for Assessing and Managing Dust notes that deposition gauge dust monitoring is generally not suitable for active site dust management. Such monitoring may provide some data about the level of soiling nuisance but generally cannot identify the effectiveness of any on-site dust mitigation techniques, except over very long time periods. However, real-time monitoring using an optical nephelometer could be used to cost-effectively provide near-instantaneous feedback on the effectiveness of dust control measures.

I have undertaken some initial investigations into the cost of suitable real-time TSP monitoring equipment. A suitable optical instrument would include a controlled heated inlet and could be leased or purchased. One supplier indicates a purchase cost for a suitable instrument in the order of \$9000 plus GST. Servicing is included for the first year and thereafter is approximately \$3500 per year. Rental costs are in the order of \$900 plus GST per month and include servicing. The unit would include real-time monitoring (assuming mobile network coverage is available), live data available on a website and text or email alerts when alarm thresholds are reached. The instrument could be operated using solar power or mains power.

In my opinion such real-time TSP monitoring equipment is a cost-effective means of providing feedback to ensure dust control measures are appropriately applied. These monitoring techniques are now routinely used for large quarry developments in the Canterbury region. Assuming monitoring occurred near the Howard residence, TSP trigger levels of $250\mu\text{g}/\text{m}^3$ (1-hour average) and $80\mu\text{g}/\text{m}^3$ (24-hour average) would be appropriate. These trigger levels are suggested for moderate sensitivity receiving environments by the Good Practice Guide for Assessing and Managing Dust.

This information is provided for the applicant's consideration, prior to preparing expert evidence and final proposed consent conditions. I reiterate that I have not yet had

opportunity to visit the application site. A site visit will be undertaken prior to any hearing of the application, provided that is allowed for by national Covid-19 alert levels. I will provide further advice on appropriate monitoring and consent conditions after the site visit.

Consent Conditions

The applicant proposes conditions that are consistent with Consent RM16.138.19 granted for the Coronation North project, with only minor alterations to change specific references to the location.

These conditions are generally appropriate. However, as discussed above, I consider that additional conditions warrant consideration. In particular, such conditions could include the following requirements.

- Continuous TSP monitoring in the vicinity of the Howard residence, with real-time feedback and appropriate trigger levels, for at least the initial period of development. This would confirm the effectiveness of dust control measures, particularly during the initial period of overburden stripping and bund development when dust emissions will be significant at times.
- Limiting heavy vehicle speeds to 20kph on the section of haul road to the east of the Howard residence. This restriction could be relaxed if real-time TSP monitoring indicated that trigger levels were not exceeded.
- Restricting overburden stripping and bund construction activities when winds from the north-easterly quarter exceed 5m/s (approximately 0.8% of the year).

Concluding Remarks

I concur with the conclusion of Beca that any adverse health effects of the proposed discharge of PM₁₀ and RCS from the Deepdell North Stage 3 expansion are likely to be less than minor, given monitoring results for the existing mining operation and the separation distance to sensitive receptors. The primary effects caused by the discharge are expected to be associated with dust nuisance caused by suspended and deposited particulate matter.

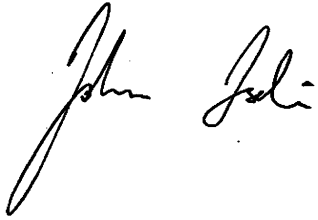
The most affected property is considered to be the Howard residence. This dwelling is located approximately 1.1km from the haul road and 1.5km from the pit. The residence will be affected during winds from the north-eastern quarter that occur for approximately 12% of the time during a typical year. The Howard dwelling may experience dust effects from the proposed discharge at times, particularly associated with overburden stripping, noise bund formation, and heavy vehicle movements on the haul road. However, I consider that mitigation measures can be implemented to ensure that any adverse effects of dust at this location are acceptable.

The mitigation measures proposed are considered to be generally appropriate and are contained in the Dust Management Plan for the mine site. Two additional measures are recommended that are specific to the Deepdell North Stage 3 proposal. The first involves restricting heavy vehicle speeds on the section of haul road to the east of the Howard residence. This restriction could be relaxed if real-time TSP monitoring indicated that trigger levels were not exceeded. The second additional measure restricts overburden stripping and bund construction activities when winds from the north-easterly quarter exceed 5m/s (approximately 0.8% of the year).

Provided these dust control measures are diligently implemented, I consider that any adverse effects of particulate matter emissions from the site will be acceptable. TSP monitoring in the vicinity of the Howard residence, with real-time feedback and appropriate trigger levels, would be valuable to confirm the effectiveness of the dust control measures, particularly during the initial period of overburden stripping and bund development when dust emissions will be significant at times.

Please contact me if you require any clarification of the above matters.

Yours sincerely

A handwritten signature in black ink, appearing to read "John Iseli". The signature is written in a cursive style with a large, sweeping initial "J".

John Iseli
Principal Air Quality Consultant