Ulkatcho First Nation

Environmental Assessment Review

New Gold Blackwater Gold Project

FIRST DRAFT – FOR DISCUSSION PURPOSES

February 10, 2016

Keefer Ecological Services Ltd

Keefer Ecological Services Ltd
3816 Highland Rd.
Cranbrook BC V1C 6X7
(250) 489-4140
www.keefereco.com

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Keefer Ecological Services Ltd.
3816 Highland Road
Cranbrook, BC V1C 6X7
www.KeeferEco.com

To: Ulkatcho First Nation Chief and Council
Cc: Laurie Vaughan, Ulkatcho EA Review Team
From: Michael Keefer
Subject: Blackwater EA Review
Date: February 9, 2016

Introduction: This briefing is written to provide an update on the work of Keefer Ecological Services (KES) and its team of subject experts. As you are all aware, KES was engaged by your community to conduct a third party technical review of the Blackwater Environmental Assessment. As described in the Project Framework document there are two major stages to our review, the higher level comments and the final detailed comments. This note is concerning the higher level comments on the assessment.

It is crucial to note that though there are substantial concerns raised, it is believed by our team that they may readily be addressed so that there is a well-designed mine that should not pose undue risks to the environment or society. Upon your review we look forward to sharing the results with New Gold so that these concerns may be properly addressed before our final submission to the BC Environmental Assessment Office. Attached with this briefing note are the memos from the subject matter experts.

Issues: The review team has come up with concerns about the environmental assessment that span all of the various disciplines of our team including: dam safety, geo-chemistry, hydrology, water quality, wildlife biology, reclamation and economics. Found below are some of the key concerns of the project:

Water:

- The predicted effects of water withdrawal from Tatelkuz Lake on the mean lake level have been significantly underestimated due to a miscalculation. New Gold predicts a 3% decrease in mean lake level, whereas our calculation predicts a 7% decrease. Also, seasonal effects of water withdrawal were not taken into account and could cause a 12-20% decrease in under ice water level. These water level changes will alter the significance of the effects on Tatelkuz Lake water levels and associated fish and fish habitat.
- During closure and post-closure, the effectiveness of constructed wetlands to treat outflow from the Tailings Storage Facility (TSF) is not well documented or substantiated. This raises concerns about the ability of the wetlands to treat the discharge (with potentially elevated levels of metals and sulfate) to achieve water quality guidelines prior to outflow into Davidson Creek.
- It is planned that there will be an accumulation of a significant volume of water in the tailings pond over the mine life which can create an unnecessary risk for the dam.
- Given that the TSF is in part being designed to act as the main water storage and management structure for the project, and the inherent uncertainties in water balance predictions and water quality predictions, it appears there is a risk that the project could find itself at a point at which it would need to discharge water (water balance uncertainties)

and at that point in time would need to have water quality that was of appropriate quality to discharge or be able to treat water prior to discharge.

- The proposed project does not include active water treatment or the contingency for one. It should be recognized that active treatment technology is a proven method to minimize downstream effects and may be required at the Blackwater project despite integration of all the best management practices for waste management. It is our expectation that there is a high likelihood that active water treatment of some form and at some stage of the project is a likely probability.
- The current design of the dam, with the current thickness of the core and the construction over many years, raises significant concerns over the adequacy of the thickness of the core of the dam to withstand the predicted forces over the life of the project.

Human Health:

- The Human Health assessment has not included Anahim Lake within its study boundaries. Therefore, the assessment has not taken into account the Ulkatcho people specifically, however some general assumptions using standard thresholds would be applicable.
- Traditional use was not sufficiently addressed and needs to be tied with human health.

Wildlife:

- Concern whether methodologies and rationales support conclusions on wildlife impacts
- Inappropriate wildlife species indicators selected for VCs ie. beaver/marten for furbearers and the yellow rail for waterbirds
- Geographic scale inappropriate for some of the analyses
- Lack of attention paid to publically available literature
- Cumulative effects analyses not repeatable and/or based on insufficient data

Economics:

- The Anahim Lake, Nimpo and other areas left out of the analysis.
- Need a strategy for enhancing economic opportunities - preference for local suppliers, advance warning of bid tenders, and smaller lot orders.
- Need for a commitment for training and education of Ulkatcho members.
- Need for a commitment to build a mine access road for Ulkatcho workers.
- Need a commitment for education for First Nations students.
- Need a commitment to mitigate negative social effects on First Nations communities.

Recommendations: I urge Chief and Council to submit this briefing and the attached memos directly to New Gold prior to submission to the BC EAO so that New Gold has the opportunity for technical discussions with the EA Review Team. It is hoped that these concerns can be properly dealt with during such discussions as part of the review period.

Aquatics and Engineering Technical Working Group Review

MEMORANDUM

DATE: February 9, 2016

TO: Michael Keefer, Keefer Ecological Services

FROM: John Brodie, P. Eng.

SUBJECT: Ulkatcho FN – New Gold Blackwater Project Review

Working in conjunction with Keefer Ecological Services and others, BCL is reviewing the EA documentation for New Gold's Blackwater Project. BCL's scope is:

- Review of tailings pond design and safety (including any dam structures), mine closure plans and the potential impacts to the environment

- The work is to focus on the following sections of the EA:
    - Section 2,
    - Appendix 2.2A,
    - Appendix 2.2A-2,
    - Appendix 2.2A-3,
    - Appendix 2.2A-4,
    - Appendix 2.5A,
    - Appendix 5.3.5B,
    - Alternative Tailings Technologies document, Section 10 (pending)

Non-Technical Summary

- The Blackwater design has used generally accepted best practices for management of mine waste (placing PAG tailings and rock underwater). That said, there are some risks for short and long-term water quality due to the timing of material placement.
- It is planned to accumulate a significant (up to 25M m3) inventory of water in the tailings pond over the mine life. Such an inventory of water creates unnecessary risk for the dam.
- A low permeability core in the dam is proposed to control seepage and stability. The core is relatively thin for the expected conditions. Construction will require a high level of quality control to ensure that a piping failure cannot occur. Continual raising of the dam over many years is not ideal for maintaining a high level of quality control. It is expected that the core of the dam will be a priority issue for consideration by the review board for the dam (once that board is formed).
- Seepage analyses of the dam should be re-assessed and include sensitivity studies to identify the potential effects of a range of material properties.

- The proponent has considered a suitable range of alternative technologies for tailings management for this project. The conclusions are reasonable (i.e. underwater disposal of PAG tailings and waste rock at Site C and Site D is a credible conclusion).

Technical Summary

Comments on each section are presented below. It is anticipated that these may be modified after discussion with other review team members and/or response from the company.

Section 2

Section 2.2.3.2.13.11

- All PAG rock is to be flooded in one year after deposition. There is a schedule of dam raising which suggests the one year target is quite achievable, so long as lift thicknesses are kept to “less than next year’s scheduled pond elevation. However, Figure 3-54 (a plot of pH in (small) field bins and humidity cells) shows acidic conditions developing in less than a year. There is very little NP to speak of (~20 kg $CaCO_3$/t) so if exposed, the sulphide oxidation could depress pH quite quickly. Even with the proposed placement of PAG rock and flooding in one year, it is likely that some oxidation will have occurred

    Questions: Have seepage analyses assumed un-oxidized or partially oxidized source terms for the TSF seepage water quality prediction? Will there be annual maximum elevation of PAG rock in the TSF to ensure that all PAG rock is submerged as planned (i.e. one year or less)? How will material be flooded in the event of temporary or premature closure?

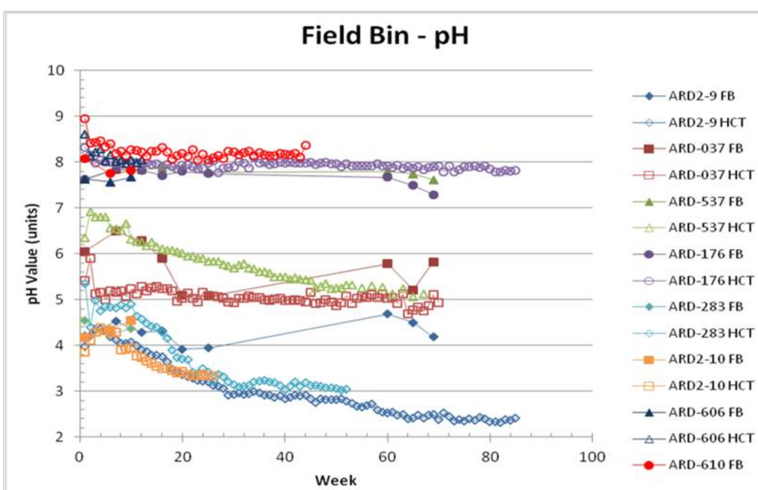

Figure 3-54: Waste Rock Kinetic Field Bin pH values

Figure 2.2.3-8.7 The figure shows the TSF water inventory through the mine life. It is anticipated that there will be an accumulation of 10 – 25M m3 of water in Site D which is not suitable for discharge. This volume is substantially greater than is needed for reclaim water purposes and poses an unnecessary risk to the operation of the TSF and integrity of the dams.

Questions: Why not treat and release this water?

Section 2.6.5.1.4 (page 405 of 498) LGO It is planned to process the LGO to produce a NAG layer of tailings over the PAG tailings.

Questions: If this material (LGO) is un-economic to process, what will be done to cover the PAG tailings?

Section 2.6.5.1.6 (page 410 of 498) ARD/ML Control: Pit water is expected to meet BC Criteria for wildlife. It is not expected to meet aquatic criteria.

Questions: How will this water be released to ensure adequate dilution? Will there be staged discharge? If so, how will this be managed in the long-term?

Section 2.6.5.1.7 (page 410 of 498) Water Mgmt. No discharge from the TSF is proposed for operations.

Questions: In the event of temporary shut-down how will the water be managed? Treat and release, or increase storage is TSF (which increases risk to the dams). Discharge to pit is suggested however this is rarely done. At what threshold of water storage will the company commit to either processing in treatment plant or pumping to the pit? Will there be appropriate facilities on site (WTP or pump system) so that the commitment can be met when the threshold is reached?

Section 2.6.6.1.1 Pit Lake: Accelerated flooding of the pit with TSF water over a 20 year period is proposed. If TSF water (not suitable for discharge) is moved to the pit where it will encounter oxidation products on pit walls (see Fig. 3-54 inserted above), then it is certain that the pit water will be of poor quality. Treatment of this water using algal blooms is suggested. Conceptually, algal treatment could be conducted to improve pit water quality. However, this method only treats the upper few meters of water.

Questions: How many years would such a treatment system be required? How would the pit water level be managed? (withhold water in summer treatment period followed by fall/winter pumped discharge?) What are the implications for closure financial security?

Section 2.6.6.1.2.2 TSF; A final cover of 0.3 m of overburden is proposed on the tailings and PAG rock. Placing this material on the tailings, especially the slimes area will be very difficult. Hydraulic methods are suggested.

Questions: Further detail on how this material might be placed is required. Can the proponent provide any examples of hydraulic distribution of a till-like material?

Section 2.6.6.1.2.2 (page 421 of 498) TSF; It is expected that there will be a downward hydraulic gradient in the TSF after closure. This is probably good for the pond water quality. However, it means that there will be flushing of partially oxidized PAG rock.

Questions: The flushing of PAG and associated water quality impacts should be addressed. (link to response to questions on Section 2.2.3.2.13.11 above)

Section 2.6.6.2.1 LGO; If this material is not processed it is expected to be acidic.

Questions: If oxidized LGO is placed in the TSF or pit, it will impact water quality. What predictions of water quality of flooded LGO after 20 years of oxidation have been made? How will this affect the level of effort and post-closure cost for water management?

Section 2.6.6.3.3 Soil: Soil requirements for reclamation are based on a 0.3 m thick cover layer. The natural soil profile in this region is 0.1 m top soil over good to fair soil to a depth of 0.5 m. There is abundant suitable soil salvaged in the mining plan.

Questions: Why place a marginal soil cover when a soil horizon suitable for future (good) land use can readily be achieved?

Table 2.6-13 Reclamation Cost Estimate; No details are provided to support the cost estimate.

Questions: Why is there no contingency in the cost estimate? (at this stage of project planning a 25% contingency would be reasonable). An estimate of a "specific contingency" for short-term water treatment should be included for temporary closure and the anticipated post-closure. The movement of TSF water to the pit is the largest single item in the cost estimate; additional details should be provided.

Appendix 2.2A MINE WASTE Figure 5.8 and APP C1 Fig. C1.2-10; These figures show the Site D dam in cross-section. The core is a uniform 10 m wide from the top of starter dam to the ultimate crest. The resulting hydraulic gradient across the core of the dam is approaching 10 (see additional comment on seepage in App 5.3.5B – Seepage: actual gradients may be higher). Although dams have been constructed with gradients of 10, and even higher, a lower gradient will have a reduced risk of piping. Higher gradient designs require significant effort of quality control in construction, which is very difficult to achieve for a mining dam which is constructed over several decades.

Performance of the dam will be very sensitive to defects in the core which may arise due to:

- Poor bonding between lifts,
- Winter construction,
- Variability in till source material,
- Frost degradation of previously placed layers (annual frost penetration could approach 2m at this site),
- Settlement or seismic stress which could cause cracking of the core.

The proposed design has a risk of piping failure which should be critically assessed, and if appropriate, the design should be modified. It is expected that the core of the dam will be a priority issue for consideration by the review board for the dam (once that board is formed).

Questions: As the dam will perform essentially as a water retaining dam, seepage analyses and core/filter design should be assessed for these conditions. Have the potential effects of settlement on the core been assessed?

Appendix 2.2A-2
Section 6.7 (page 94 of 356): it is proposed that the "facilities will operate in balance or surplus of water throughout operations, with accumulation of up to 25 M m3 of water in Site D and an additional 8 Mm3 in Site C. Discharge of excess water to the pit (in the event of temporary closure) is the only contingency presented. It is not clear from the information presented that an extreme event (24 hour PMP or a wet year) could be managed without encroaching on the freeboard level.

> Questions: Can the proponent demonstrate what range of extreme events (short high intensity and sustained wet periods) can be managed without discharge to the pit or exceeding freeboard levels for both operations and temporary closure?

Appendix 2.2A-3 no comments

Appendix 2.2A-4 no comments

Appendix 2.5A no comments

Appendix 5.3.5B Seepage
Seepage sensitivity studies are presented.

- The modeled permeability of the tailings is towards the low end of the range (i.e. less permeable than may occur). This is especially the case for the tailings nearest the dam where there is little deposition of fines.
- It does not appear that the effects of the PAG rock in the upper end of the TSF has been considered. It is likely that there will be full hydrostatic head at the base of the waste rock and into the sand and gravel foundation of the TSF which underlies the less permeable tailings. This sand and gravel can transmit pressure to the waste rock zone on the upstream side of the dam (Zone C) and increase hydraulic pressure on the core of the dam. It is also likely that there will be a plume of ARD/ML being transported on this flow path.
- The modeling suggests that there will be a head loss across the Zone C waste rock. In a low seepage system this is improbable. The suggested permeability of this material is much too low.

> Questions: the proponent should re-assess the seepage modeling and post-closure water quality modeling which includes the partially oxidized PAG waste rock upstream of the tailings and much more permeable waste rock in Zone C of the dam.

Alternative Tailings Technologies document, Section 10
The Alternative Tailings Technologies document has been reviewed. A suitable range of sites and methodologies for tailings management have been considered. The conclusions are reasonable.

That said, the document relies upon the Failure Mode and Effects Assessment report which was prepared by Knight Piesold in 2015. A summary of risk for the Site C and Site D tailings area is presented in the table Risk Description and Preliminary Risk Rating. Thirty-nine risks are identified. It is the opinion of BCL that risk items 13, 14, 15, 16, 25 and 34 are all more likely to occur than is suggested by Knight and Piesold. The risks associated with 13, 14 and 15 could all be mitigated with a much wider core, composed of non-brittle (plastic) till, and without any winter construction of the core.

TECHNICAL MEMORANDUM

Date: February 7, 2016

To: Keefer Ecological Services Ltd.

From: Rina Freed, Source Environmental Associates Inc.

Subject: Ulkatcho First Nation – New Gold Blackwater Project Review – First Draft

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Working in conjunction with Keefer Ecological Services Ltd. and others, Source Environmental Associates (SEA) is reviewing the environmental assessment (EA) documentation for New Gold's proposed Blackwater Project, as requested by Ulkatcho First Nation.

SEA was retained to review the following sections:

- Section 5.1.2.3: Aquatic Environment, Baseline (pending)
- Section 5.1.2.4: Aquatic Environment, Baseline (pending)
- Section 5.3.5: Groundwater Quantity (pending)
- Section 5.3.6: Groundwater Quality (pending)
- Section 10: Accidents or Malfunctions (pending)
- Section 12: Summary of Proposed Environmental and Operational Management Plans (pending)
- Appendix 2.2A-2: Mine Waste and Water Management Design Report
- Appendix 2.2A-6: Updated water balance letter report
- Appendix 2.2A-10: Open pit water management plan (pending)
- Appendix 5.3.5A: Numerical groundwater modelling report
- Appendix 5.3.5B: Surface Water Quality Goldsim Model
- Appendix 5.3.3B: Tailings Storage Facility seepage sensitivity analysis
- Alternative Tailings Technologies document (pending)

A summary of the recommended information requests as well as a detailed breakdown of the comments on each reviewed section are presented below. These comments may be modified after discussion with other review team members and/or response from New Gold.

Summary Report

- **Conceptual representation of the water quality model is required to provide a clear understanding of how the model was developed.** In order for a reviewer to understand the numerical model that was developed for water balance and water quality modelling, a clear graphical representation of the system should be provided to show the location of the modelling points, the relevant mine components, and locations of input data sources.

- **Water balance reporting is incomplete**. A cohesive description of the site-wide water balance that was used as the basis for water quality predictions was not provided in the application. The report should present the methodology and results for the site-wide (mine site and receiving environment) flow predictions for all phases of mining (construction through post-closure).
- **Variability in meteorological conditions should be incorporated into the water quality modelling**. The site-wide water balance and water quality model should simulate the expected range in hydrological conditions (i.e., wet/dry periods) at the site. The intent of the simulations will be to illustrate how the proposed water management system (water storage, water supply, water treatment) will perform, and how it will be able to meet expectations for water quantity and water quality management under the full range of expected environmental conditions.
- **Additional information is required to demonstrate how the wetland system was accounted for in the water quality model.** A wetland is proposed as a passive treatment system. The flow rate and concentrations of all sources into the wetland as well as the treated effluent should be provided for a reviewer to understand the simulated rate of removal of contaminants from mine discharge.
- **TSF inundation study is required**. The preferred tailings storage alternative involves a storage dam such that potentially acid generating mine wastes can be stored in a saturated state to slow the acid generation process. Failure of the dam would result in a flood wave of water and tailings downstream from the mine site. A dam breach inundation study should be provided to evaluate the impacts of a dam breach scenario.
- **Tailings Technologies Alternatives Assessment – Information Requirement.** An alternatives assessment was undertaken by New Gold to evaluate various locations and methods for storing mine waste. A decision matrix was used to numerically compare the merits of each option to help in the selection of the preferred alternative. An electronic copy (excel spreadsheet) of the decision matrix should be made available for review. The electronic copy will help the reviewer understand how the different criteria were weighted, and how the alternatives were subsequently scored in comparison to each other.

Technical Report

Based on the Mine Waste and Water Management Report (KP, Sept 12, 2014). SEA understands the following water management systems will be in place (by project phase):

Operations

- West Waste Dump drain to Tailings Storage Facility (TSF) Pond
- East Waste Dump drainage diverted to TSF
- Low Grade Ore (LGO) stockpile drainage collected and treated, released to TSF Pond
- TSF pond zero discharge to Davidson Creek
- TSF seepage (53 L/s) recovered to TSF
- TSF seepage (2 L/s) unrecovered to Davidson Creek
- Mill Makeup supplied from Tatelkuz Lake.
- Waste Dump runoff and seepage collects in TSF

Closure / Decommissioning

- TSF pond pumping to Open Pit (~18 years). No discharge to Davidson Creek
- TSF seepage (53 L/s) recovered to TSF
- TSF seepage (2 L/s) unrecovered to Davidson Creek

Post-Closure

- Open Pit flows to TSF Pond
- West Waste Dump drains directly to TSF Pond
- East Wast Dump drainage diverted to TSF Pond
- East Waste Dump seepage travels to Creek 661 (travel time ~400 years)
- TSF Discharge to Davidson Creek
- TSF seepage (53 L/s) travels through constructed wetlands for treatment, then discharges to Davidson Creek.
- TSF seepage (2 L/s) discharge directly to Davidson Creek

Key issues related to waste management, water balance and water quality are provided in the following sub-sections with action items to be fulfilled by New Gold.

Conceptual representation of the water quality model is required to provide a clear understanding of how the model was developed

The water quality modelling report (Appendix 5.3.3.B) provides flow diagrams to illustrate connectivity of the proposed mine site drainage system. However, there is not enough information provided in those diagrams for the reader to understand the structure of the site – wide numerical water balance and water quality water models.

Action Items:

1. Create a conceptual base map in plan-view that clearly shows existing site conditions. New Gold's current consultant ERM developed an appropriate set of conceptual figures for the Kemess Underground EA Application (See Kemess Technical Appendix, Water Balance and Water Quality Model). The location of all baseline hydrology and water quality stations should be included in the figure. The footprint outline of relevant mining components should be superimposed over the figure so the reader can understand where the sampling points are relative to the proposed mine. Satellite images, roads and other information not relevant to water balance and water quality modelling should be omitted so not to detract the reader.

2. Create plan-view figures for the Water Balance / Water Quality Model overview to show the changes in the project by project phase. Again, ERM's Kemess example is a good starting place. The first figure should show the proposed site during the final years of operations, and the second figure should show post-closure conditions. The figures should show enough information to provide the reader with an understanding how the site-wide water quality model was developed. The following information should be included on each figure:
    - footprint outline of relevant proposed project infrastructure
    - water quality monitoring stations whose data were used as model input
    - location of water quality prediction points
    - drainage basin area boundary of water quality prediction points
    - flow direction arrows for mine contact water that enters the receiving environment

Water balance reporting is incomplete

The water quality model is presented in Appendix 5.3.3B. A water balance model is the basis for the mass balance and water quality model. Flow rates for select years are presented in Table 5 of Appendix 5.3.3B. Derivation of those flow rates were not provided in the water quality modelling report. The water quality modelling report stated that the flow rates were based on the water balance models presented in Appendix 5.3.3B ("Blackwater Project - Feasibility Study Water Balance Model", KP, Dec 23, 2013), and Appendix 5.1.2.1B ("Watershed Modelling Report", KP, January 17, 2014). However, it is not possible for a reviewer to understand how the water balance models and water quality model were linked.

Action Item:

3. A description should be provided for the site-wide water balance model that was used as the basis for water quality predictions. The report should include site-wide (mine site and receiving environment) flow predictions for all phases of mining (construction to post-closure). Total streamflow at each modelling point should be provided along with a

breakdown of the individual flows that contribute to total streamflow at each modelling point.

It is important that the water balance report is structured such a reviewer can easily cross reference between the water quality model and water balance model reports to understand which water balance flows were used as input to the mass loading balance in the water quality model.

Variability in meteorological conditions should be incorporated into the water quality modelling

The water quality model was run using average annual water balance conditions. To evaluate the effects of dry periods on water quality, the model was run for the 7Q10 event, and a 1:50-yr dry year. This approach is overly simplistic because it does not account for extended wet and dry periods.

Wet and dry periods can last several years. If more than one consecutive wet or dry year were to occur, there may be periods when there is no discharge from TSF Pond and the TSF seepage would continue to discharge to Davidson Creek. The site-wide water balance and water quality model should be run with an input dataset that will simulate the expected inter-annual variability in hydrologic conditions at the site. The intent of the simulations will be to illustrate how the proposed water management system (water storage, water supply, water treatment), will perform, and how it will be able to meet expectations for water quantity and water quality management under the full range of expected environmental conditions.

Action Items:

4. A long-term synthetic dataset of monthly meteorological and hydrological conditions should be developed and applied as model input on a site-wide basis. The synthetic dataset should be based on long-term continuous records of weather and streamflow conditions.

5. Demonstrate that with the proposed system, water quantity and water quality can be managed under the expected range of environmental conditions at the site, for all phases of mining.

Wetland Inflow Water Quality Information Required

A constructed wetland is proposed for treatment of TSF seepage during post-closure. Wetland inflow water quality will presumably be a blend of TMF seepage, TSF embankment drainage, and possibly some local overland runoff. The treated effluent from the wetland will then mix with TSF pond discharge at the WQ-10 (Plunge Pool) water quality prediction point. The combined inflow water quality to the treatment system is not presented in the water quality modelling report (Appendix 5.3.3B).

Action Item:

6. Provide the inflow water quality to the post-closure wetland treatment system.

Wetland Effluent (Treated Outflow) Water Quality Information Required

The assumed effluent water quality from the wetland treatment system was presented in Table 6 (Appendix 5.3.3B). The underlying assumption was that the discharge from the wetland would have the same water quality as that of a wetland treatment system at the Musselwhite Gold Mine (northwestern Ontario). A water treatment report was provided by Clear Coast Consulting (2013) and is included as Appendix 2.6C. The report was intended to be used as the basis for the wetland treatment system design concept. While Musselwhite was used as a case study in Appendix 5.5.3C, the report did not explicitly state that the Musselwhite effluent water quality should be used to represent the water quality for treated seepage for all water quality parameters at the Blackwater Project.

Action Item:

7. Provide justification for the assumption that Musselwhite wetland effluent water quality would be achieved in the treated Blackwater TSF seepage for all water quality parameters.

Relative Contribution of Individual Loading Sources Should be Presented

It would be beneficial, particularly for the parameters of potential concern, to show which loading sources are predicted to be have the largest influence on downstream water quality.

Action Item:

8. Provide a table for each prediction point in the receiving environment that shows the relative proportion each loading source would have on total loading. The table should include at minimum the water quality parameters of potential concern. See **Error! Reference source not found.** for an example. The values in the table should be based on total annual loading for a given year. A table should be presented for a representative year during operations and another table for a representative year during post-closure.

Table 1 – Example table of percent contributing of each Loading Source at W-10

Source of Loading	Post-Closure Fraction Contributing (%) to Davidson Creek at W-10						
	SO4	Cd	Zn	…	…		
Background Streamflow	3	45	2				
TSF Pond Discharge	51	5	71				
TSF Seepage	46	50	27				
East Dump Seepage	0	0	0				
Total	**100**	**100**	**100**	**100**	**100**	**100**	**100**

TSF Inundation Study is Required

The preferred tailings storage alternative involves a storage dam such that potentially acid generating mine wastes can be stored in a saturated state to slow the acid generation process. Failure of the dam would result in a flood wave of water and tailings downstream from the mine site. It is appropriate for New Gold to fully assess the downstream impacts of such a failure mode.

Action Item:

9. A dam breach inundation study should be provided for the proposed tailings facility. The study should show the estimated extends of area that would become inundated, and the long-term impact of the spilled tailings on the receiving environment.

Tailings Technologies Alternatives Assessment

ERM provided the report titled "Evaluation of Alternative Tailings Technologies for the Blackwater Project", dated December 2015. The report presented different potential locations and methods for storing mine waste. A decision matrix was used to compare the merits of each option to help in the selection of the preferred alternative.

Action Item:

10. An electronic copy (excel spreadsheet) of the decision matrix should be made available for review. The electronic version will help the reviewer to understand how the scores for each option were numerically derived.

Additional Items – Water Management Systems Overview

Action Items:

11. The mechanisms that will control the post-closure release of TMF pond water and TSF seepage (via the wetland) into Davidson Creek should be described. The timing of the mine water discharge should also be described. For example, will seepage be discharged year-round or will it be held back during the winter (low-flow) months such that it can be augmented with TMF Pond water prior to release into Davidson Creek?

12. The Waste and Water Management Report (Section 5.7, pg 47) states that during Operations, 53 L/s seepage will be recovered, and 2 L/s of unrecovered seepage will flow into Davidson Creek. Derivation of the total TSF seepage rate of 55 L/s was not provided. Appendix 5.3.5A (Numerical Groundwater Modelling Report, KP, Jan 16 2014) provides prediction of the seepage through the foundation, which was calculated to be 21.3 L/s. The seepage through the embankment was presumably calculated with a separate model and makes up the difference between 55 L/s and 21.3 L/s. Derivation of the total TSF seepage should be provided in the groundwater modelling report to provide the reader with that overview. Table 6.1 (page 56) from Appendix 5.2.5A should be updated to include the embankment seepage value.

13. Table 6.1 from Appendix 5.3.5A (Numerical Groundwater Modelling Report, KP, Jan 16 2014) does not include an estimate for the amount of seepage that is expected from the LGO stockpile. Table 6.1 should be updated to include the LGO stockpile seepage values.

Additional Items – Vertical Gradient of TSF Porewater

The KP Groundwater Modelling Report (Jan 16, 2014) provided a prediction for the amount of seepage that will travel from the tailings and waste rock pores and into the TSF foundation. However, no discussion was provided about the potential for TSF pore water to travel upward and into the TSF pond water during post-closure conditions. A potential location for upward groundwater flow is the upslope end of the TSF where background groundwater will discharge from the valley walls and into the TSF pore water.

If upward gradient groundwater flow were to occur, it would result in the pore water of stored tailings and/or waste rock to be displaced and transported into the tailings pond. This would be a long-term source of loading at the post-closure site, and the tailings pond water quality would be impacted by it.

Action Item:

14. Demonstrate modelling results graphically to show that upward movement of groundwater into the TMF Pond (post-closure) is not expected. Provide sections along the alignments shown in the marked up figure. The sections should include the following information:
    - existing ground surface elevation
    - Stored material in TSF
    - TSF dam
    - pond top elevation
    - pieziometric contours (lines of equal hydrostatic pressure)
    - resulting groundwater flow path direction

Additional Items – Tailings Seepage Water Quality

Tailings and PAG waste rock will be sub-aqueously disposed in the TSF. This will inhibit sulphide oxidation and prevent further release of metals and acidity associated with the sulphide mine waste. Although long-term drainage chemistry from saturated mine waste is expected to be better compared to unsaturated conditions, drainage from the saturated TSF is not expected to be entirely benign due to the abundance of water soluble weathering products associated with mineralized zones that have been exposed to in-situ weathering processes.

Seepage from the TMF is likely the most significant long-term source of loading into Davidson Creek. The magnitude of loading from TMF seepage was estimated as the flow rate of seepage multiplied by seepage water quality. According to Table 4 (Water Quality Model Sources Assumptions) of Appendix 5.3.3B (Water Quality Modelling Report), 39 day ageing test results were used to represent seepage water quality.

Note 7 on Figure 6-19 (5.1.3.1A Geochemistry Report) provides a statement that indicates a source term for post-closure seepage has not been developed: “During post-closure period, seepage water quality from TSF may be worse than operations due to post-depositional remobilization of tailings and waste rock components (e.g. redox and pH controlled processes).”

Kinetic test results may be more appropriate for the estimation of seepage water quality.

Action Item:

15. Rather than using ageing test results to predict seepage water quality, the results from saturated columns undertaken should be considered to quantify the behavior and metal leaching potential of waste rock and tailings under sub-aqueous conditions. The combination of tailings and PAG rock should be replicated in the testing to replicate the proposed TMF configuration and sequences for flow pathways.

Additional Items – Tailings Beach Loading

According to Table 4 (Water Quality Model Sources Assumptions) of Appendix 5.3.3B (Water Quality Modelling Report), 39 day tailings ageing test results were used to represent water quality of tailings seepage and runoff into the TSF Pond from the tailings beach. Kinetic test results would be more appropriate for development of tailings beach loading source terms.

16. The source term for seepage from submerged tailings should be developed from saturated leach column test results for a submerged sample of tailings.

17. The source term for runoff from unsubmerged tailings should be developed from humidity cell test (or field bin test) results for an unsubmerged tailings sample.

Additional Items – LGO Stockpile Seepage Loading

Presumably the LGO stockpile seepage will infiltrate into the groundwater and eventually report downstream (to the TSF Pond or other receptors). It appears LGO seepage source terms were not developed.

18. Develop source terms and seepage flow estimates for LGO seepage. Estimate the receptor(s), and travel time to the receptor(s).

Additional Items – Accumulation of Solutes in the Process Water

TMF Pond water will be reclaimed to the Mill for re-use. Water quality parameters that are mobile at neutral pH (e.g. Sb, As, Mo, Se and U) are expected to accumulate within the process water over time as the TMF Pond water is recirculated through the mill.

Action Items:

19. Provide a list of the water quality parameters that were assumed to accumulate in the mill process water over time.

20. Describe how the accumulation of substances was calculated during a given model time-step.

Additional Items –Waste Rock Flushing Upon Submergence

Flushing of built-up oxidation products from the surface of the waste rock and into the TSF was calculated in the model. The source term development was described in Section 6.5 of Appendix 5.1.3.1A (Geochemistry Source Term Report) of the EAC application. The loading from that flushing was assumed to enter the waste rock voids. The load from flushing should enter the TSF Pond water and not the voids.

Action Item:

21. Model the loading from waste rock submergence to enter the TMF Pond water rather than being lost to the waste rock voids.

Additional Items - Post-Closure TSF Pond Water Quality

Table 4 (Water Quality Model Sources Assumptions) shows that the post-closure TSF Pond water was assumed to be equal to background water quality. Post-closure TSF Pond water should be calculated as a mixture of the following loading sources:

- background runoff
- pit Lake discharge
- tailings beach runoff
- waste rock dump seepage
- LGO seepage

Water quality will also be influenced by the inflow of precipitation water and the outflow of evaporation from the pond surface.

Action Item:

22. Calculate the TSF pond water quality as a mixture of the water and loading sources passing through the water body. Assessment of solubility limits (using phreeqc software) in the TMF Pond water may be appropriate.

Additional Items - Loading from Waste Rock into the Receiving Environment

23. The diversion channel that will be in place (post-closure) to collect runoff and seepage water from the East Waste Dump to the TSF Pond can be expected to have a capture efficiency of less than 100%. That is, some of the East Dump drainage can be expected to enter Creek 661. What capture efficiency was assumed for the diversion channel?

24. How was loading from East Dump (via groundwater flow path) to Creek 661 accounted for in the modelling?

Additional Items - Cyanide Management

25. Provide clarification on the use of low permeability substrate underlying the TSF and how the natural conditions create a liner. How do the conditions at Blackwater compare to those of other mine sites (such as KSM) that have opted for installation of synthetic liners?

26. What is the treatment objective for cyanide destruction plant for process water going to the tailings pond?

Closure

Thank you for the opportunity to provide review for the Blackwater Project. This document was prepared by SEA as an independent assessment. A full review of the Blackwater Project archive was not within the scope of the review. Budget limitations are considerable. The material in this document reflects SEA's judgement in light of the information that was reviewed by SEA at the time of document preparation. We trust this review meets your requirements at this time. If you have any questions, please contact the undersigned.

Yours truly,

Source Environmental Associates Inc.

Rina Freed, Ph.D., P.Eng.
Senior Environmental Engineer, Mining

MEMORANDUM

DATE: February 5, 2016

TO: Michael Keefer, Keefer Ecological Services
CC: Ulkatcho First Nation

FROM: Shannon Shaw, pHase Geochemistry Inc.

SUBJECT: Ulkatcho FN – New Gold Blackwater Project Review
FIRST DRAFT – Review still underway

Working in conjunction with Keefer Ecological Services Ltd. and others, pHase Geochemistry Inc. (pHase) is reviewing the environmental assessment (EA) documentation for New Gold's proposed Blackwater Project, as requested by Ulkatcho First Nation.

pHase was retained to review the following sections:

- EA Section 2: Proposed Project Overview
- Appendix 2.6B: Capping Material Requirements by Project Components (pending)
- Appendix 2.6E: Pit Lake Treatment (pending)
- Appendix 5.1.3.1A: Geochemical Characterization Report
- Alternative Tailings Technologies document, Section 10 (Conclusions)

Given the integration of the geochemical source term predictions with water quality predictions, Section 5.3.3 was also reviewed though in a very general sense.

It should be noted that pHase does not have expertise in water treatment or in reclamation and as such their review of Appendices 2.6B and 2.6E were only in the context of how the geochemistry influences or is influenced by the capping or treatment aspects discussed.

A summary of the analysis of each section reviewed as well as a detailed breakdown of the comments on each reviewed section are presented below. These comments are anticipated to be modified after discussion with other review team members and/or response from New Gold.

Summary Report

The geochemical characterization work completed for the Blackwater project appears to be robust and comparable in scope and extent to what has been completed on other projects of similar size. The results of the geochemical characterization work are used to support two key aspects of the project:

1. To assist in waste management planning and mine design in order to minimize geochemical impacts, and
2. To predict potential water chemistry associated with mine features used in water quality models and impact assessments.

Based on the initial review, it appears that the waste management planning (item 1 above) has been done well and has integrated best available practices for the minimization of ARD and ML to the extent possible. This includes:

- storage of potentially acid generating rock and rock with highest zinc content below water to the extent possible to minimize weathering
- minimizing the footprint of the on-land waste rock facilities
- directing most contact water towards the TSF where treatment could be conducted if required
- accelerated flooding of the open pit on closure

The use of the characterization data to predict of source term chemistries (item 2 above) however appears somewhat weak with significant uncertainties (discussed in more detail in the following section), with the resulting implication that the residual effects related to water quality may be under predicted.

It is acknowledged that these types of predictions always include uncertainties which should be addressed in the discussion and by means of sensitivity analyses, both of which are limited or missing. As such, the level of confidence in the source term predictions is low.

When confidence in predictions is low, there tends to be a larger reliance and onus on water management systems and potentially treatment plans. The water management plan was not reviewed in detail by pHase, but in concept involves routing of most contact water to the TSF where it can be stored and if needed treated.

It is noted that the proposed project does not include active water treatment. While the tendency and ideal is to have a mining project that does not require long term active water treatment, it should be recognized that active treatment technology is a proven method to minimize downstream effects and may be required at the Blackwater project despite integration of all the best management practices for waste management. It is our expectation that there is a high likelihood that active water treatment of some form and at some stage of the project is a likely probability.

Given that the TSF is in part being designed to act as the main water storage and management structure for the project, and the inherent uncertainties in water balance predictions and water quality predictions, it appears there is a risk that the project could find itself at a point at which it would need to discharge water (water balance uncertainties) and at that point in time would need to have water quality that was of appropriate quality to discharge or be able to treat water prior to discharge.

Technical Report

Below are specific comments or questions related to review of specific geochemical characterization work. Review is still on-going as such this should be deemed a review-in-progress and incomplete.

Appendix 5.1.3.1A: Geochemical Characterization Report

General comment

The Geochemical Characterization Report is unsigned.

Geology

Section 1.3.3 provides a summary of the geological features relevant to the ML/ARD characterization. These include:

- *The main rock types are felsic to intermediate volcanic and volcaniclastic rocks;*
- *The deposit host rocks have been intensely hydrofractured and silicified. This intensive silicification has generally overprinted lithological units;*
- *Pyrite, pyrrhotite, and sphalerite are the most common metal sulphide minerals.*
- *Calcite is a diagnostic feature of unmineralized andesite peripheral to the deposit.*

Further, sulphide mineralogy was described in details as follows:

> *All rocks have trace pyrite-pyrrhotite-sphalerite and gold-bearing polymetallic sulphide mineralization. Disseminated mineralization associated with pyrite-sphalerite-marcasite-pyrrhotite +/- chalcopyrite +/- galena +/- arsenopyrite (+/- stibnite +/- tetrahedrite +/- bismuthate). Mineralization types include:*

- *Disseminated – as pinhead to coarse blebby sulphide grains and aggregates typically ranging from 1% to 5% total volume of the rock, but locally exceeding this volume. Disseminations may be uniform or irregular, with sulphides displaying an anhedral to euhedral crystal form. Disseminations of a dark-grey, very fine grained sulphide material called "dendritic-black-sulphide" (DBS) is common at Blackwater and may form as fine disseminations to coarse clusters, as thicker coatings to fractures, or as an irregular network of "dendritic" micro-cracks within the rock mass.*
- *Porosity infill – sulphides that fill, rim, or replace devitrified pyroclasts, tephra, and juvenile pumiceous material. Sulphides also commonly form parallel to compositional layering and*

laminations within felsic pyroclastic flows and laminated tuff units. Mineralized amygdules and altered feldspars are also observed in the andesite flow units.

- *Vein – polymetallic, anhedral to euhedral sulphide assemblages in sub-millimetre to centimetre-scale polymetallic veinlets-veins of quartz-sericite-chlorite-clay (illite) ± (iron) carbonate ± tourmaline ± vivianite.*
- *Hydrothermal brecciation and related silicification – centimetre- to metre-scale zones of hydrothermal brecciation, alteration, and elevated sulphide content. These breccia zones are typically healed with silica-sericite-sulphide cement and cut by a micro-stockwork of vitric quartz ± sulphide veinlets.*
- *Structure-related – sulphides crushed to comminuted in brittle fault breccia and gouge.*

Of the above descriptions, it might be said that sulphides are disseminated and fracture/vein controlled and that with the exception of the andesite, the rock has negligible calcite. Understanding the mineral distribution is important to assessing sampling methodologies and representivity.

<u>Sampling</u>

Sampling for waste rock and ore characterization was conducted to obtain 10 metre composites based on lithology, oxidation facies and exploration assays of S, Ca and Zn. Compositing was done in a few different ways, but all samples represented 10 m intervals of core. This type of sampling has pros and cons. The main intent appears to have been to obtain a sample that represented an approximate bench height. One issue that can occur with compositing over larger intervals is that you get a 'blended' sample that may or may not represent behavior of rock at a more localized or discrete interval length.

Take for example the illustration below which shows very different possible sulphur distributions of 1 metre length intervals within a 10 metre length. The top two scenarios show the same PAG classification within a 10 m length though the first is 9 m of non-PAG rock and 1 m of strongly sulphidic PAG rock which could represent dendritic black sulphide or brecciated zones described. The second scenario is 10 m of consistent PAG rock that might be typical of the more disseminated sulphide distribution.

	Scenario 1			Scenario 2		
meterage	sulphide content (%)	NP/AP assuming an NP = 20 kg CaCO3/t	Classification	sulphide content (%)	NP/AP assuming an NP = 20 kg CaCO3/t	Classification
1	10	0.06	PAG	1	0.6	PAG
2	0.1	6.4	non-PAG	1	0.6	PAG
3	0.1	6.4	non-PAG	1	0.6	PAG
4	0.1	6.4	non-PAG	1	0.6	PAG
5	0.1	6.4	non-PAG	1	0.6	PAG
6	0.1	6.4	non-PAG	1	0.6	PAG
7	0.1	6.4	non-PAG	1	0.6	PAG
8	0.1	6.4	non-PAG	1	0.6	PAG
9	0.1	6.4	non-PAG	1	0.6	PAG
10	0.1	6.4	non-PAG	1	0.6	PAG
10 m average	1.1	0.6	PAG	1.0	0.6	PAG

Similarly, the bottom two scenarios show two different distributions that both classify on a 10 m basis as non-PAG rock. The first (scenario 3) is half PAG and half non-PAG while the second is consistently non-PAG. The potential risk of localized acidity in these two scenarios is significantly different. Because the neutralization potential is low, even in non-PAG rock, any acidity generated locally could have a larger influence, and it could plausibly be that the alkalinity that could be generated in the 5 m of non-PAG rock would be insufficient to neutralize the acidity that could be generated if 5 m of that zone became acidic.

	Scenario 3			Scenario 4		
meterage	sulphide content (%)	NP/AP assuming an NP = 20 kg CaCO3/t	Classification	sulphide content (%)	NP/AP assuming an NP = 20 kg CaCO3/t	Classification
1	0.1	6.4	non-PAG	0.3	2.1	non-PAG
2	0.1	6.4	non-PAG	0.3	2.1	non-PAG
3	0.35	1.8	PAG	0.3	2.1	non-PAG
4	0.5	1.3	PAG	0.3	2.1	non-PAG
5	1	0.6	PAG	0.3	2.1	non-PAG
6	0.5	1.3	PAG	0.3	2.1	non-PAG
7	0.34	1.9	PAG	0.3	2.1	non-PAG
8	0.1	6.4	non-PAG	0.3	2.1	non-PAG
9	0.1	6.4	non-PAG	0.3	2.1	non-PAG
10	0.1	6.4	non-PAG	0.3	2.1	non-PAG
10 m average	0.3	2.0	non-PAG	0.3	2.1	non-PAG

How each of these 10 m blocks is sampled, classified, mined, hauled and deposited could have a different result on the behavior in the field. Therefore, understanding how sulphur is distributed in intervals shorter than 10 m lengths would be valuable to understanding whether or not compositing has resulted in a dilution of PAG intervals within non-PAG blocks or if there are shorter, localized occurrences of PAG rock within predominantly non-PAG sections. Assessing the sulphur distribution in this manner would also assist in understanding some of the operational limitations or challenges that might occur in segregating PAG and non-PAG rock on the pit bench scale.

Where possible, the exploration database could be used to conduct such an assessment. It would also be expected that verification studies be undertaken early in operations to assess the efficacy of the segregation program.

Sampling for tailings materials was conducted in concert with metallurgical testwork. A number of tailings types were tested, though only the whole ore leach tailings are of relevancy to the proposed project as noted. Understanding of the variability of geochemical characteristics in tailings is always difficult because the samples are limited to the metallurgical testwork conducted. The main gap as identified is that oxide ore tailings that are currently planned to be processed at the end of mine life in order to form the final tailings beach have not yet been characterized and will need to be evaluated as early in operations as is practically possible.

Test Methods

The test methods utilized in the program were all those typically employed for characterization work and followed the standard protocols established in the industry. In addition to the standard test methods, NG conducted a number of tests that are not necessarily typical in order to gain a more detailed understanding of mineral forms etc.

Results

The results indicated that the overburden was non-PAG. Some samples however had Zn content above 1000 mg/kg which would classify as metal leaching (NAG 3) based on the classification criteria proposed as shown in Figure 3-2 of the appendix. There was a general increase in metals with depth, i.e. near bedrock but this was inconsistent. Metal leaching was said to be low based on NAG leachate and SFE tests.

It is unclear whether the proponent plans to segregate overburden so as not to use NAG 3 equivalent overburden in construction. It is also unclear whether there was a source term for overburden integrated into the water quality modeling. It appears they used monitoring data from station WQ10 as a proxy to overburden contact water which may not be appropriate (discussed further in the source term section)

Waste rock fell within the management classification basis as below.

• *PAG 1: Waste rock with an NPR <1;*
• *PAG 2: Waste rock with NPR values between 1 and 2;*
• *NAG 3: Waste rock with NPR values greater than 2 and zinc concentrations greater than or equal to1,000 mg/kg;*
• *NAG 4: Waste rock with NPR values greater than 2 and zinc concentrations between 600 to 1,000 mg/kg; and*
• *NAG 5: Waste rock with NPR values greater than 2 and zinc concentrations less than 600 mg/kg.*

This classification basis appears appropriate and supported by the testwork.

Sulphur distribution and neutralization potential are summarized in box and whisker plots copied below. Sulphur is generally present as sulphides and is typically <1%. Neutralization potential however is also quite low indicating that even in those samples that are non-PAG there is not likely to be any significant excess acid consumption potential within the non-PAG blocks. This implies that any localized acid generation from pockets of higher sulphide even within the non-PAG zones could result in elevated metal leaching.

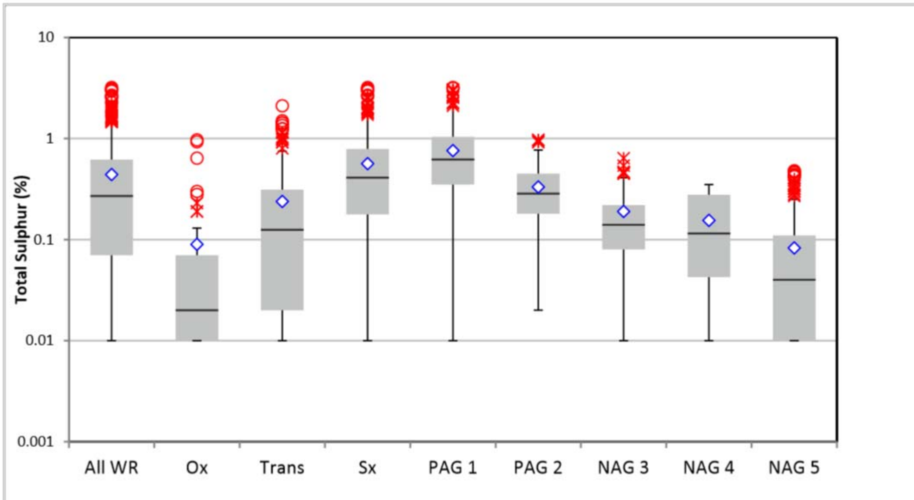

Figure 3-7: ***Box and Whisker Plot of Waste Rock Total Sulphur Concentrations***

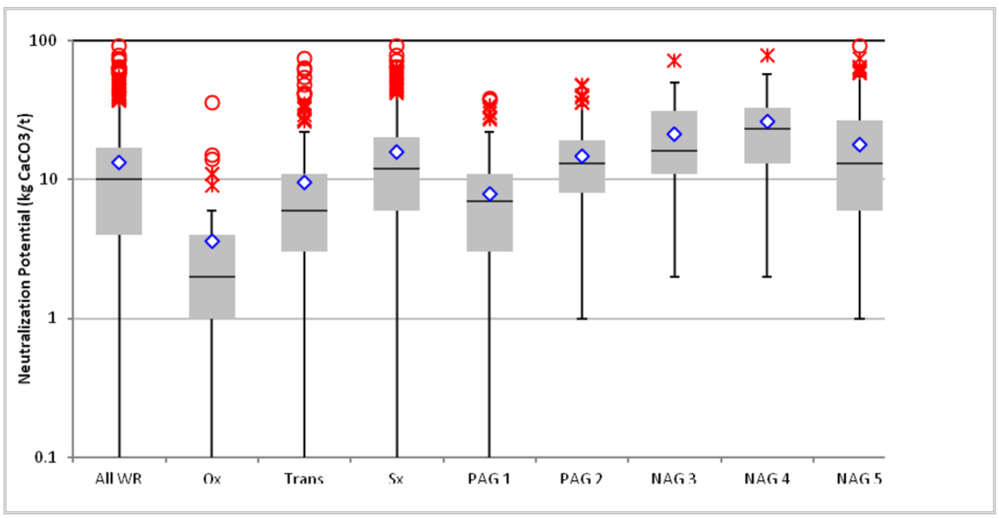

Figure 3-14: ***Box and Whisker Plot of Modified Sobek Neutralization Potential – Waste Rock***

Different potential adjustments of these two main parameters (NP and AP) were evaluated with generally good agreement with respect to classification, except perhaps close to the NP/AP value of 2 which was used to differentiate PAG and NAG.

Table 3-21: Neutralization Potential Ratio Distributions Using Different Sources of Neutralization Potential and Acid Potential

	PAG 1 (%)	PAG 2 (%)	NAG 3 (%)	NAG 4 (%)	NAG 5 (%)
NP/ZnS Adjusted AP	40	14	10	4	33
ICP Ca NP/MPA	45	10	9	3	33

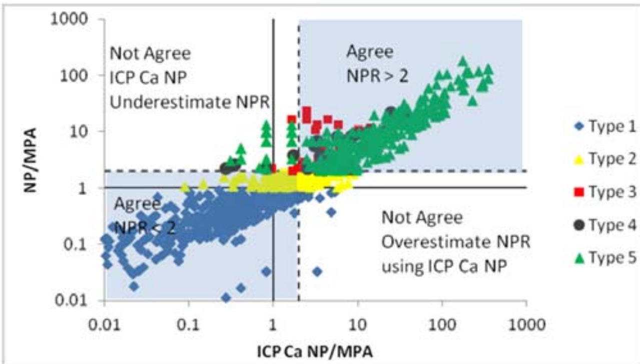

Figure 3-23: Comparison of NPR calculated using Modified Sobek NP and ICP Ca NP

The kinetic NAG test, used more consistently in Australia than in North America was used in part to evaluate a site specific NP/AP and lag times. Results were used to suggest an NP/AP as low as 1.3 might be appropriate. It should be noted however that this conclusion was based on 4 samples and would require significant verification work before being adopted as a project specific criteria. The lag times suggested were on the order of 2 to 5 years, however it should be cautioned that this too was based on 5 samples and was provided as a qualitative assessment based on professional judgement and not a quantitative or calculated value.

The humidity cell sample set was plotted on a cumulative frequency plot of NPR values reproduced below

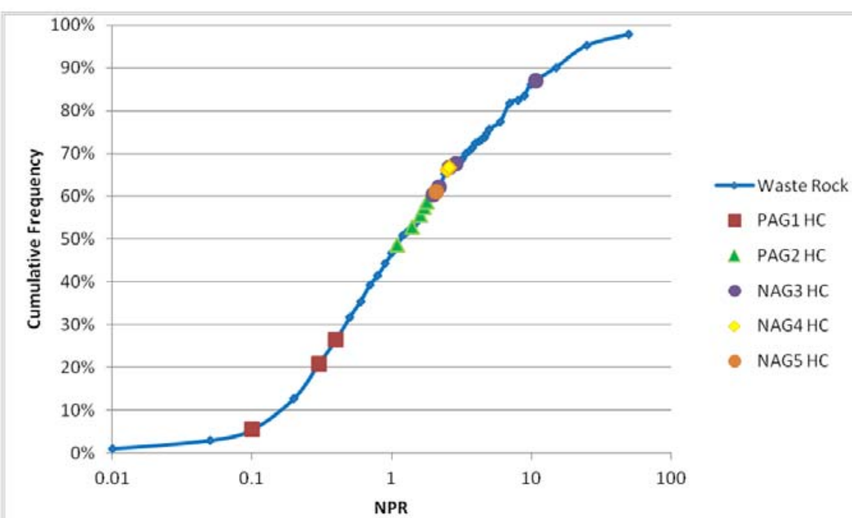

Figure 3-31: Waste Rock Cumulative Frequency Plot and Humidity Cell NPR Values

Table 3-29: Waste Rock Humidity Cell Samples

ARD Class	ARD Sample No.	Description	Test Duration (weeks)	Facies	NP (kg CaCO3/t)	TS (%)	NPR	Zn (ppm)	Cd (ppm)
PAG 1	BW-ARD2-9	PAG, high S, low NP	107	T	9	2.1	0.1	3,000	23.8
PAG 1	BW-ARD-037	PAG, average S, low NP, high Zn	70	S	6	0.5	0.3	4,690	23.5
PAG 1	BW-ARD-509	PAG, low metals	68	S	3	0.2	0.4	178	0.78
PAG 2	BW-ARD-566	PAG, elevated metals	36	O	9	0.7	1.1	1,050	7.74
PAG 2	BW-ARD-537	PAG, median metals	66	S	12	0.4	1.1	285	2.05
PAG 2	BW-ARD-499	PAG, median Zn	62	O	4	0.07	1.4	855	5.55
PAG 2	BW-ARD-510	PAG, median metals	46	S	19	0.4	1.6	405	0.71
PAG 2	BW-ARD-176	PAG, moderate Zn	105	S	24	0.4	1.7	2,160	18.2
PAG 2	BW-ARD-288	PAG, high Zn	91	S	18	0.3	1.8	4,140	24.5
NAG 3	BW-ARD-526	NAG, Silicate NP, elevated metals	66	S	5	0.3	2	1,280	22.4
NAG 3	BW-ARD-606	NAG, moderate Zn	12	S	13	0.2	2.2	1,580	6.5
NAG 3	BW-ARD-648	NAG, moderate Zn	43	S	37	0.4	2.6	1,180	7.7
NAG 3	BW-ARD-473	NAG, high Zn	30	T	27	0.08	10.8	3,790	1.9
NAG 3	BW-ARD-692	NAG, moderate Zn	43	S	43	0.5	2.9	1,840	21
NAG 3	BW-ARD-153	NAG, moderate Zn	21	S	13	0.1	3.9	1,750	10.9
NAG 3	BW-ARD-238	NAG, moderate Zn	21	T	15	0.1	3.9	1,400	7.7
NAG 4	BW-ARD-338	NAG, low Zn	43	S	27	0.4	2.5	707	6.3
NAG 4	BW-ARD-468	NAG, low Zn	30	S	13	0.2	2.6	622	3.4
NAG 5	BW-ARD-610	NAG, very Low Zn	43	S	8	0.1	2.1	378	1.3

Note: NPR = NP/MPA, NP is modified Sobek NP.

Of note is that within the humidity cell sample set, there is only one NAG 5 sample and two NAG 4 samples. These samples are meant to represent all of the on-land waste rock and construction rock. There is no overburden sample included in the dataset. This introduces some uncertainty into the source term predictions based on this component of work (discussed more below).

Testing shows that PAG samples can become acidic quickly. The proponent has acknowledged this within the context of the waste management plan with the objective to submerge all PAG rock within the first year of being excavated in order to minimize oxidation. This appears to be an appropriate approach though there remains a risk that some acidity and soluble metal loads could be generated within at last portions of the PAG rock prior to submergence.

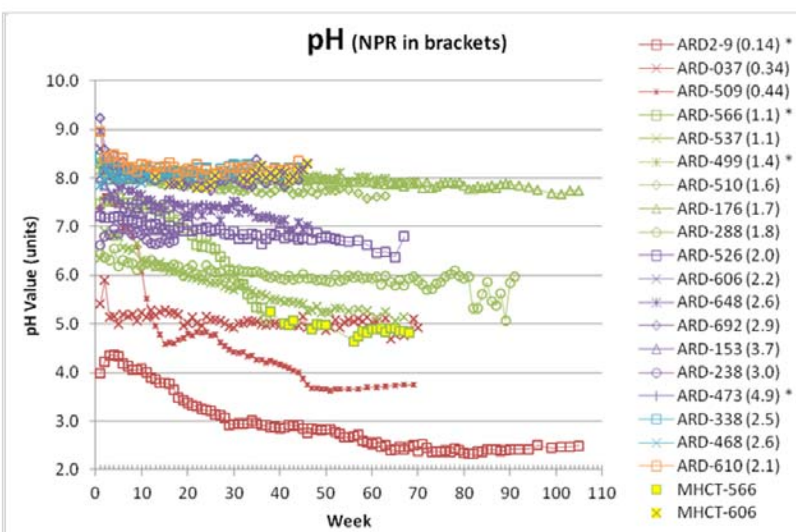

Figure 3-34: Waste Rock Humidity Cell pH values

Because the second criteria to minimize metal leaching is based on solids zinc content, the proponent compared solids Zn to pH and Zn released in humidity cells in Figure 4-3. Provided the pH can be maintained above 7, the criteria of 1000 mg/kg appears to be protective with respect to Zn leaching. However, if there are pockets of higher sulphide within the NAG 4 or NAG 5 blocks, elevated Zn leaching can occur with slight pH depression in samples with Zn content less than 1000 mg/kg in the solids.

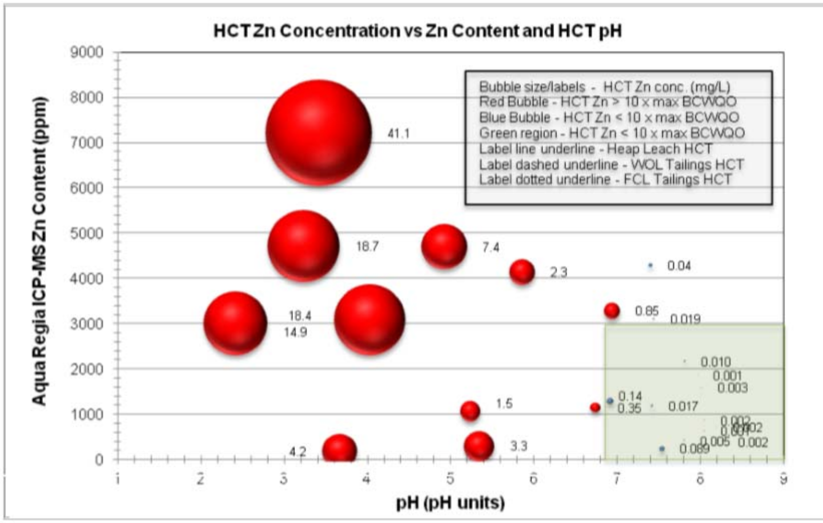

Figure 4-3: ***Humidity Cell Test Zn Concentration vs. Zn Content and Humidity Cell Test pH***

The humidity cell results for the NAG 5 sample generally showed low metal release rates with the exception perhaps of arsenic that was relatively high in the NAG 5 sample compared to others (see Figure 3-43 copied below, samples ARD-610).

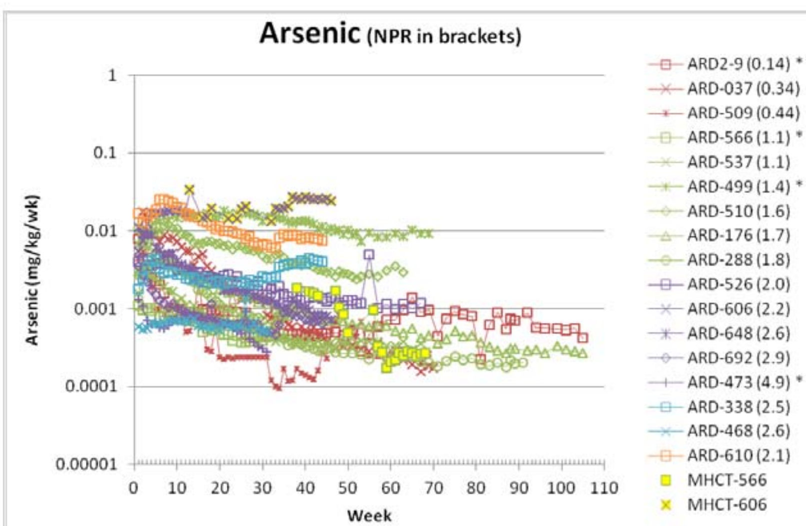

Figure 3-43: ***Waste Rock Humidity Cell Arsenic Loads***

The proponent has initiated small field bins as another component of the kinetic test which, while at early stages of testing, will provide valuable information as time goes on. It was not clear how concentrations were converted to loads in the field bins. Often the flow component is difficult to measure and quantify in the field and can be a source of uncertainty in field bin load estimates. Can NG provide details on that calculation?

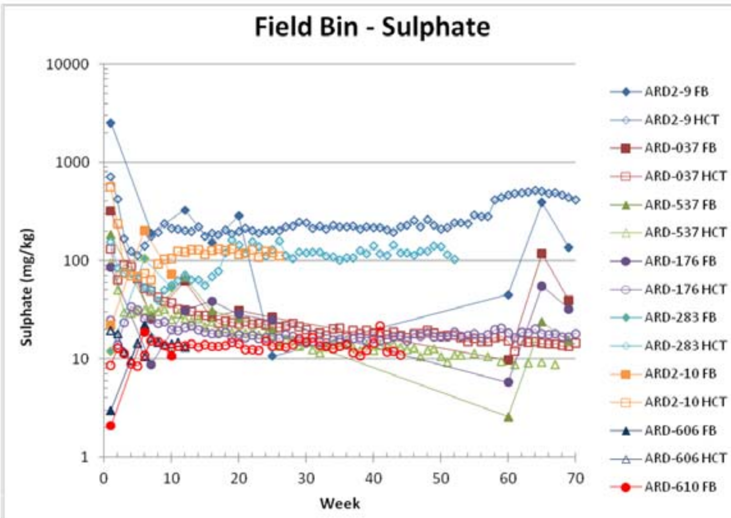

Figure 3-57: ***Waste Rock Kinetic Field Bin Sulphate Loads***

Further on the topic of lag times, the Kinetic NAG test indicated samples with NP/AP values above 1.3 may not be acidic however the depletion rates based on humidity cells (Table 3-36) indicates that some samples with NP/AP using the carbonate NP above 2 in some cases might be acidic. This illustrates the need to be conservative with this ratio.

Table 3-36: ***Theoretical Waste Rock Depletion and Lag Times Based on Laboratory Humidity Cell Tests***

ID	ARD Class	NPR	NP (kg $CaCO_3$/t)	CNP (%)	Sx (%)	Sx Deplete (yrs)	NP Deplete (yrs)	CNP deplete (yrs)	Lag Time - NP (yrs)	Lag Time - CNP (yrs)
ARD-037	**PAG 1**	**0.3**	**6**	**4**	**0.55**	**11.5**	**234**	**44**	**0 wk**	**0 wk**
ARD-2-9	**PAG 1**	**0.1**	**9**	**15**	**1.97**	**3.6**	**4**	**7**	**0 wk**	**0 wk**
ARD-509	**PAG 1**	**0.4**	**3**	**4**	**0.19**	**4.2**	**10**	**7**	**10 wk**	**10 wk**
ARD-176	PAG 2	1.7	24	11	0.44	7.2	19	7	not AG	7 years
ARD-288	PAG 2	1.8	18	6	0.32	9.5	174	56	27 wk	27 wk
ARD-499	PAG 2	1.4	4	4	0.05	1.3	3	1	not AG	1 year
ARD-510	PAG 2	1.6	19	7	0.37	16.2	13	7	13 years	7 years
ARD-537	PAG 2	1.1	12	8	0.33	21	109	74	20 wk	20 wk
ARD-566	PAG 2	1.1	9	7	0.69	14.3	3	6	30 wk	30 wk
ARD-526	NAG 3	2	5	4	0.06	15.9	27	11	not AG	11 years
ARD-606	NAG 3	2.2	13	4	0.19	4.9	10	3	not AG	3 years
ARD-648	NAG 3	2.6	37	25	0.45	38.6	123	83	not AG	not AG
ARD-692	NAG 3	2.9	43	29	0.47	139.2	114	77	114 years	77years
ARD-153	NAG 3	2.3	15	5	0.1	6.5	60	23	not AG	not AG
ARD-238	NAG 3	3.3	13	4.2	0.1	5.3	64	25	not AG	not AG
ARD-338	NAG 4	2.5	27	19	0.32	89.2	292	234	not AG	not AG
ARD-468	NAG 4	2.6	13	22	0.34	21.3	29	20	not AG	not AG
ARD-473	NAG 3	4.9	54	43	0.14	5.4	11	19	not AG	not AG
ARD-610	NAG 5	2.1	8	6	0.11	4	7	5	not AG	Not AG

Note: Highlighted cells indicate acidic pH leachate in at least final week of test (pH < 6)
Highlighted **bold** cells indicate acid pH leachate less than 5 in at least 1 week of testing

Oxygen consumption testing on one sample was provided. The oxidation rate provided was not compared to rates as calculated from humidity cell testing. Where the values comparable? Did the proponent use that rate in water quality prediction calculations? The test indicated that the sample was slowly reactive which is not the case for some of the kinetic samples that went acidic fairly quickly. NG appears to have taken the position that acidic conditions could occur quickly and therefore have proposed placement of PAG rock underwater within a year of excavation. This management approach appears to be appropriate.

Humidity cell testing on tailings

Only the Whole Ore Leach Tailings are representative. Table 3-56 provides Average leaching rates calculated from the last 10 weeks of testing. Figures 3-88, 3-91 and 3-93 for example plot data as time trends. It is clear that the release rates were changing relatively during that time period and average values may not be appropriate. Therefore if average release rates from this testing were used in predictions, they could significantly under predict loading from the exposed tailings.

Table 3-56: Average Metallurgical Tailings Humidity Cell Leaching Rates

	Average Loading Rate (mg/kg/wk)				
Parameter	**Whole Ore Leach Tailings (P_{80}-150 µm)**	**Heap Leach Tailings (P_{80} – 6.3 mm)**	**Sulphide Ore Float Tailings**	**Transition Ore Float Tailings**	**Rougher Flotation Tailings**
Sulphate	46.3	80.6	30.0	13.2	20.2
Acidity	8.3	34.4	0.51	0.17	1.19
Alkalinity	1.9	2.1	6.0	6.2	2.4
Aluminum	0.02	1.23	0.02	0.02	0.02
Antimony	0.001	0.003	0.005	0.004	0.002
Arsenic	0.002	0.004	0.006	0.013	0.002
Bismuth	0.04	0.05	0.05	0.05	0.05
Boron	0.04	0.05	0.05	0.05	0.05
Cadmium	0.01	0.07	0.002	0.0005	0.002
Calcium	10.7	15.1	14.0	6.4	6.7
Chromium	0.002	0.002	0.002	0.002	0.002
Cobalt	0.01	0.02	0.005	0.005	0.005
Copper	0.02	0.08	0.03	0.02	0.02
Iron	0.06	1.17	0.05	0.01	0.01
Lead	0.01	0.10	0.00	0.00	0.00
Lithium	0.04	0.05	0.05	0.05	0.05
Magnesium	0.48	1.26	0.90	0.58	0.42
Manganese	1.8	6.3	0.21	0.01	0.44
Mercury	0.00005	0.00006	0.00008	0.00008	0.00005
Molybdenum	0.004	0.005	0.005	0.005	0.005
Nickel	0.01	0.02	0.005	0.005	0.005
Phosphorus	0.22	0.24	0.23	0.24	0.23
Selenium	0.002	0.002	0.004	0.004	0.002
Sulphur	14.8	36.1	13.9	5.7	6.6
Thallium	0.0005	0.0005	0.0007	0.0005	0.0005
Tin	0.04	0.05	0.05	0.05	0.05
Titanium	0.04	0.05	0.05	0.05	0.05
Vanadium	0.004	0.005	0.005	0.005	0.005
Zinc	2.9	9.2	0.21	0.01	0.15

e.g. the last few SO4 values were ~ 100 mg/kg/wk and Zn above 10 mg/kg/wk, 2 to 4 times what the tabulated averages above are

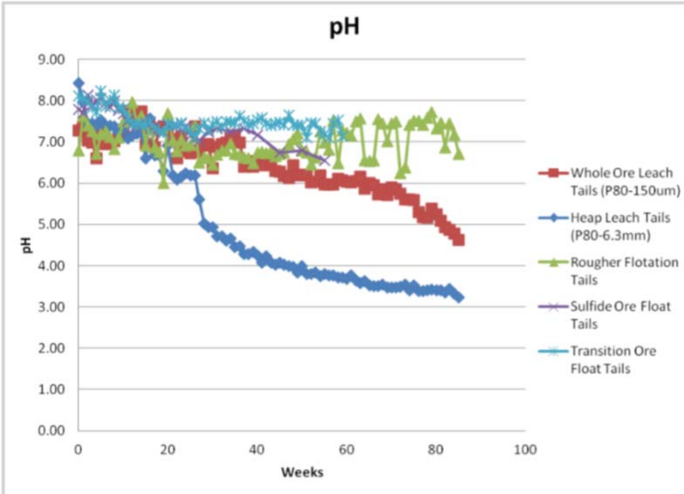

Figure 3-88: Metallurgical Tailings Humidity Cell pH

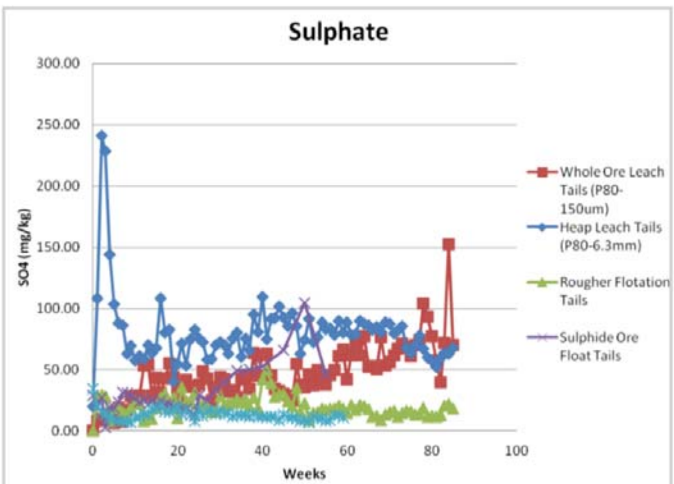

Figure 3-91: Metallurgical Tailings Humidity Cell Sulphate Loads

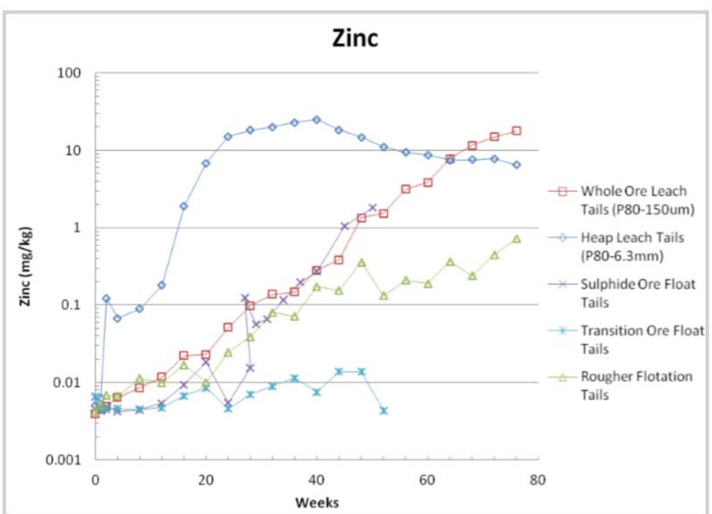

Figure 3-93: Metallurgical Tailings Humidity Cell Zinc Loads

Subaqueous column testing

Average subaqueous waste rock column leaching rates provided in Table 3-32 do not seem to match the corresponding figures. For example, Figure 3-47 shows SO4 mg/kg/wk rates for sample Column ARD-672 on the order of 500 mg/kg/wk and for Column ARD-611 on the order of 100 mg/kg/wk near the end of testing. Table 3-32 provides average values of 5.6 and 0.67 respectively. The proponent should ensure that the proper units are shown on both and make corrections where appropriate. If these rates were used in source term predictions it should be verified that the correct values/units were used in those calculations.

Tailings supernatant aging tests:

This testwork is appropriate to look at the degregation of the CN complexes and related breakdown products, there remains some uncertainty and question about how the information was used in source terms (more below).

Table 3-58: Tailings Supernatant Ageing Test Results

Parameter	Unit	CND 8 Comp Short Term Day 0	CND 8 Comp Short Term Day 1	CND 8 Comp Short Term Day 7	CND 8 Comp Short Term Day 14	CND 8 Comp Short Term Day 30
pH	units	8.93	7.93	7.51	7.64	8.13
Hardness	mg/L as $CaCO_3$	436	422	432	502	510
Acidity	mg/L as $CaCO_3$	< 2	< 2	< 2	< 2	< 2
Alkalinity	mg/L as $CaCO_3$	67	59	67	78	99
Conductivity	µS/cm	2700	2820	2830	2760	3050
TDS	mg/L	2050	2050	2240	2260	2340
F	mg/L	0.30	0.30	0.31	0.33	0.34
NH_3+NH_4	as N mg/L	3.7	3.4	4.7	2	14.4
TKN	as N mg/L	50.9	64.0	75.1	54.5	82.7
Tot Reactive P	mg/L	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
SO_4	mg/L	1000	1000	1000	1100	1200
CN(T)	mg/L	1.94	1.57	0.48	< 0.1	0.02
CN_{WAD}	mg/L	0.13	< 0.01	0.34	< 0.1	0.01
CNO	mg/L	150	160	150	150	150
CNS	mg/L	93	96	99	100	110
Dissolved Metals						
Ag	mg/L	< 0.0001	< 0.0001	0.0002	0.0005	0.0019
Al	mg/L	0.19	0.15	0.12	0.06	< 0.01
As	mg/L	0.010	0.006	0.008	0.006	< 0.002
Ba	mg/L	0.0302	0.0288	0.0336	0.0443	0.0469
Be	mg/L	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002
B	mg/L	0.020	0.019	0.040	0.024	0.025
Bi	mg/L	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001
Ca	mg/L	171	166	169	197	199
Cd	mg/L	< 0.00003	< 0.00003	0.00016	0.00139	0.00326
Co	mg/L	0.0641	0.0628	0.0671	0.0682	0.0581
Cr	mg/L	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
Cu	mg/L	0.153	0.135	0.165	0.097	0.046
Fe	mg/L	0.898	0.542	0.036	102	0.046
K	mg/L	131	130	150	110	118
Li	mg/L	0.007	0.007	0.010	0.01	0.015
Mg	mg/L	2.04	1.98	2.20	2.26	3.06
Mn	mg/L	0.0234	0.0205	0.0472	0.107	0.233
Hg	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001	< 0.0001
Mo	mg/L	0.170	0.165	0.172	0.19	0.192
Na	mg/L	436	426	379	450	496
Ni	mg/L	0.175	0.171	0.148	0.069	0.017
P	mg/L	0.019	0.011	0.009	0.026	0.029
Pb	mg/L	< 0.0002	< 0.0002	< 0.0002	< 0.0002	0.0026
S	mg/L	482	---	---	---	---
Sb	mg/L	0.0749	0.075	0.078	0.08800	0.074
Se	mg/L	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Si	mg/L	1.34	1.26	1.36	1.65	1.86
Sn	mg/L	0.0156	0.0323	0.0151	0.0587	0.0709
Sr	mg/L	0.440	0.435	0.462	0.546	0.547
Ti	mg/L	< 0.001	< 0.001	0.003	0.002	0.002
Tl	mg/L	< 0.0002	< 0.0002	< 0.002	< 0.002	< 0.002
U	mg/L	0.00415	0.00265	0.00325	0.00331	0.00418
V	mg/L	< 0.0003	< 0.0003	0.0004	< 0.0003	< 0.0003
Zn	mg/L	0.009	0.002	0.010	0.037	0.139

<u>Block Model</u>

The approach to block modeling was described. In summary, the block model was constructed of blocks representing 12 x 12 x 12 m blocks. Parameters modeled included sulphur (AP), ICP-Ca based NP and NPR calculated for each block on those parameters. Zinc was also modeled. Results by proportion were provided in Figures 5-1 and 5-2 and cross-sections provided in Figures 5-3 and 5-4. pHase can't comment on the specifics of how the block modeling work was completed and how blocks without data were populated, but it appears to be a typical approach to what we've seen conducted on other projects.

The block model looks promising with respect to the clustering of NAG 4 and NAG 5 blocks near the outer edges of the pit. This appears to correlate well with the andesite. Did the proponent look at whether the ICP-Ca proxy to calculate NP for andesite differs from the other rock types? It is noted that andesite has higher Ca-bearing feldspars (plagioclase), does that mineralogy influence the assumed NP values? It is presumed that there will be an early stage verification program to ensure these blocks are indeed NAG rock.

> *In general, the location and largely contiguous nature of NAG 4 and NAG 5 blocks and tendency to associate with andesite lithology indicates that segregation should be relatively straightforward during mining. Singleton NAG 4 and NAG 5 blocks should be handled as PAG and confirmatory testing of NAG 4 and NAG 5 blocks near boundaries with PAG 1, PAG 2 and NAG 3 blocks should be conducted. Confirmatory testing should involve ABA analyses with the NAG test substituted if a good correlation is established.*

The above appears appropriate.

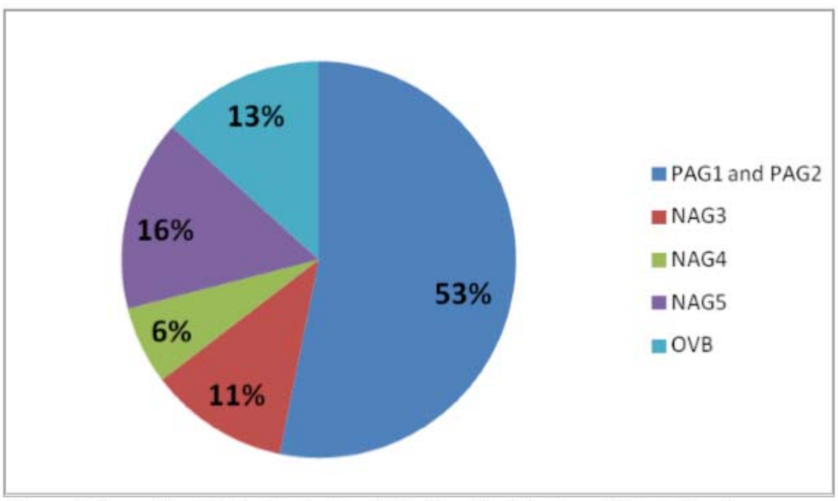

Figure 5-1: Feasibility Study Block Model – Distribution of Waste Rock and Overburden

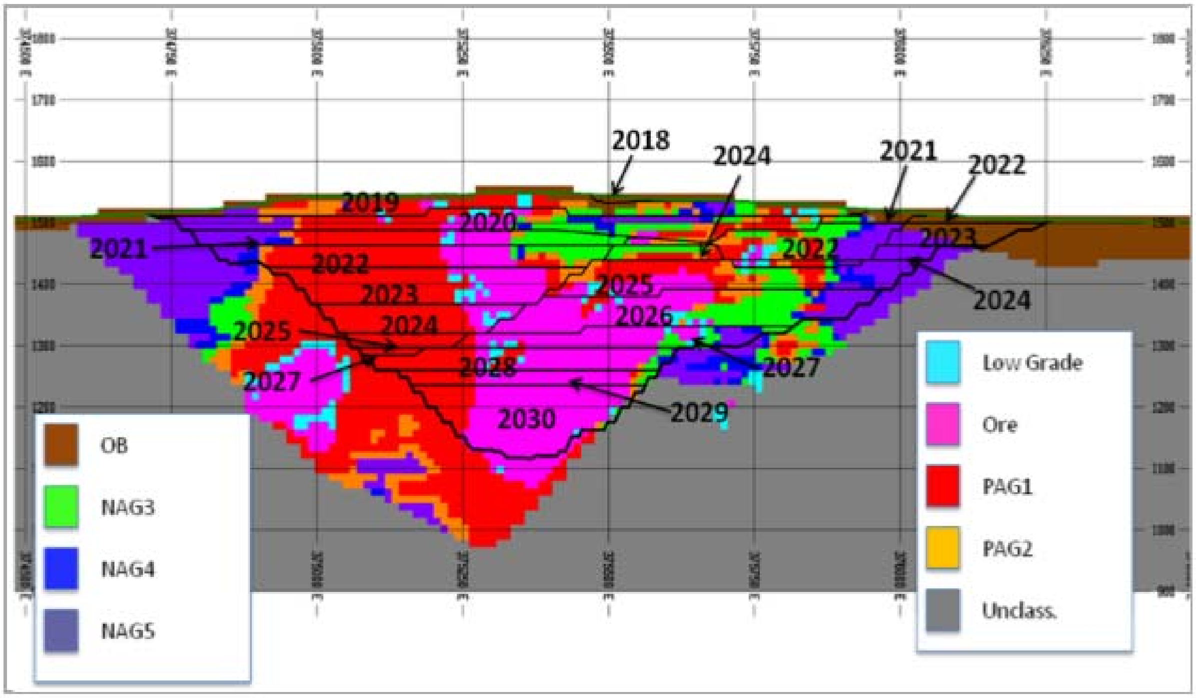

Figure 5-3: Block Model – Cross Section 5893300N

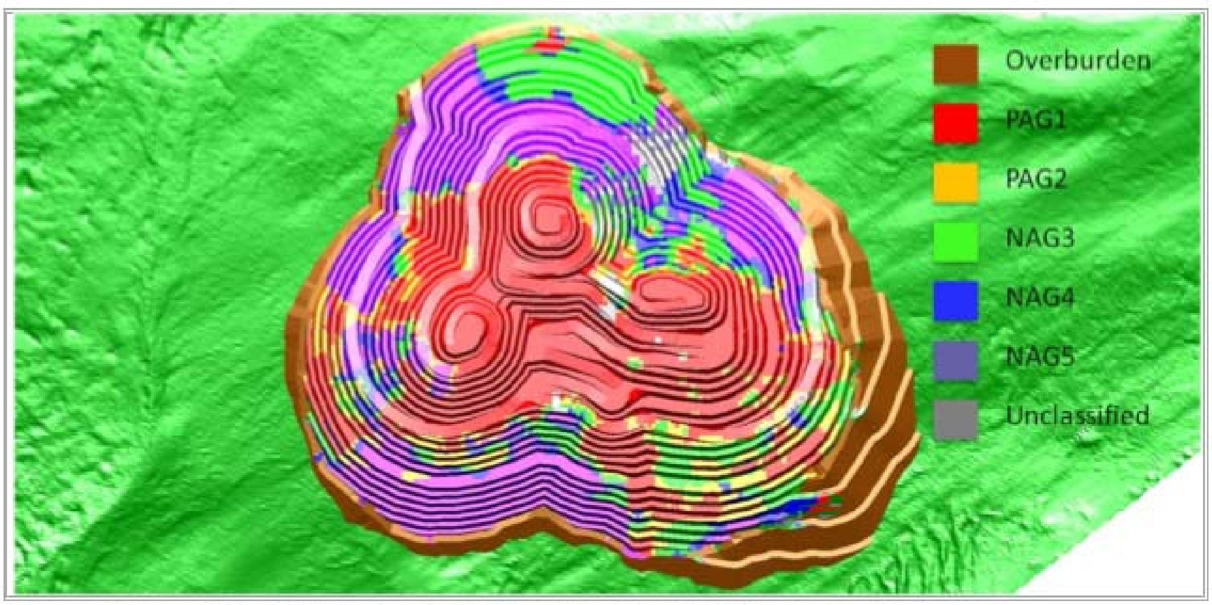

Figure 5-4: Block Model – ARD Classification of Ultimate Pit Walls

Zones that are largely purple – NAG 5 andesite are probably easily segregated, but blocks of NAG 4 so close to the NAG 3 and PAG blocks may be more difficult to separate.

Source Term Predictions

There are a few questions and concerns related to the source term predictions that require additional review. Initial impression is:

- Scaling lab data to field data was done in part on the basis of reactive surface areas. It is not explained exactly how this was done and what were the assumptions. The assumed reactive surface area for rock appears low which would result in low predicted source term concentrations. The proponent should describe in detail how that scaling was completed and what assumptions were included in the assumed rock surface area as it has a significant influence on the predicted source terms.
- It appears the predicted interstitial pore water in the submerged rock was low. It is unclear how this was integrated into the larger water quality model. A few parameters had higher release rates in the sub-aqueous columns than in the humidity cells for similar samples. Of particular note was the release of arsenic in the subaqueous rock. Was this accounted for?

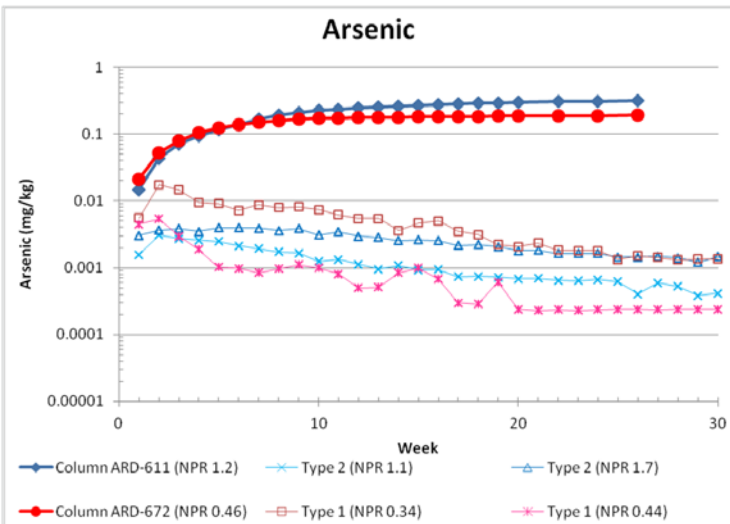

Figure 3-53: Subaqueous Waste Rock Leachate Column Arsenic Loads

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- It is unclear whether or not the results of the sub-aqueous column testwork on waste rock was used in the overall water quality model as an additional loading to the TSF waters
- It is unclear whether or not the tailings beach was assumed and calculated to contribute a load to the TSF system
- It appears there was no accounting for accumulations of loads via recirculating of water from the TSF to the processing plant. It would be expected that mass would accumulate over time resulting in gradually increasing concentrations within the supernatant, pond and pore waters of tailings as time progresses
- Water quality from monitoring a. t WQ10 was used as a proxy for leaching from overburden because there was no kinetic work on overburden. Concentrations from SFEs on overburden however were higher than monitoring at WQ10. The appropriateness of WQ10 data therefore is uncertain. Further, that data highly influences the source term predictions. The median SFE

concentration for SO4 for example is 5 to 6 times the value used from the WQ10 data and Zn is an order of magnitude higher in SFE data than in the water quality monitoring.

Evaluation of incomplete segregations in East Dump

NG did provide an evaluation of the potential influence of incomplete segregation in the East Dump. This involved assuming 1% PAG and 3.3% PAG within the NAG piles. It seems possible that the percentage of PAG that could end up in the NAG pile could be higher. There is not only potential errors of trucks loaded with PAG rock by mistake going to the NAG piles, but there is also uncertainty that a truck with predominantly NAG rock has portions of PAG rock within it, particularly near boundaries of the andesite and other rock units or near structure that could have higher sulphide content. The work conducted indicated that some parameters are more strongly affected than others – e.g. Zn increases approximately an order of magnitude with 1% of PAG rock. It would seem feasible that the proportion of PAG rock could be higher on an operational scale than just 3.3%. Sensitivity with higher proportions would provide value to the assessment of potential influence on the East Dump water quality.

Integration of source terms into site water quality model

This review is still underway.

Swanson Environmental Strategies

BRIEFING NOTE

Date: February 9, 2016

To: Keefer Ecological Services Ltd.

From: Stella Swanson, Swanson Environmental Strategies Ltd.

Subject: Ulkatcho First Nation – New Gold Blackwater Project Review – First Draft

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Working in conjunction with Keefer Ecological Services Ltd. and others, Swanson Environmental Strategies Ltd. (SES) is reviewing the environmental assessment (EA) documentation for New Gold's proposed Blackwater Project, as requested by Ulkatcho First Nation.

SES was retained to review the following sections:

- Section 5.3.1 Identification and Selection of Valued Components
- Section 5.3.2 Surface Water Flow
- Section 5.3.3 Surface Water Quality
- Section 5.3.4 Sediment Quality
- Section 5.3.7 Wetlands
- Section 5.3.8 Fish
- Section 9.2 Assessment of Potential Health Effects
- Section 10 Accidents or Malfunction

A summary of the recommended information requests is presented below. A detailed summary report of the comments is available upon request. These comments may be modified after discussion with other review team members and/or response from New Gold.

Summary of Recommendations

Below is a very high-level summary of the recommendations for the above reviewed sections. This summary was prepared by SES as an independent assessment. The material in this document reflects SES judgement in light of the information that was reviewed by SES at the time of document preparation. These recommendations may be modified after discussion with other review team members and/or response from New Gold.

1. **The methodology for the Cumulative Effects Assessment needs to be re-assessed**
    a. Insufficient evidence was presented to demonstrate that the methods were sound, reasonable and well-founded

b. Need further alignment with current Provincial cumulative effects assessment methodologies
c. Need to include assessment of historical conditions and human activities on the landscape to determine current condition
d. Need to consider potential coliform (e-coli) exposure from nearby ranching activities in the assessment
e. Scope of assessment did not extend to social and economic conditions (employment, income levels, education, and health and social support systems)

2. **The methodology for the selection of Valued Components needs to be re-assessed**
    a. The list of valued component provided is a mixture of indicators (things that are measured to determine the condition of a valued component) and valued components
3. **There needs to be a commitment from New Gold that they will coordinate and work with nearby industries (forestry, hydro, etc.) to ensure there are no negative effects to fish or other aspects of the project**
    a. Forestry service roads, mine access roads, and transmission lines can have an effect on fish by introducing new sources of sediment (earth) to nearby streams
    b. New Gold must develop an effective management plan, monitoring strategy, and mitigation strategy to ensure this does not happen
4. **Additional information is required to confirm that there is minimal risk in eating traditional/country foods**
    a. Need to reinforce the benefit of eating country foods and how that eating those foods does not pose a risk to humans
    b. Important to avoid over-estimating the potential health effects of eating country foods in the human health risk assessment
5. **Further discussions are required between New Gold and the communities on how New Gold can positively affect social and economic conditions**
    a. Need further discussion on how New Gold can positively affect conditions in nearby communities such as employment, income levels, education, health and social support systems, etc.
6. **New Gold needs to consider, and commit to providing as many opportunities for Ulkatcho involvement in the project as possible**
    a. Potential opportunities for Ulkatcho involvement include (but are not limited to):
        i. Monitoring and Mitigation
        ii. Engagement with nearby residents and seasonal users to determine whether there are significant noise effects
        iii. Providing input for the development and implementation (including training) of the Accidents and Malfunctions Management Plan
        iv. Detailed briefings and Q and A sessions regarding dam safety

v. Sharing results of monitoring and the feedback from monitoring into mine management
vi. Provide input and build capacity for developing emergency response plans (emergency services training)

7. **The boundaries proposed for the Risk Assessment are too small for some of the major accidents or malfunctions (e.g. tailings dam failure)**
    a. Projected likelihood of accidents or malfunctions need to take into account the changes in frequency and/or severity of storm events associated with climate change
    b. Projected likelihood of Major Fuel Releases during Transport or Transportation Accidents involving Hazardous Material is not supported by references to spill incidence literature
    c. New Gold must have a fully-developed response plan in place for potential fuel spills into water courses as well as transportation of hazardous materials

Terrestrial
Technical Working Group Review

Aspen Wildlife Research Inc.
2708 Cochrane Road NW • Calgary, Alberta • T2M 4H9 • Canada
Ph: (403) 270-8663 • Fx: (403) 283-9467
EMAIL: clayton.apps@telus.net

MEMORANDUM

DATE: February 9, 2016

TO: Michael Keefer, Keefer Ecological Services
CC: Ulkatcho First Nation

FROM: Clayton Apps, PhD, RPBio
Aspen Wildlife Research Inc.

SUBJECT: Ulkatcho FN – New Gold Blackwater Project Review
GRIZZLY BEAR AND FURBEARERS – OVERVIEW COMMENTS

Working in conjunction with Keefer Ecological Services Ltd. and others, Aspen Wildlife Research is reviewing the environmental assessment (EA) documentation for New Gold's proposed Blackwater Project, as requested by Ulkatcho First Nation.

From the perspective of Clayton Apps, Wildlife Ecologist, the following sections were reviewed:

- Section 5.1.3: Environmental Baseline (Terrestrial Environment)
- Section 5.4.1: Identification and selection of Valued Components
- Section 5.4.12: Grizzly Bear (Key section that cross-references others)
- Section 5.4.13: Furbearers (Key section that cross-references others)
- Section 5.5: Summary of Assessment of Environmental Effects
- Section 12: Summary of Proposed Environmental and Operational Management Plans (Wildlife Management Plan)
- Section 19: Summary of Residual Effects
- Section 20: Summary of Mitigation Measures
- Section 21: Conclusion
- Appendix 5.1.3.4A: Wildlife and Wildlife Habitat 2011-13 Baseline Report

A summary of the analysis of each section reviewed as well as a detailed breakdown of the comments on each reviewed section will be presented at a later date. For now, a "high level overview" summary is provided. These comments are anticipated to be modified after discussion with other review team members and/or response from New Gold.

Summary Report (overview comments – subject to change)

Grizzly bears, Wide-Ranging Carnivores and Cumulative Effects

With respect to grizzly bear and furbearer species, I have some concerns with the rationale and methodology that ostensibly supports conclusions of the environmental assessment (EA). For wide-ranging species such as grizzly bears and the mid-sized carnivores that comprise many of the furbearers (a.k.a., mesocarnivores), the relevant assessment area is that which encompasses the local population. Over this area, the Project should be considered in the context of existing and projected cumulative impacts to these species. Thus, the defined local study area (LSA) is of little relevance given that the home range of an individual animal will extend well beyond such an area. The defined regional study area (RSA) is also small for evaluating population-level impacts. Defining study areas according to buffers around project features does not account for the much larger landscape impact when bears with overlapping home ranges (e.g,, 300-500 km^2 for female grizzly bears) are potentially subject to increased mortality risk or displacement from a landscape. Similarly, considering that a population needs to be reasonably well connected to be viable, Project impacts can resonate over the much larger region if a localized landscape does not allow for successful movement and dispersal of individuals. Hence, I was happy to see that the EA delineated an area over which cumulative effects to grizzly bears are relevant, on the basis of the 3 grizzly bear population units (GBPUs) intersected by the Project.

Unfortunately, however, a cumulative effects assessment was not actually carried out at the scale of the 3 combined GBPUs. The quantitative aspect of the EA considered only the smaller LSA and RSA, and only habitat "removal" was considered. Based only on the amount of habitat loss, which becomes proportionately smaller as diluted over larger areas, the EA concludes that impacts are Not Significant (minor or negligible). But localized impacts that have little effect with respect to the loss of underlying habitat can still resonate over the larger population through mortality, displacement, and related fragmentation of the population. For example, if animals that are using or attracted to a local area are likely to die, a "mortality sink" can occur. Grizzly bears are also known to avoid entire landscapes due to human use levels. These effects can facture or reduce the connectivity of a regional population by preventing reproductive and/or dispersal movements. Thus, the abundance, stability and viability of a population can be impacted by localized development, with resilience to localized impacts dependent on the context of other such impacts in the larger region (i.e., "cumulative" impacts).

I found nothing in the EA that puts the Project in appropriate context of existing cumulative impacts to grizzly bears and other wide-ranging terrestrial species. The EA does refer to the fact that road density within the 3 GBPUs exceeds 0.6 km/km^2, which is a rough threshold of maximum human accessibility with which grizzly bears can persist. While road density is a crude proxy for human impacts, it does suggest that existing cumulative impacts in the area likely are excessive. Moreover, the EA acknowledges that one of the GBPUs is presently considered to be Threatened (i.e., population is thought to be less than half of what the area could likely support without human impacts). Therefore, understanding the potential of the Project to exacerbate existing cumulative impacts, and understanding options by which the Proponent may contribute to offsetting cumulative impacts within the region, is highly relevant. At this point, the Project's estimated contribution to cumulative effects and whether this is in fact likely to be minor is not known without valid assessment of population distribution, connectivity and the influence of existing habitat and human activities. In my opinion, the statements that "the Project is not expected to affect the viability of this species due to the widespread and common extent of grizzly bears and their habitat within the RSA" and that "cumulative effects are anticipated to be Not Significant (minor)" are not supported.

Furbearers Specifically

A major concern that I have with the furbearer section is the fact that only marten and beaver were considered. The reasoning provided is that these species are considered to be representative of other furbearers. However, marten and beaver most certainly do not represent the requirements for wide-ranging mesocarnivores such as lynx, wolverine and fisher. These species that have been historically important to aboriginal communities, at least from an economic (trapping) if not also a non-consumptive perspective. The rationale that marten is an important prey species to other carnivores is wrong. And the assumption that furbearers are not of concern because populations are managed by government is also misinformed. These species are easily subject to locally unsustainable mortality or displacement due to legal harvest, illegal killing, and competition with other generalist species as facilitated by human-caused habitat change.

Mitigation

For grizzly bears and wide-ranging furbearers, the focus on my review of Project mitigation measures is on what I consider to be the most relevant impacts to these species. Aside from direct habitat loss, these are as follows:

(1) how the project is increasing motorized access by people to habitats of these species across seasons,
(2) where and how the 500 - 1400 workers in camp during construction and operation are going to spend their recreational time in the surrounding area, and
(3) how attractants (primarily garbage) are going to be managed to minimize the potential for bear-human conflict, compromised human safety, and bear mortality.

Technical Report

Specific comments are forthcoming.

Keefer Ecological Services Ltd.
3816 Highland Road
Cranbrook, BC V1C 6X7

MEMORANDUM

DATE: February 4, 2016

TO: Michael Keefer, Keefer Ecological Services
CC: Ulkatcho First Nation

FROM: Randy Moody, Keefer Ecological Services Ltd.

SUBJECT: Ulkatcho FN – New Gold Blackwater Project Review
FIRST DRAFT

Keefer Ecological Services Ltd. and others, are reviewing the environmental assessment (EA) documentation for New Gold's proposed Blackwater Project, as requested by Ulkatcho First Nation.

From the perspective of Keefer Ecological Services Ltd., the following sections were reviewed:

2.2.1.1.5 Environmental Significance and Environmental Setting
2.6 Reclamation and Closure
5.1.3 Terrestrial Environment
5.3.7 Wetlands
5.4.1 Identification and Selection of Valued Components
5.4.5 Ecosystem Composition
5.4.6 Plant Species and Ecosystems at Risk
5.4.15 Invertebrates
12.2.1.18.4.4.9 Management for Whitebark Pine
Appendix 5.1.3.3A Vegetation 2011-13 Baseline

A summary of the analysis of each section reviewed as well as a detailed breakdown of the comments on each reviewed section are presented below. These comments are anticipated to be modified after discussion with other review team members and/or response from New Gold.

Summary Report

- This review looked at a range of terrestrial and aquatic components not otherwise covered by other reviews, thus this review includes both aquatic and terrestrial plants, rare plants, rare ecosystems, invertebrates, and revegetation and closure planning.

- In general, the ecosystem mapping and rare plant surveys appear to be conducted to standard and are likely a good representation of what is present on site.

- The presentation of the analysis is somewhat confusing and confuses the reader; primarily with respect to the following:
    - Rare plants – are initially presented as a single group, then split into wetland and terrestrial groups in completely different sections of the document resulting in a disconnect and an inability to readily review rare species;
    - Potential rare plants – a list of potentially occurring plant species-at-risk was created from a more extensive list produced through desktop queries; it is not well defined how this list was arrived at and this list seems separate from the confirmed species thus it is unclear how the confirmed and potential species at risk are addressed collectively.
    - A habitat evaluation of these 10 species is conducted but it doesn't link the habitat with the respective species thus it is difficult to assess the impact.

- Invertebrates target butterflies, damselflies, and a few others while Bumblebees were not mentioned despite being put forward as a potential VC (rejected). Two species of bumble bee are Federally recognized (Gypsy Cuckoo – SARA Endangered; and Western Bumblebee – COSEWIC Special Concern).

- In general there is a feeling of downplaying impacts and/or mitigation responsibilities:
    - Rare ecosystems are simply called too difficult to restore (may be correct but lacks justification);
    - Rejected VC's are simply justified in a cut and paste manner, more detail should be used to justify these decisions;
    - Wetland ecosystem loss is 'not-significant' despite temporal loss of 10% of wetlands during mine operation (1% post-closure);
    - Long-toed salamanders were identified as receiving a lower survey effort than required; and
    - Statements such as blue-listed plants are not 'expected' to be impacted by mine development, there should be greater certainty around the level of impact.

- Whitebark pine section generally delivers the prescribed mitigation results but some wordsmithing would improve the section. The terms whitebark and white bark are interchanged (it is the former). Some of the sections from the whitebark plans are not summarized completely accurately but the final mitigation message is delivered.

Technical Report

2.2.1.1.5 Environmental Significance and Environmental Setting

- No comment

2.6 Reclamation and Closure

- "The long-toed salamander was found in parts of the Project area, but it was not found within the freshwater pipeline area; however, the salamander is expected to use the area, and is believed to have not been detected due to a lower survey effort in this area." This is not a species of concern but all BC's salamanders are protected under the wildlife act.
- "Salvageable pipe will be removed from site and sold for salvage value. Pipe with no salvage value will be disposed of in the open pit or waste rock dumps and covered with waste rock or overburden." Is burying pipe the best and most appropriate way to dispose of it?

5.1.3 Terrestrial Environment

- No comments

5.3.7 Wetlands

- "Four plant species are Blue-listed in BC: swollen beaked sedge (*Carex rostrata*), small-flowered lousewort (*Pedicularis parviflora ssp. parviflora*), meesia moss (*Meesia longiseta*), and sickleleaf tomentypnum moss (*Tomentypnum falcifolium*) (Table 5.3.7-10). Sickleleaf tomentypnum is not on the list of potentially occurring at-risk wetland plant species." What is the "so what" behind sickleleaf not being on the list - should it be on the list and your record is new to the CDC? Not really sure what this statement is implying.
- "The Project will directly affect 309.3 ha (9.3%) of wetland ecosystems in the mine site during construction, operations, and closure. An additional 132.6 ha of wetland functions may be degraded, and 89.9 ha of wetlands may be hydrologically altered. The primary effect on the Wetlands VC will be the loss of wetland extent and functions, and the degradation of functions provided by remaining wetlands. Mitigation measures to address these impacts include avoidance, minimization, and compensation actions. After considering mitigation measures, the temporal loss of wetland functions remain as residual effects. The loss of wetland functions was rated as a Not Significant (moderate) effect as there will be a less than 1% reduction in wetland cover at post-closure within the mine site." Temporal losses during operating phase should be considered more, question not-significant as rating.

- During the Project construction, operations, closure, and post-closure, neither the mine site nor the linear components are "expected" to affect the four confirmed Blue-listed plant populations in the LSA. Why is this only 'expected," what measures will be taken to ensure populations are avoided or impacts minimized?

5.4.1 Identification and Selection of Valued Components

- Table 5.4.1-3 should provide a better explanation of how the VC is being covered by other VC's.

5.4.5 Ecosystem Composition

- Given that VRI data sources have some degree of error especially for higher elevation forests, was the area ground-truthed to confirm mapped old-growth or to identify new old-growth not present on the VRI maps?

5.4.6 Plant Species and Ecosystems at Risk

- Table 5.4.6-1 should also be somewhat integrated with Tables 5.4.6-5 and 5.4.6-6 as the latter table is regarding habitat but doesn't allow the reader to fully understand which plants are losing potential habitat.
- Not really clear why the 5 confirmed plant species aren't also included here, only 'potentially occurring species'. It is recognized that 4 of the confirmed species are wetland species and covered in that section but many of the potentially occurring species and the potential habitats are also wetland species/ecosystems. The separation of wetland species/habitats needs more clarity as it leads to the impression that species are not being considered.
- How were the 10 potential species identified? The methods to narrow down the original list should be better defined so it can be replicated. This list seems completely distinct from the list of confirmed species confusing the final analysis.
- It is mentioned in previous section 5.4.5: "Reclamation of Ecosystems at Risk is not considered Possible;" while this statement has home merit, the ecosystems identified in 5.4.6.3.9.5 consist of many plant species well suited to reclamation and restoration. The area of these ecosystems lost is minimal and all along the transmission line.
  While it is noted that the ecosystems are more than just plant communities, a reclamation research project should be implemented to work with these associations. Many species associations such as Lodgepole pine – Juniper – Ricegrass and Black Cottonwood – Dogwood – Prickly Rose would be easy to test on dry sites and moist sites respectively, acknowledging that the communities are more complex than just the species composition.

5.4.15 Invertebrates

- Bees may need a better explanation. Western Bumblebee (COSEWIC Threatened), Gypsy Cuckoo Bumblebee (SARA Endangered), and Yellow-Banded Bumblebee (COSEWIC Special Concern) all may occur regionally. Gypsy Cuckoo Bumblebee was reported at the Kenney Dam.

- o www.sararegistry.gc.ca/virtual_sara/files/cosewic/sr_Western%20Bumble%20Bee_2014_e.pdf
- o http://www.sararegistry.gc.ca/virtual_sara/files/cosewic/sr_Gypsy%20Cuckoo%20Bumble%20Bee_2014_e.pdf

12.2.1.18.4.4.9 Management for Whitebark Pine

- The message is generally consistent with the 5-year whitebark plan but could use some wordsmithing. Some of the sections paraphrased from the whitebark plan aren't completely correct – this doesn't affect the final commitments however.
- The proper spelling is whitebark not white bark.

Appendix 5.1.3.3A Vegetation 2011-13 Baseline

- No comments – covered in other sections.

MEMORANDUM

DATE: 5 February 2016

TO: Michael Keefer, Keefer Ecological Services
CC: Ulkatcho First Nation

FROM: Kim Poole, Aurora Wildlife Research

SUBJECT: Ulkatcho FN – New Gold Blackwater Project Review
FIRST DRAFT

Working in conjunction with Keefer Ecological Services Ltd. and others, Aurora Wildlife Research (AWR) is reviewing the environmental assessment (EA) documentation for New Gold's proposed Blackwater Project, as requested by Ulkatcho First Nation.

From the perspective of AWR the following sections were reviewed:

- Section 5.1.3: Environmental Baseline (Terrestrial Environment)
- Section 5.4.1: Identification and selection of Valued Components
- Section 5.4.10: Moose (Key section that cross-references others)
- Section 5.4.11: Caribou (Key section that cross-references others)
- Section 12: Summary of Proposed Environmental and Operational Management Plans (Wildlife Management Plan)
- Appendix 5.1.3.4A: Wildlife and Wildlife Habitat 2011-13 Baseline Report
- Project description in sufficient detail to obtain an understanding of the Project
- (other sections listed in the scope of work were simple summaries of information presented in more detail above)

A summary of the analysis of each section reviewed as well as a detailed breakdown of the comments on each reviewed section are presented below. These comments are anticipated to be modified after discussion with other review team members and/or response from New Gold.

Main comments:

- Although most of the assessment was easy to read (although it would be nice if they understood the distinction between *alternate* and *alternative*!), citation of baseline data was incomplete (e.g., a 2013 FLNRO moose survey of WMU 6-01, which contains the mine site, was not discussed or used in the assessment);
- Field work leading up to the EA directed at ungulates (moose and caribou) was on the rudimentary side. Surveys that provide quantitative baselines from which to assess potential

project effects would have been far more valuable than unstructured reconnaissance-level surveys;

- To anchor their predictions on moose population dynamics, New Gold should have used recent survey estimates for the WMUs containing the mine site and linear corridors;
- Thresholds for examining changes in caribou population dynamics are provided, but it is unclear how the Proponent will be able to assess changes in these parameters (caribou population dynamics and wolf densities) related to potential Project effects;
- The rationale to consider a 35% threshold for habitat loss at the cumulative effects (CE) scale is perplexing since the Proponent acknowledges that this still means only a 60% chance of persistence, and given the impacts from mountain pine beetle there is a reasonable likelihood that future cumulative impacts to caribou habitat could increase beyond the 35% threshold even in the absence of Project residual effects;
- Loss of 5% moderate to high quality caribou habitat within the RSA should not be considered a "small amount"; indeed, many would argue that 5% is a reasonably large proportion of caribou habitat in the region, especially considering the declining trajectory of herd numbers. Even if the Blackwater Project will have an additional (non-significant) impact on Tweedsmuir-Entiako range, New Gold should consider a caribou off-set mitigation plan directed at this herd;
- Many of the CE level mitigation measures proposed are very long term in nature, and won't see any short to medium term return. The Project and CE mitigation measures proposed need to address reduction or elimination of short term impacts;
- The Wildlife Management Plan (WMP) does not provide enough specifics for many mitigation measures, with too much use of qualitative judgement words. Our main concerns are:
    - how can monitoring be used to verify impact predictions,
    - what programs are tied to testing the effectiveness of mitigation measures, and
    - how does adaptive management work in principle?
- Project monitoring (e.g., incidental observations and unstructured use of wildlife cameras) is inadequate to address the WMP sub-bullets noted above. The WMP states that wildlife migration corridors will be monitored, but it was unclear where and how these wildlife corridors were identified;
- The adaptive management approach referred to is poorly detailed, and should be presented in clear, structured detail.

General impressions

In general, writing in the moose and caribou sections of the EA was good. However, while there was a reasonable review of existing knowledge, some very relevant literature was missing (such as the 2013 moose survey of WMU 6-01 which contains the mine site; Thiessen et al. 2013). References in the text were not always found in the literature cited section (e.g., Heard 2011). Statements in the text are not always supported by proper citation (e.g., "*and a larger decline [of moose] of 50% between 2005 and 2012* " (Section 5.4.10.1; pg 5.4.10-1) should have been cited as Cadsand et al. 2012). This sloppiness makes review of the EA challenging and brings into question the completeness of the assessment.

The mountain pine beetle (MPB) epidemic has severely impacted these forests; forestry and wildfire are major existing landscape modifiers. As reported in the EA, primary concerns and comments raised by Aboriginal groups and other review agencies included general effects of Project disturbance on caribou populations, migration and winter range, potential increases in wolf predation, and the effects of increased hunting pressure on moose populations due to improved access. Concerns expressed earlier in the review process regarding the Tweedsmuir-Entiako caribou herd wintering range apparently resulted in changes to mine infrastructure and access that generally avoided these sensitive areas. Concerns expressed about increased access along the transmission line led to a design that maximizes use of existing road right-of-ways.

Section 5.1.3: Environmental Baseline (Terrestrial Environment)

Appendix 5.1.3.4A: Wildlife and Wildlife Habitat 2011-13 Baseline Report

Field work leading up to the EA directed at ungulates (moose and caribou) was on the rudimentary side; generally aerial and ground-based track counts and some reconnaissance level surveys. The assessments focus on 5 categories of assessment (habitat availability, wildlife population dynamics, wildlife mortality risk, wildlife movement patterns, and wildlife health), which appear to be appropriate categories to examine. The assumptions used to model direct and indirect habitat loss appear reasonable; threshold assumptions used to trigger significance were generally precautionary (but see below).

The EA concludes that moose numbers within the area are likely declining (as is occurring in the broader region). While this is likely true for Wildlife Management Units 7-11 and 7-12 which contain the linear corridors (Cadsand et al. 2012), a 2013 survey estimate of WMU 6-01, which contains the mine site area, suggested a similar moose population size to the previous estimate from 1997 (Thiessen et al. 2013). Calf ratios have been declining for the past 10-20 years. Wolf predation may be the primary proximate cause of the decline, but increased access from logging and chasing MPB may have increased harvest effort. There was limited direct use of recent survey data for the Regional Study Area (RSA) and no specific surveys conducted by New Gold beyond reconnaissance aerial surveys and track counts. To anchor their predictions on wildlife population dynamics, New Gold should have incorporated the 2013 government moose survey of WMU 6-01 and could have conducted structured surveys of the areas most relevant to the mine site and linear corridors; these would have added great validity to their baseline and assessment.

The Tweedsmuir-Entiako caribou herd, whose numbers have declined rapidly in recent years, has the greatest chance of interaction with the Project. Here too, wolf predation may be the proximate cause of the decline (with both bear species also contributing), with habitat change and alteration of predator-prey dynamics the ultimate driver. Historical telemetry data and recent sign indicate that members of the Tweedsmiur-Entiako caribou herd may occasionally be found on the western edge of the mine Local Study Area (LSA) primarily during late spring, summer, and fall. No tracks were recorded during winter surveys, but some purported caribou scat was observed on the mine site.

Section 5.4.10: Moose (Key section that cross-references others)

A "precautionary threshold" of 70% residual habitat was used during the moose assessment, which appears to be a reasonable assumption. Mortality risk thresholds for vehicle strikes appear to be reasonable. Although the assessment concluded that direct and indirect moose habitat loss will be minimal and non-significant, loss of moose habitat could be converted to functional moose home ranges, to get a better handle on amount of area lost and implications this has to the area's moose populations. This analysis could feed directly into assessing impacts on moose population dynamics.

As noted above, moose surveys conducted by government in 2012 and 2013 could be used to provide quantitative analysis for categories of assessment (e.g., moose population dynamics). Moose telemetry data are available for Tweedsmuir Park (Thiessen et al. 2013: Fig. 10), which could have been used to predict moose movements within the RSA and better delineate the moose population potentially impacted by the mine. Home range size and movements could be used to assess animal health – as in whether they could be exposed to contaminants for extended periods of time based on their range size and movement patterns; this could have relevance to the tailings pond post-closure. Harvest data summarized by WMU (as per Thiessen et al. 2013) could be used to establish baseline and trends for which to assess the Project going forward.

The effectiveness of mitigation ratings are all very optimistic (most high, a few moderate; Table 5.4.10-10), with limited proof of their veracity. Since these success ratings are incorporated into the confidence ratings, these unsubstantiated claims are carried through to the assessment stage.

Section 5.4.11: Caribou (Key section that cross-references others)

Currently, use of the Project area by caribou appears to be limited. Current use of the Parks, west of the Project, may be related to reducing population size (and hence smaller range) and higher disturbance factors outside the Parks (roads, logging). However, potential caribou habitat is present in and near the Project, and must be retained as much as possible. Should caribou numbers increase, broader use of habitat may again occur.

Curiously, the assessment used 20% habitat loss as the precautionary disturbance threshold for determining the significance of the Project's effect on undisturbed moderate to high value suitable caribou habitat in the RSA and subpopulation area, but 35% cumulative habitat disturbance at the subpopulation level for cumulative effects (CE) assessment. Even though they acknowledge that the Tweedsmuir-Entiako herd currently is declining, why the proponent used a less cautionary yardstick for CE is unclear, especially when they acknowledge i) that the 35% threshold still means only a 60% chance of persistence, and ii) due to the large area affected by MPB, there is a reasonable likelihood that future cumulative impacts to caribou habitat could increase beyond the 35% threshold even in the absence of Project residual effects. Therefore, it appears their precautionary approach appears less than precautionary. Since the outlook for caribou is dismal, negative, and close to significant for habitat loss, would not even a small additional loss from the Project still be considered significant?

Thresholds for examining changes in caribou population dynamics include greater than 10% reduction in caribou numbers/density because of proposed Project effects within the RSA; increase in wolf density from Project effects (greater than 3 wolves/1,000 km^2 in the regional area), and a limit on mortalities from vehicle collisions. Except for these unlikely vehicle collisions, it is unclear how the Proponent will be able to assess changes in caribou population dynamics and wolf densities related to the Project; this should be clarified.

Many of the CE level mitigation measures proposed (e.g., progressive restoration of habitat) are very long term in nature, and won’t see any short to medium term return. The mitigation measures proposed need to address reduction or elimination of short term impacts.

Aurora Wildlife Research
1918 Shannon Point Rd., Nelson, BC, V1L 6K1
Tel/cell: (250) 825-4063; e-mail: kpoole@aurorawildlife.com

Section 12: Summary of Proposed Environmental and Operational Management Plans (Wildlife Management Plan)

The Wildlife Management Plan (WMP) provides mitigation measures under a general section, with specific sections for caribou and moose. There are not enough specifics provided for all mitigation measures, with too many qualitative judgement words used (e.g., minimize, reduce, where possible). Main concerns with the WMP are:

i) how can monitoring be used to verify impact predictions,
ii) what programs are tied to testing the effectiveness of mitigation measures, and
iii) how does adaptive management work in principle?

The WMP states that a "small amount of available moderate to high quality habitat (5%) will be affected relative to that available in the RSA." Many would argue that 5% is a reasonably large proportion of caribou habitat in the region, especially considering the declining trajectory of herd numbers. Acknowledging that the Blackwater Project will have an additional (arguably non-significant) impact on Tweedsmuir-Entiako range, New Gold should consider a caribou off-set mitigation plan directed at this herd. The plan would involve on-site (within the range of the herd) enhanced mitigation of habitat to off-set the loss of caribou habitat incurred by the Project. A similar wetlands mitigation and offsetting plan has been proposed.

The WMP states that adaptive management measures would be implemented to reduce disturbance, if population monitoring results in observations of caribou within 500 m of the mine site during sensitive periods (essentially all year except from 15 July to 15 September). The Project "population monitoring" consists of incidental observations and use of wildlife cameras. This is inadequate to detect caribou when present, and provides too small a buffer distance to avoid disturbance. Canfor and the Ulkatcho First Nation (2013) proposed a 5 km buffer around work areas, with work deferred if caribou were present.

For both moose and caribou it appears monitoring of wildlife population dynamics and wildlife movement patterns will not be robust enough to detect changes in these parameters. For example, "*Wildlife corridors that intersect roads will be monitored prior to and during construction*." (12.2.1.18.4.6.6 Management of Wildlife-Human Interactions). I was unable to identify where (and how) these wildlife corridors were identified. The Proponent should develop more robust programs to more adequately assess their impact predictions and evaluate the success of mitigation measures.

The WMP states that the Proponent will implement adaptive management measures and use an adaptive management approach. This adaptive management approach is poorly detailed, and should be presented in clear detail.

Literature Cited

Cadsand, B., D. C. Heard, J. Courtier, A. Batho, and G.S. Watts. 2012. Moose density and composition in the southern Omineca Region, winter 2011-2012. British Columbia Ministry of Forests, Lands and Natural Resource Operations, Prince George, BC. 40 pp.

Canfor and the Ulkatcho First Nation. 2013. Forestry Management Strategies for Canfor's Operating Area within the Range of the Tweedsmuir – Entiako Caribou Herd. Unpubl. report, Canadian Forest Products Ltd. and the Ulkatcho First Nation, September 25, 2013.

Thiessen, C., D. Peard, and B. Jex. 2013. Entiako/North Tweedsmuir mid-winter moose density estimate: January 2013. British Columbia Ministry of Forests, Lands, and Natural Resource Operations. Smithers, BC. 22 pp.

COOPER BEAUCHESNE AND ASSOCIATES LTD
KOOTENAY OFFICE - BOX 2508, #308-1123 WEST 2ND ST
250.837.3550

MEMORANDUM

DATE: 2016-02-05

TO: Michael Keefer, Keefer Ecological Services
CC: Ulkatcho First Nation

FROM: Harry van Oort, Cooper Beauchesne and Associates Ltd.

SUBJECT: Ulkatcho FN – New Gold Blackwater Project Review
FIRST DRAFT

Working in conjunction with Keefer Ecological Services Ltd. and others, Cooper Beauchesne and Associates Ltd. is reviewing the environmental assessment (EA) documentation for New Gold's proposed Blackwater Project, as requested by Ulkatcho First Nation.

From the perspective of Cooper Beauchesne and Associates Ltd. the following sections were reviewed:

- Section 5.1.3: Environmental Baseline (Terrestrial Environment)
- Section 5.4.1: Identification and selection of Valued Components
- Section 5.4.8: Water Birds
- Section 5.4.9: Forest and Grassland Birds Section 5.5: Summary of Assessment of Environmental Effects
- Section 12: Summary of Proposed Environmental and Operational Management Plans (Wildlife Management Plan)
- Section 19: Summary of Residual Effects
- Section 20: Summary of Mitigation Measures
- Section 21: Conclusion
- Appendix 5.1.3.4A: Wildlife and Wildlife Habitat 2011-13 Baseline Report

A summary of the analysis of each section reviewed as well as a detailed breakdown of the comments on each reviewed section are presented below. These comments are anticipated to be modified after discussion with other review team members and/or response from New Gold.

Summary Report

- The two VC's considered here were (1) Waterbirds, and (2) Forest and Grassland Birds. Note that both VC's include many different species, each with different habitat needs. Within each of these VC's, habitat-specific species assemblages can be identified; as an extreme example, consider the second VC includes both Forest and Grassland birds.
- Bird species assemblages vary predictably across regions of BC, and among habitat types within regions of BC. The baseline field studies confirm expected species assemblages nicely,

and also identify particular sites, or locations that are regionally notable for local/regional biodiversity. One such site is Snake Lake where a colony of Bonaparte's Gulls nest; other important sites were likely discovered, but these have not been clearly listed, ranked and mapped within the RSA. This would be useful additional knowledge to have going into this assessment, particularly so with respect to the ecological importance/significance of individual wetlands in the RSA.

- A central goal in predicting the potential impact to wildlife involves calculating the significance of habitat loss. Rather than attempting to map suitable habitat, and address impacts for each independent species in the VC groupings, the approach taken was to select 'indicator species' that act as good representatives of the VC groups – the idea being that a large calculated impact for the indicator species would indicate a large impact for a large proportion of the VC group. As such, indicator species need to be selected carefully and justified. In this respect, there is considerable improvement to be made.
- Of particular concern, one species (Yellow Rail) was used to represent local/regional waterbirds and calculate impacts was a poor choice as it is a species of waterbird not found in the region; a much better choice would be one of the four most common wetland birds, including Greater Yellowlegs and Wilson's Snipe which were detected near the mine site.
- Two species used to represent Forest and Grassland Birds (Red-tailed hawk and Olive-sided Flycatcher) are species that are attracted to fragmented (harvested) forests/forest edges. These species therefore cannot represent forest birds that experience negative impacts of forest clearing activities. It would be more salient to choose at least one indicator species that depends on contiguous mature forests (e.g., Northern Goshawk or Brown Creeper), and to assess the cumulative magnitude that additional forest clearing may have for the community of true forest birds that have already suffered considerable habitat loss and fragmentation in the region.
- Clarks Nutcracker is an excellent, highly relevant indicator species given the expected reduction in white-bark pine habitat at the mine site. All other indicator species should be reassessed.
- It is not clear how habitat suitability was modelled (mapped). This is fundamental to the assessment and detailed methodology needs to be made clear.
- The assessment of habitat loss and alteration appears to be overly simplistic, and the methods are poorly described. More work needs to be put into this before the results can be interpreted well (better description of methods and results, and more detailed analysis).
- A general concern is that there is little in the way of assurance that waterbirds will not have access to or be deterred from using tailings ponds.
- The assessed impact to Clarks Nutcracker may be under-estimated.

Technical Report

Section 5.1.3: Environmental Baseline (Terrestrial Environment)

- No comment

Section 5.4.1: Identification and selection of Valued Components

- Forest and Grassland birds is a poor VC as it is comprised of ecologically distinct groupings. Forest birds should be their own VC; it is questionable how valuable grassland birds are as a VC.
- Choice of indicator species is poorly justified. Provide more information as to why these choices were made
- The indicator species are poor choices and should be reassessed (Waterbirds). There is likely a good range of wetland types in the LSA and RSA depending on elevation, groundwater source/flows, acidity etc. The choice of indicator species should be (1) a local/regionally relevant species (unlike Yellow Rail), and should represent some of the diversity of wetland habitats (different waterbird communities). Greater Yellowlegs seems like a very good choice.

- The indicator species are poor choices and should be reassessed (Forest Birds). The choice of edge species (Olive-sided Flycatcher, Red-tailed Hawk) is inappropriate. The impact of habitat clearing for forest birds should be reflected by an indicator species that depends on forests, and is sensitive to this impact (e.g., Northern Goshawk, Brown Creeper). Also, if Grassland birds are an issue –shouldn't they be represented?
- Olive-sided Flycatcher does have relevance as it is endangered, but requires special treatment. Olive-sided flycatchers are potentially tricked into selecting edges made by forest clearing activities, only to suffer higher than normal nest predation (Robertson and Hutto 2007). There is a significant population of this species in the RSA/LSA, and given their vulnerability are worth considering. This species would make a good VC, but does not make a good VC indictor species for forest or grassland birds.

Section 5.4.8: Water Birds
Section 5.4.8.2

- Note that Yellow Rail were not detected – of course – the species doesn't belong.
- Wilson's Snipe and Greater Yellowlegs were common, and the only two detected at the mine site. These would be more appropriate indicator species.

Section 5.4.8.3.1

- The way this reads, the LSA may have been re-defined, specifically for waterbirds; if so, it seems that LSA should not be used, and the difference should be clearly stated. Otherwise it would be better to cross-reference one section where the LSA is described, and not repeat.

Section 5.4.8.3.4

- This section seems to suggest that the level of uncertainty around conclusions and assessment is of no concern because RISC standards were followed. I find this to be a large assumption, and does it imply that the levels of uncertainty do not need to be calculated?

Section 5.4.8.3.5

- The Andrén (1994) model of a threshold is inappropriately applied here. The paper suggests that when a cumulative total of 30% of habitat is lost, fragmentation effects become apparent with additional habitat loss; with more than 30% retention of habitat, fragmentation effects are hard to measure. This type of threshold considers the effects of fragmentation specifically, and therefore has relevance to species that select contiguous habitats (e.g., area-sensitive species).
- There are two issues with the application of the rationale of justifying a threshold based on the Andrén paper. (1) For waterbirds, wetlands are naturally fragmented at the scale of the LSA and RSA, so these birds select a naturally fragmented habitat, minimizing the relevance. (2) Fragmentation, per se, is not considered in the analysis that examines the amount of habitat loss.
- It is incorrectly stated that "When remaining functional habitat is less than 10% to 30% in a region, species are still affected by habitat loss but are not necessarily at risk of regional extirpation." The opposite is true.
- In table 5.4.8-4 in the first category of assessment (habitat loss), it describes that the analysis of habitat loss "*included ranking habitat quality for water birds, so that the relative quantitative and qualitative loss of moderate to high quality versus lower quality habitat was assessed in relation to the local and regional availability of suitable habitat measured as percentage and hectares lost*." The RSA is an arbitrary area and will always be much larger than the footprint of habitat loss. Is it not therefore a forgone result that the % of habitat loss will appear to be very small? If so, this makes the analysis uninformative. In the case of the waterbird VC, a much better approach might be to classify and rank each wetland for density and biodiversity of watebirds – and therefore ecological importance of each site, and compare those that are lost vs altered vs retained without impact.

Section 5.4.8.3.6

- More detail is need to explain how habitat suitability models were derived.

- More detail is needed to explain how habitat loss and alteration was calculated.
- A table that lists, defines, and describing each candidate and utilized predictor variable should be provided.
- Other impact categories (mortality and population dynamics) are perhaps best left as discussion, as there was no technical assessment attempted

Section 5.4.8.3.6.2

- Habitat simply defined as fens for Yellow Rail and open water for Ring-necked Duck. This is overly simplistic, and provides very low confidence that true habitat quality for these indicators was adequately mapped.

Section 5.4.8.3.6.2

- See above comments – the results are probably meaningless, at least with respect to the RSA. A quick look at this table gives the impression of minimal impact, but the methods reported give very low confidence that we can accept any conclusions.

Section 5.4.8.3.7.2/3

- It is unconvincing that any real impact to mortality or population dynamics has been assessed.

Section 5.4.8.3.8

- See in particular Table 10. The mitigation measure to avoid destroying bird nests (a prohibition of the Migratory Birds Convention Act) emphasizes using nest surveys over the recommended approach of clearing outside of nesting time period. Nest surveys are not valid in most cases. As noted by Environment Canada, the nest survey and avoidance method can only be effective if the habitat is already highly disturbed/of low potential value for nesting. For example: *“Except when nests are known to be easy to locate, active nest searches are generally not recommended because 1) searchers may disturb or stress nesting birds, and 2) in most habitats, the likelihood of detecting all nests in a given search area is known to be low.*” (https://www.ec.gc.ca/paom-itmb/default.asp?lang=En&n=1B16EAFB-1). And “*In some cases, nest surveys may be carried out successfully by skilled and experienced observers using appropriate methodology, in the event that activities would take place, in simple habitats (often in man-made setting) with only a few likely nesting spots or a small community of migratory birds. Examples of simple habitats include: (1) an urban park consisting mostly of lawns with a few isolated trees; (2) a vacant lot with few possible nest sites; (3) a previously cleared area where there is a lag between clearing and construction activities (and where ground nesters may have been attracted to nest in cleared areas or in stockpiles of soil, for instance); or (4) a structure such as a bridge, a beacon, a tower or a building (often chosen as a nesting spot by robins, swallows, phoebes, Common Nighthawks, gulls and others).*” (https://www.ec.gc.ca/paom-itmb/default.asp?lang=En&n=8D910CAC-1#_003).

Section 5.4.9: Forest and Grassland Birds Section

Section 5.4.9.3.1

- The way this reads, the LSA may have been re-defined, specifically for forest and grassland birds; if so, it seems that LSA should not be used, and the difference should be clearly stated. Otherwise it would be better to cross-reference one section where the LSA is described, and not repeat.

Section 5.4.9.3.4

- This section seems to suggest that the level of uncertainty around conclusions and assessment is of no concern because RISC standards were followed. I find this to be a large assumption, and does it imply that the levels of uncertainty do not need to be calculated?

Section 5.4.9.3.5

- The Andrén (1994) model of a threshold is inappropriately applied here. The paper suggests that when a cumulative total of 30% of habitat is lost, fragmentation effects become apparent with additional habitat loss; with more than 30% retention of habitat, fragmentation effects are hard to measure. This type of threshold considers the effects of fragmentation specifically, and therefore has relevance to species that select contiguous habitats (e.g., area-sensitive species).

- There are three issues with the application of the rationale of justifying a threshold based on the Andrén paper. (1) Both Red-tailed Hawk and Olive-sided Flycatchers prefer and select edges and fragmentation, so the model does not apply. (2) Fragmentation, per se, is not considered in the analysis that examines the amount of habitat loss. (3) The Andrén paper considers cumulative habitat loss, which in the case of forest birds was not considered (see next point).
- In table 5.4.9-4 in the first category of assessment (habitat loss), it describes that the analysis of habitat loss "*included ranking habitat quality for forest and grassland birds, so that the relative quantitative and qualitative loss of moderate to high quality versus lower quality habitat was assessed in relation to the local and regional availability of suitable habitat measured as percentage and hectares lost*." The RSA is an arbitrary area and will always be much larger than the footprint of habitat loss. Is it not therefore a forgone result that the % of habitat loss will appear to be very small? If so, this makes the analysis uninformative.
- Again, mapping habitat loss for edge species in a fragmented landscape would need to be done with a more detailed depth of their biology, but more importantly, is probably not a good representation of the impacts to most forest or grassland species.

Section 5.4.9.3.5

- More detail is need to explain how habitat suitability models were derived. For example, it is unclear how forest edges were incorporated in the habitat mapping.
- A table listing, defining and describing of each predictor variable should be provided.

Section 5.4.9.3.8

- See in particular Table 10. The mitigation measure to avoid destroying bird nests (a prohibition of the Migratory Birds Convention Act) emphasizes using nest surveys over the recommended approach of clearing outside of nesting time period. Nest surveys are not valid in most cases. As noted by Environment Canada, this method can only be effective if the habitat is already highly disturbed/of low potential value for nesting. For example: *"Except when nests are known to be easy to locate, active nest searches are generally not recommended because 1) searchers may disturb or stress nesting birds, and 2) in most habitats, the likelihood of detecting all nests in a given search area is known to be low.*" (https://www.ec.gc.ca/paom-itmb/default.asp?lang=En&n=1B16EAFB-1). And "*In some cases, nest surveys may be carried out successfully by skilled and experienced observers using appropriate methodology, in the event that activities would take place, in simple habitats (often in man-made setting) with only a few likely nesting spots or a small community of migratory birds. Examples of simple habitats include: (1) an urban park consisting mostly of lawns with a few isolated trees; (2) a vacant lot with few possible nest sites; (3) a previously cleared area where there is a lag between clearing and construction activities (and where ground nesters may have been attracted to nest in cleared areas or in stockpiles of soil, for instance); or (4) a structure such as a bridge, a beacon, a tower or a building (often chosen as a nesting spot by robins, swallows, phoebes, Common Nighthawks, gulls and others).*" (https://www.ec.gc.ca/paom-itmb/default.asp?lang=En&n=8D910CAC-1#_003).
- It is also perhaps missed in this EIA that clearing of bird nesting habitat will not be a one-time event. The ROW for the transmission lines will likely be cleared during the nesting season repeatedly every 20 year or so – no?

Section 5.5: Summary of Assessment of Environmental Effects

- There appears to be no mitigation to prevent Waterbirds from accessing Tailings Storage Facilities, and other such potentially harmful features that may be created by the Project.
- For both Waterbirds and Forest and Grassland Birds, harvesting trees, and removing other nesting habitat should take place outside of the breeding season in order to avoid the prohibitions of the Migratory Bird Convention Act. This is the only effective and readily

plannable mitigation measure to avoid destroying active nests. This approach needs to be prioritized over nest search approaches which are not effective

- As detailed in Section 5.4.9, the impact to Clarks Nutcracker may include as much as 20% habitat loss. Yet at the mine site where this impact takes place, the impact is rated as Not Significant (Moderate). The impact could be significant for the species if they are already habitat-limited, as I would suspect. The impact appears to be down-played.

Section 12: Summary of Proposed Environmental and Operational Management Plans (Wildlife Management Plan)

- My concern lies with bird health for waterbirds. Please assure that this potential impact is reviewed by a third party specialist in mine tailings/toxicology/wildlife.

Section 19: Summary of Residual Effects

- No comment

Section 20: Summary of Mitigation Measures

- No comment

Section 21: Conclusion
Section 21.4

- Page 21-17. How will vehicular speed be enforced?
- Page 21-17 to 21-18. It is unclear which alternate prey on roads leads to increased predation of waterbirds (certainly increased hunting may be an issue). What's even less clear is how the altered predator prey relationship will be mitigated via erosion control, spill responses plans etc.

Appendix 5.1.3.4A: Wildlife and Wildlife Habitat 2011-13 Baseline Report

- A wealth of local information was gathered, but was not utilized for the impact assessment. For example, the species encountered did not appear to influence VC indicator species choices, and the detection data did not get incorporated into habitat suitability work. For waterbirds in particular, the data could have been incorporated into a more detailed ranking of wetland values.

References

Andrén, H (1994) Effects of habitat fragmentation on birds and mammals in landscapes with different proportions of suitable habitat: a review. Oikos 71: 355-366

Robertson, BR and RL Hutto (2007) Is selectively harvested forest an ecological trap for Olive-sided Flycatchers? The Condor: February 2007, Vol. 109, No. 1, pp. 109-121.