ROUND TWO INFORMATION REQUEST (IR) RESPONSE

EA No: 0809-001 **Information Request No: Yellowknives Dene First Nation IR #01**

Date Received

December 2, 2011

Linkage to Other IRs (from Round I)

Yellowknives Dene First Nation IR#11

Date of this Response

February 17, 2012

Request

Preamble

The Federal Metal Mining Effluent Regulations (MMER)[1] is commonly used a regulatory discharge limits for operating metal mines. It is YKDFN position that MMER effluent discharge limits are not applicable for a closed metals mine, such as Giant Mine. MMER effluent discharge concentrations do not guarantee protection of all aquatic life in the environment. YKDFN supports effluent discharge criteria that are protective of aquatic life in the receiving environment. Regulatory effluent discharge limits are recommended to achieve this outcome.

AANDC stated that the MVLWB will set effluent discharge criteria during the water licencing phase of the project and that the water treatment plant will achieve these set limits. Based on previous Environmental Assessments where particular criteria have been established, YKDFN believe that the MVEIRB stage is appropriate for overarching effluent targets or specific contaminants of concerns to be selected. The MVLWB effluent discharge criteria may not fully embody impacts to aquatic life through its mandate and legislation.

Without additional information to understand the concentrations of parameters in the environment that are protective of aquatic life, it is YKDFN's understanding that MMER as the effluent discharge quality will likely be AANDC target for consideration by the MVLWB. YKDFN notes that previous reclamation activities by AANDC, for example at the former Hidden Lake mine (NWT), did not apply MMER as acceptable effluent discharge water quality; rather, a risk assessment was completed to

[1] Metal Mining Effluent Regulations, SOR/2002-222

understand the parameters of potential concern and the associated concentrations that resulted in acceptable potential impact.

Question

1. AANDC to define the acceptable water quality in the receiving environment by providing a list of parameters, and associated concentrations, that are protective of the receiving environment and evaluated through the MVEIRB process to understand potential impact to aquatic life. These will be called the water quality objectives. Presumably, if these water quality objectives are known, then the MVLWB could apply this knowledge in the determination of a regulatory limit that will achieve the objectives.

2. AANDC to compare the water quality objectives to the predicted water quality in the receiving environment.

3. AANDC to compare the (effluent) design specifications for its Water Treatment Plant and that planned for the Con Mine Site.

4. MVEIRB to apply the concept that water quality objectives, which are protective of the aquatic environment, as the gauge to determine significance of potential impact for effluent waters released from Giant Mine. For example, if the predicted effluent water quality is less than the water quality objectives, than there may be reasonable certainty that there will be minimal negative impacts; if the predicted effluent water quality is greater than the water quality objectives, there may be potential negative impacts.

Reference to DAR (relevant DAR Sections)

s.6.8.5 Water Treatment and Sludge Disposal
s.6.8.6 Outfall and Diffuser

Reference to the EA Terms of Reference

s. 3.5.1 Water
s.3.5.2 Fish and Aquatic Habitat

Summary

The mine water management system proposed for the Giant Mine to replace the existing seasonal system was selected to achieve protection of all water uses in Yellowknife Bay, including Back Bay. The proposed system includes an outfall and diffuser in Yellowknife Bay to obtain optimum mixing of the treated discharge with bay water and proven treatment technology for removal of arsenic and other contaminants of potential concern based on the preliminary characterization of mine water at the Giant Mine. The Giant Mine Remediation Project Team (Project Team) remains committed that the final system will ensure protection of all forms of aquatic life in the bay, protect the health of fish and ensure

that they are safe to eat, protect the quality of Yellowknife Bay water as a future drinking water source, and ensure that Yellowknife Bay is safe for all forms of recreational use.

At the current stage of design (i.e., Preliminary Design) there is insufficient information available to provide final site-specific numerical water quality objectives. The Project Team is currently undertaking efforts to fully characterize site mine water as well as definitive background conditions within Yellowknife Bay, including Back Bay. Based on preliminary design, it is predicted that water quality at the edge of the mixing zone will fall within CCME guideline values, and for many parameters well below these values. These guidelines are developed conservatively to protect specific designated uses on a National scale. These major water uses include drinking water supply, recreational use, and protection of freshwater aquatic life. However, the Project Team acknowledges that it is possible that the guidelines are over or under protective at specific locations having unique conditions. To this end, for those contaminants that are predicted to be at or near CCME levels, additional work is planned to confirm the appropriateness of those CCME guideline values for use as site-specific water quality objectives for Giant Mine, in order to meet the level of protection being targeted.

It has been proposed that the predicted performance of the new plant be used to establish performance criteria for the water treatment system, with due consideration being given to operational variability that may occur. The proposed plant will not discharge effluent which is acutely toxic to aquatic organisms. The plant performance will be similar or better than that for the Con Mine site as they were designed on similar process concepts.

Response 1

The approach adopted in developing the mine water management system for Giant Mine was based on, first and foremost, protection of water quality in the receiving environment (i.e. Yellowknife Bay, including Back Bay) for all beneficial uses both in the short term and long term. Yellowknife Bay is a valued source of fish for residents who live in the study area and is also used for recreational purposes. The proposed management system (i.e., treatment plant and outfall to the bay) were selected based on protecting aquatic species that inhabit the bay, as well as, protection of the bay waters as a potential source of drinking water and for a range of recreational pursuits (e.g., boating, swimming, diving). To ensure protection of Yellowknife Bay water to support all uses, it was determined that: an outfall equipped with a diffuser was desirable to achieve optimum mixing of the treated discharge with lake water; the outfall diffuser should be located in a deep area of the bay to minimize effects on ice cover during the winter and to achieve a minimum dilution ratio of 100:1 (ratio of 100 lake water volumes to 1 effluent volume) under all conditions in the lake; and, the area of influence of the mixing zone should be as small as reasonably achievable to minimize any physical (disturbance of sediments) or chemical (chronic toxicity) effects on the aquatic ecosystem. The mixing ratio of 100:1 should ensure that surface water objectives for arsenic and other water quality parameters of potential concern present in mine water from the Giant Mine are met at the edge of the mixing zone under all conditions. With specific reference to arsenic, the Canadian water quality guideline is 0.005 mg/L (5 µg/L) was used in the assessment as it is protective of sensitive aquatic species at all stages of their life cycle. The arsenic guideline incorporates a safety factor of 10 as discussed in Response 2 below.

To further ensure that the desired level of protection is achieved, the treatment technology selected for this application was based on proven treatment processes (chemical precipitation, clarification and effluent filtration) that have been shown to reliably achieve consistent effluent quality. The chemical treatment process selected for the Giant Mine specifically targets removal of arsenic, the primary parameter of concern, but also removes other metals, either as co-precipitates with ferric hydroxide or as metal hydroxide precipitates. The clarification and filtration steps ensure that the chemical precipitates are captured and that the effluent has a low suspended solids level. Similar treatment systems operating at other locations have been shown to reduce the arsenic level in the processed water to below 0.2 mg/L on a routine basis; however, occasional excursions above the target of 0.2 mg/L will occur for short time intervals and this was factored into the assessment of effects.

As stated above, the overarching water quality objective is to protect water quality in the receiving environment for all beneficial uses both in the short term and long term. However, at this stage of the design process (i.e., Preliminary Design) there is insufficient characterization data on the ambient conditions in Yellowknife Bay and Back Bay to allow for a detailed quantification of water quality objectives. The best estimate the Project Team can provide at present is a comparison of the expected incremental concentrations of parameters at the edge of the mixing zone to the applicable CCME guideline values. This comparison is relevant since the CCME guidelines are set to be protective of sensitive aquatic species. This comparison demonstrates that none of the guidelines would be exceeded at the edge of the mixing zone under even the most limiting mixing conditions in the lake. When the Giant Mine Remediation Project (Remediation Project) reaches the water licencing process the Project Team will be able to present quantitative water quality objectives for the Remediation Project that have been developed following final assessment of synthesized treated effluent, effluent mixing, reference/background water quality conditions and where necessary a site-specific, risk-based approach for remaining contaminants of concern.

The anticipated performance of the new water treatment plant for a longer list of parameters is presented in Table 1. The metals summarized in the table include those generally regulated in metal mine effluents. Effluent quality data for other metals of potential interest (e.g. cadmium, chromium, mercury, silver) were consistently less than method detection limits and therefore are not included in the table as they pose no risk of adverse effect on aquatic biota. It is noteworthy that the end of pipe effluent concentrations of the metals other than arsenic (i.e. copper, lead, nickel, and zinc) are quite low and only marginally above the referenced CCME water quality guidelines listed in the table. The analysis, discussed further below, confirmed that further treatment of the Giant mine water to achieve lower levels of these metals in the treated effluent is not warranted and that the proposed system will provide the desired level of environmental protection.

Besides the metals, the expected levels of key general chemistry parameters are also included in Table 1. The pH and total suspended solids levels are effectively controlled by the treatment system and are not of concern. Cyanide levels in the effluent from the existing system are low and are not a concern. Ammonia and nitrate are present in the mine water from the use of ANFO (an ammonium-nitrate fuel oil mixture) for blasting during historical mining. The proposed treatment system is not expected to remove either parameter; however, as discussed below the concentrations of these water quality parameters do not pose environmental risks.

The proposed treatment system would be operated to achieve an effluent arsenic concentration of 0.2 mg/L or lower; however, as stated previously, it is recognized that there will be periods when optimum system performance will not be achieved and the effluent arsenic concentration could reach 0.5 mg/L. Hence, it is proposed that during licensing the predicted performance of the new plant be used to establish performance criteria for the water treatment plant, with due consideration being given to operational variability that may occur. The point of compliance for verifying performance relative to the regulatory criteria would be upstream of the discharge point or end-of-pipe and the plant would be equipped with holding facilities to store non-compliant water for retreatment prior to discharge.

Table 1 – Water Quality Parameters

Water Quality Parameter	Units	Expected Treatment Plant Effluent Quality[1]	Incremental Concentration at Edge of Mixing Zone (100:1 Dilution)	CCME Surface Water Quality Guideline	Source
General Chemistry					
Ammonia[2]	mg/L	0.02-5.3 (1.5 average)	0.0002 - 0.053	1.54 (at pH=7.5 & Temperature=20°C)	CCME 2000 [a]
Cyanide	mg/L	<0.002 - 0.0145	<0.001	0.005 (as free CN)	CCME 2011 [b]
Nitrate (as N)[3]	mg/L	0.02 – 5.3	0.0002 – 0.053	2.9	CCME 2011 [b]
pH	mg/L	7.5-8 (target)	-	6.5 - 9	CCME 2011 [b]
Tot. Suspended Solids	mg/L	<5 (target)	<1	5 (above background)	CCME 2011 [b]
Metals and Metalloids					
Arsenic (total)	mg/L	0.2 (target) 0.5 (upper bound)	0.002 - 0.005	0.005	CCME 2011 [b]
Copper	mg/L	0.005 - 0.02	<0.0002	0.002	CCME 2011 [b]
Lead	mg/L	<0.00025	<0.0001	0.001	CCME 2011 [b]
Nickel	mg/L	0.02 - 0.07	<0.001	0.025	CCME 2011 [b]
Zinc	mg/L	0.003 - 0.07	<0.001	0.03	CCME 2011 [b]

Reference Sources: a) CCME (Canadian Council of Ministers of the Environment) 2000. Canadian Water Quality Guidelines for Protection of the Environment - Ammonia Fact Sheet.
b) CCME (Canadian Council of Ministers of the Environment) 2011. Canadian Water Quality Guidelines for Protection of the Environment - Excel Summary Table.
Notes:
1. The effluent quality for most parameters (other than the target parameter arsenic) has been based on measured levels in the effluent from the existing treatment plant as performance data are not available at this time for the proposed treatment system. The proposed system is expected to perform at least as well as the current plant.
2. Ammonia removal currently occurs in the surface ponds via natural oxidation to nitrate and/or utilization by aquatic plants. The ammonia level in the treated effluent is expected to be higher than achieved by the existing system as minewater will not be held in surface ponds prior to treatment in the new treatment plant.

3. Nitrate levels have typically not been measured in mine water at the Giant Mine hence the expected nitrate level was estimated based on measured ammonia levels. Nitrate is expected to be present in approximately equal portions to ammonia as the source of both parameters is ammonium-nitrate which is commonly used as a blasting compound in mining.

Following confirmation that the effluent meets the established criteria, it would be discharged to Yellowknife Bay via a new outfall and diffuser. Dispersion modeling carried out in support of the proposed outfall design over a range of ambient conditions (including under ice cover), indicates that the size of the mixing zone would to be limited to a 15 metre (or less) radius from each of the discharge ports of the diffuser. The outfall design has been based on achieving a surface water quality objective for arsenic of 0.005 mg/L (5 µg/L) at the edge of the mixing zone based on an effluent concentration of 0.5 mg/L (i.e., the upper bound effluent discharge concentration). Under normal operation, the arsenic concentration at the edge of the mixing zone would be 0.002 mg/L (2 µg/L) or less. As indicated in Table 1, the incremental effect on the concentrations of the other water quality parameters at the edge of the mixing zone are a small fraction of the corresponding CCME water quality guidelines. For example, the incremental increases in the ammonia and nitrate concentrations are predicted to range between 0.0002 and 0.053 mg/L for both parameters as compared to the guideline values of 1.54 mg/L-N for ammonia (based on a pH of 7.5 and water temperature of 20^0 C) and 2.9 mg/L-N for nitrate. The small incremental effects on these parameters would not cause toxicity effects nor would they enhance aquatic plant growth. While not included in Table 1, total phosphorus levels in the treated effluent from the existing treatment plant have typically measured less than 0.1 mg/L. The effluent from the proposed treatment system is expected to have a similar phosphorus content. The incremental effect on phosphorus (an essential nutrient linked to aquatic plant growth) would be less than 0.001 mg/L at the edge of the mixing zone. Ultra-oligotrophic lakes (i.e. lakes with very low aquatic plant growth) typically have less than 0.004 mg/L total phosphorus (CCME 2011). These comparisons confirm that the proposed mine water treatment and diffuser system will provide a high level of protection of environmental conditions in Yellowknife Bay.

While the key design objective of the proposed mine water management system is to provide a high level of protection of the receiving environment, it is not feasible from a practical perspective to regulate the effluent discharge based on measurements in the receiving environment, due to the dynamic nature of mixing conditions within lake systems and various other factors including the inability to monitor in the receiving environment on a continuous basis. [Plant effluent will be routinely monitored and regulated at the last point of control before being discharged from the water treatment plant.] Rather, confirmation that water quality objectives are being met and aquatic communities are not adversely impacted is best carried out via an environmental effects monitoring program, which focuses on assessing effects on aquatic biota (e.g., benthic communities and fish) in the exposure area on a periodic basis. The Project Team has committed to implementing such a program following applicable guidance documents such as “Guidelines for Designing and Implementing Aquatic Effects Monitoring Programs for Development Projects in the Northwest Territories, June 2009” and EEM Guidance.

Response 2

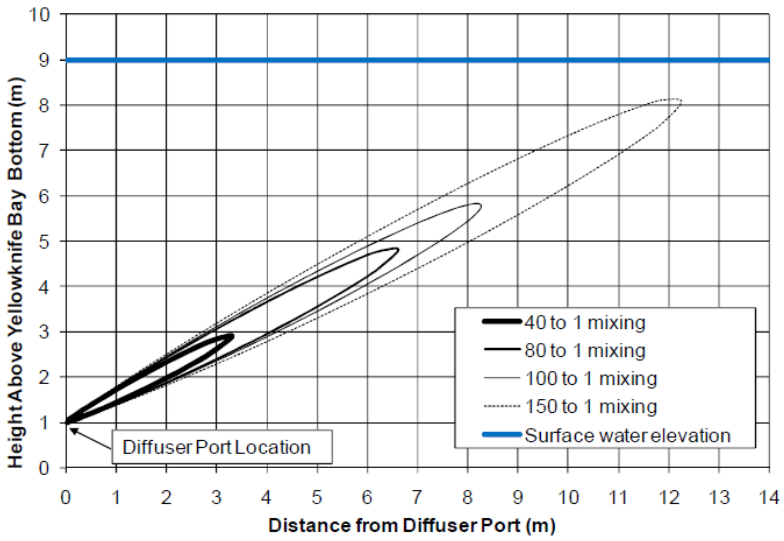
Water quality guidelines have been listed in Table 1 in Response 1 for comparison to the predicted incremental effects of the treated effluent discharge on water quality at the edge of the mixing zone. The guidelines presented in the table are based on published Canadian water quality guidelines for

protection of all freshwater aquatic biota, including sensitive species under a range of exposure conditions.

The guidelines incorporate a factor of safety. To illustrate, the 0.005 mg/L (5 µg/L) Canadian Water Quality Guideline for protection of freshwater aquatic life (CWQG FAL) for arsenic is based on observations that the most arsenic-sensitive species (a type of freshwater algae) have demonstrated growth inhibition at a concentration of 0.050 mg/L. To be protective of these species, the guideline was selected by multiplying the exposure concentration (0.050 mg/L) by an application/safety factor (0.1) to derive the guideline of 0.005 mg/L. In essence, the CWQG FAL guideline for arsenic includes a 10 times factor of safety for the lowest effect levels in a highly arsenic-sensitive aquatic species.

In comparing the predicted incremental effects on arsenic and the other constituents included in Table 1 to the water quality guidelines, it is seen that the predicted increases at the edge of the mixing zone fall below the guidelines for all constituents excepting arsenic. For example, with 100:1 mixing, the upper bound treated effluent discharge arsenic concentration of 0.5 mg/L, the guideline value of 0.005 mg/L would be met in a distance of less than 10 m from the outfall diffuser ports (note the incremental increase does not include the baseline arsenic concentration of 0.0003 mg/L (0.3 µg/L) present in the inflow from the Yellowknife River). The mixing of treated effluent in the vicinity of the diffuser is illustrated in Figure 1.

Figure 1 - Dispersion of Treated Effluent



An important point to be kept in mind is that aquatic biota would not be acutely affected within the mixing zone as effluent toxicity testing of the current treated discharge has consistently been found to be non-toxic in acute toxicity tests.

Response 3

The future Giant Mine and Con Mine treatment plants are designed based on similar process concepts; however, the Con Mine plant operates during summer months only, whereas the Giant Mine plant is expected to operate throughout the year. As a result, the size of the plant is an important factor for Giant Mine as process equipment must be enclosed in a heated building to prevent freezing during the winter. The Con Mine plant is capable of treating ~ 67 L/s compared to the 34 L/s expected for Giant Mine, and, although arsenic is a parameter of concern at both locations, Con Mine also draws from a pond, which should oxidize some of the arsenic (III) present to arsenic (V). A discussion on the design differences between the two process trains follows.

Both plants use chemical addition for arsenic reduction precipitation/co-precipitation with ferric; however, as the Giant Mine plant will obtain water directly from underground, the process also includes an oxidation step to change the state of arsenic from III to V and increase arsenic removal efficiency. Both plants incorporate reaction basins for coagulation and flocculation followed by clarification. The Giant Mine reaction basins have a shorter reaction time than the Con Mine basins as high rate clarifiers will be used instead of traditional clarifiers. High rate clarifiers are capable of handling higher loading rates (resulting in a smaller footprint) and are better able to handle variation in water quality than traditional clarifiers.

Both plants also use chemical addition to raise the pH. In the case of Con Mine, the pH is raised to meet discharge limits. For Giant Mine, raising the pH has the added benefit of precipitating any metals still in solution after precipitation/co-precipitation, and is followed by another clarification step.

Both plants also incorporate filtration to lower the suspended solids concentration after clarification, and send the effluent to storage prior to discharge. However, the Giant Mine system also includes another chemical addition step to lower the pH to meet discharge limits.

Finally, both systems include a sludge recycle step that returns sludge from the clarifier to the reactor basins. This increases the sludge density; thereby reducing the sludge volume.

Table 2 summarizes the effluent quality criteria adopted for the Con Mine water licence for information purposes only. It is expected that appropriate effluent discharge criteria will be developed for the Giant Mine during the detailed design stage taking into consideration factors such as the different receiving environments for the two discharges and differences in the treatment systems and period of operation.

Table 2 - Con Mine Effluent Water Quality Criteria

Parameter	Unit	Maximum Average Concentration	Maximum Concentration of any Grab Sample
Ammonia	mg/L	N/A	N/A
Oil and Grease	mg/L	N/A	5.00
pH	unitless	6.5 - 9.5	6.5 - 9.5
Total Arsenic	mg/L	0.50	1.0
Total Copper	mg/L	0.30	0.60

Parameter	Unit	Maximum Average Concentration	Maximum Concentration of any Grab Sample
Total Cyanide	mg/L	0.80	1.60
Total Lead	mg/L	0.20	0.40
Total Nickel	mg/L	0.50	1.0
Total Suspended Solids	mg/L	20	40
Total Zinc	mg/L	0.20	0.40

Response 4

Based on the discussion in Responses 1 and 2, the Project Team commits to ensuring that site-specific water quality objectives for Giant Mine will protect all designated uses of Yellowknife Bay, including Back Bay. At the current stage of design it is predicted that water quality levels at the edge of the mixing zone will be at or below CCME guidelines for the protection of Aquatic Life. As mentioned above, additional work is planned to ensure that final site-specific water quality objectives are appropriately protective of the aquatic environment and its intended use.

ROUND TWO INFORMATION REQUEST (IR) RESPONSE

EA No: 0809-001 **Information Request No: Yellowknives Dene First Nation IR #02**

Date Received

December 2, 2011

Linkage to Other IRs (Round II)

Alternatives North IR #21

Linkage to Other IRs (from Round I)

Yellowknives Dene First Nation IR #24
Alternatives North IR #01
North Slave Métis Alliance IR #02

Date of this Response

February 17, 2012

Request

Preamble

The YKDFN had previously noted concern regarding the uncertainties about the administration, inspection and regulation of activities at Giant Mine. Further to this concern, YKDFN is interested in understanding the organizational structure within which the AANDC inspector and the Proponent (i.e., Contaminates and Remediation Directorate - CARD) operate. The goal is to understand the authorities within which each division (inspector and CARD) operates, and where potential overlaps in authority exist.

Question

AANDC to provide the organization structure (preferably in chart form) within which the AANDC inspector(s), CARD and regional headquarters operate, with sufficient complementary description to understand the authorities of each division. Where potential overlaps in authority exist, it is requested that a description of the interaction and decision making process is described.

Summary

The Giant Mine Remediation Project Team, Renewable Resources and Environment, and the Operations Directorate are all located in the Northwest Territory Region of Aboriginal Affairs and Northern Development Canada (AANDC). They all have very different functions that help fulfill the mandate of AANDC. A complete listing of positions, roles and responsibilities are available on the Government of Canada and the AANDC websites.

Response 1

A complete organizational structure can be found on the Government Electronic Directory Services website, which can be found at http://sage-geds.tpsgc-pwgsc.gc.ca/cgi-bin/direct500/eng/TE?FN=index.htm.

Below are some links that may be helpful in understanding the roles and responsibilities of each organization:

http://www.aadnc-aandc.gc.ca/eng/1100100010337
http://www.aadnc-aandc.gc.ca/eng/1100100016927/1100100016934
http://www.aadnc-aandc.gc.ca/eng/1100100022896/1100100022897
http://www.aadnc-aandc.gc.ca/eng/1100100027630
http://www.aadnc-aandc.gc.ca/eng/1100100027743

Please see the response to Alternatives North Round 2 Information Request #21 for further explanation on the linkages within AANDC.

ROUND TWO INFORMATION REQUEST (IR) RESPONSE

EA No: 0809-001 **Information Request No: Yellowknives Dene First Nation IR #03**

Date Received

December 2, 2011

Linkage to Other IRs (from Round II)

Alternatives North IR #03

Date of this Response

February 17, 2012

Request

Preamble

A substantial amount of activities are planned to be completed at Giant Mine. It is critical that each mine component have appropriate objectives for reclamation and criteria upon which to measure success. Where there are information gaps that limit the ability to define criteria to measure success, additional information will need to be gathered. The information gaps, as well as, the timeframe to gather information, or complete studies, to fill the knowledge gaps should be defined. YKDFN understands that this information may exist within the submitted materials to MVEIRB; however, Interveners would benefit from a consolidation of information upon which to gauge the completeness of closure and reclamation planning.

An understanding of how to reclaim each mine component, as well as, the objectives and criteria for each mine component are fundamental components of closure and reclamation planning. These concepts are described at length within various guidelines that are typically applied in the NWT[2 &3] including those issued by the Federal Government of Canada.

[2] DRAFT Guidelines for the Closure and Reclamation of Advanced Mineral Exploration and Mine Sites in the Northwest Territories (2011). Developed by the Land and Water Boards of the Mackenzie Valley and Aboriginal Affairs and Northern Development Canada.

[3] Indian and Northern Affairs Canada (2007). Mine Site Reclamation Guidelines for the Northwest Territories.

Question

Within a table format, AANDC to provide the following:

a. A summary of the closure scenario adopted for reclamation of each mine component.
b. The objective(s) of the closure condition.
c. The criteria upon which the measure the success in achieving the objective(s).
d. If criteria are unknown, a description of the information gap, what information is needed to fill the information gap, and a timeframe when this information will be obtained.

Reference to DAR (relevant DAR Sections)

s. 6 Remediation Project Description
s.8 Assessment of Likely Environmental Effects and Mitigation
s.14 Environmental Monitoring and Evaluation Framework and Long-Term Environmental Monitoring

Reference to the EA Terms of Reference

s.3.6 Monitoring, Evaluation and Management

Summary

The response sets out in two tables information regarding the closure scenario components for the Giant Mine site, the core elements of the closure and criteria guidelines for the selection of measures and targets for the objectives. Table 1 sets out objectives and criteria guidelines from an environmental components perspective, while Table 2 focuses on the eleven components of the remediation project as described in the Developers Assessment Report (DAR). Table 1, includes the general criteria that will guide the selection of specific measures and the establishment of targets. Both tables also set out the work necessary to fill information gaps. The majority of gaps are anticipated to be addressed at the detailed design stages of the project and during the development of Environmental Management Plans (EMPs).

Regarding time frames, engagement on the Environmental Management System and EMPs is intended to begin in March, 2012. EMPs are intended to link back to design so that the development of monitoring and evaluation criteria is established in tandem with effective systems to assess project success. Criteria for each component will be integrated within the appropriate EMP. These will be prepared before the implementation of a particular project element proceeds.

Response

Table 1: Objective and Criteria for the Environmental Components of the Giant Mine Remediation Project

Component	Currently Identified Sub-components/ VECs	General Objectives/ Outcomes	Criteria Guidelines (for the selection of specific measures and the establishment of targets)	Ongoing Research
Surface Water Environment	Hydrology	Minimising sediment transport and the mobilisation surface contaminants into water bodies during project development. Re-alignment of section of the Baker Creek channel to carry peak design flows and thus prevent possible flooding of underground mine workings Long-term reduction in contaminant loading from all site sources. Maintenance of CWQG-FAL at the edge of the diffuser mixing zone. Public safety at diffuser.	Percentage change to baseline flow Whether a change results in hydrology being more representative of natural conditions	Further modeling of diffuser design. – This ongoing work is incorporated with water treatment plant design Further site-specific delineation of surface contaminants. – This ongoing work is incorporated into the ongoing surface remediation design Mine water treatability investigations for input to water treatment plant design Design of Baker Creek. Design for Baker Creek is a specific area of design.
	Water Quality		Health Canada's Guidelines for Canadian Drinking Water Quality Canadian Water Quality Guidelines for Protection of Freshwater Aquatic Life (CWQG-FAL) taking into consideration background conditions and the results of the Human Health and Ecological Risk Assessment findings Metal Mine Effluent Regulations Water quality criteria from former water licence Criteria established for other relevant industrial developments	
	Sediment Quality		CCME Interim Sediment Quality Guidelines (ISQGs) and CCME sediment quality Probable Effects Levels (PELs) guidelines as well as results of Human Health and Ecological Risk Assessment findings	
Geological and Hydrogeological Environment	Groundwater Flow	Long-term depression of the groundwater level on site to ensure the capture and treatment of all site waters and to lower the risk of migration of any contaminant to	The degree to which groundwater flows may result in contaminant migration to areas beyond the SSA	Ongoing modeling/ determination of appropriate monitoring stations.

		surrounding ground water	Whether a change may result in groundwater flows being more representative of natural conditions	Site-specific delineation of on-site permafrost.
	Groundwater Quality		Monitoring of contaminant concentrations in groundwater beyond the SSA Health Canada Canadian Drinking Water Quality Guidelines	
	Soil Quality		Monitoring of contaminant concentrations in soils Site Remediation Criteria for Arsenic in the Yellowknife Area CCME Soil Quality Guidelines (Industrial Criteria) Human Health and Ecological Risk Assessment findings	
	Permafrost		Loss of permafrost in previously undisturbed ground	
Atmospheric Environment	Air Quality	Minimising the release of arsenic dust from the site during demolition and tailings stabilizing activities. Long-term stabilization of tailings through armouring/vegetation Minimising air pollution from the operation of equipment and generators. Minimizing noise levels from operation of heavy equipment during reclamation phase and operation on freeze plant	GNWT Ambient Air Quality Guidelines for SO_2, TSP and $PM_{2.5}$ Canadian National Ambient Air Quality Objectives – Maximum Acceptable Concentration for NO_2 Ontario Ministry of the Environment Ambient Criterion for PM_{10} and Airborne Arsenic (adopted by the GNWT)	Types of tailings covers
	Noise Environment		NWT Occupational Exposure Limits Complaints from residents made to municipal authorities	

Aquatic Environment	Aquatic Habitat	Maintaining the quality and quantity of habitat and where appropriate and feasible enhance habitat	Quantity (i.e., area) and quality (i.e., function and relative productivity with respect to the aquatic community)	On-going monitoring of fish and fish habitat
	Aquatic Biota		Potential for population effects on VC species	
Terrestrial Environment	Terrestrial Habitat	Maintain the quality and quantity of terrestrial habitat and species mix and where appropriate and feasible enhance habitat and species use.	Quantity (i.e., area) and quality (i.e., function and relative productivity with respect to the regional terrestrial community).	Baseline studies including habitat utilization studies
	Terrestrial Biota		Potential for population effects on VC species.	
Aboriginal Interests	Aboriginal Communities	Maintain and enhance opportunities for traditional use, where appropriate and desirable. Conserve on-site archaeological resources	Community perceptions of environmental health	Consultation with communities on the inclusion of traditional knowledge and use preferences in project design and implementation. Archeological Assessment
	Traditional Land Use		Magnitude of Project-related changes in Traditional Land Use activities relative to baseline conditions	
	Aboriginal Heritage Resources		Loss or displacement of archaeological artefacts or sites determined to have heritage value	
Additional Community Interests	Land Use, Visual & Cultural Setting	Minimise disturbances to nearby public use during the project development stages. Where appropriate, enhance opportunities for local use of the site. Where appropriate, accommodate heritage conservation interests. Minimize disruption of public use of roads a highways Minimize risk of injury to public in the site development area	Regular disturbance/nuisances to offsite residences, businesses and institutions which may change the manner in which land is used (i.e., increased noise, dust, or traffic) Compliance with legislation, regulations, policy and good planning practice Existing and future use and development of land (impact on present and planned land use) Impact on views and vistas (based on sensitivity of the vantage point; extent of obstruction, distance from mine site and duration of view) Loss or displacement of built heritage features	Consultation with the public and stakeholders on the consideration of use preferences in project design and implementation
	Socio-economic		Magnitude of Project-induced changes in the population relative to baseline and/or projected	

	Conditions		conditions Magnitude of Project-induced changes in employment, business activity, income, municipal costs and revenues relative to baseline and/or projected conditions Magnitude of direct and indirect Project-induced demands on municipal infrastructure and services relative to baseline and/or projected conditions Magnitude of Project-induced changes in housing stock relative to baseline and/or projected conditions	
	Transportation		Likelihood and/or magnitude of changes in onsite traffic levels on public roads Likelihood and/or magnitude of changes in offsite traffic levels Magnitude and frequency of Project-induced changes in motor vehicle accidents relative to baseline conditions	

Table 2: Objectives for the Components of the Giant Mine Remediation Project

Component	Closure Scenario	General Objectives/Outcomes	Criteria Guidelines (for the selection of specific measures and the establishment of targets)	Ongoing Research
Arsenic trioxide dust storage areas	· Arsenic dust stored in underground chambers is contained within frozen blocks, the temperature of which is maintained by passive cooling. Thermal mass of the blocks will allow a long lead-time for adaptations, such as the addition of more thermal siphons in response to changing climatic conditions that may increase average temperatures.	· Freeze in place through ground freezing ("frozen block" method). · Improve stability of storage areas. · Maintain ground-freezing system.	· Frozen blocks attain and sustain -5° C	· Temperature or other criteria for action if frozen blocks begin to warm. To be addressed through additional modelling including building on data from the FOS. · Detailed design of the freeze system. · Environmental Management Plan addressing surface drilling factors.
Other underground mine components	· Underground components will be either decommissioned in place or removed.	· Clean up and dispose of waste materials; · Seal mine openings.	· Compliance with legislation, regulations, policy and good planning practice	N/A
Open pits	· Open pits will be stabilised and managed through a combination of contouring, backfilling, berming and fencing to minimise risks to human health and safety.	· Backfill B1 Pit and Brock Pit. · Place signs, fences and berms to control access to remaining pits.	· Compliance with legislation, regulations, policy and good planning practice	Refinement on volumes of materials.
Waste rock	· Contaminated waste rock will be disposed of in B1 pit.	· Disposal of waste rock in B1 Pit.	· Management of archaeological artefacts or sites determined to have heritage value to avoid loss or displacement consistent with the MVLUR · Site Remediation Criteria for	Archaeological Assessment. Refinement on volumes of materials.

			Arsenic in the Yellowknife Area CCME Soil Quality Guidelines (Industrial Criteria)	
Tailings and sludge containment areas	· Tailings will be graded and covered to minimize transport of contaminants.	· Re-contour and cover with rock and soil to promote drainage and potential revegetation. · Maintain the quality and quantity of terrestrial habitat and species assemblage and where appropriate and feasible enhance habitat and species use.	· GNWT Ambient Air Quality Guidelines for SO2, TSP and PM2.5 · Canadian National Ambient Air Quality Objectives – Maximum Acceptable Concentration for NO2 · Ontario Ministry of the Environment Ambient Criterion for PM10 and Airborne Arsenic (adopted by the GNWT) · Percentage of vegetation cover/ vegetation types compared to targets · Quantity (i.e., area) and quality (i.e., function and relative productivity with respect to the regional terrestrial community). ·	· Baseline plant community studies · Development of site-specific vegetation cover and species type through consultation and site studies (Tailings cover design is dependent on monitoring results from test plots) · Baseline wildlife studies · Additional air dispersion modelling · Development of Environmental Management Plans addressing sludge, tailings, vegetation, wildlife and earthworks factors.
Historic foreshore tailings	· Historic foreshore tailings will be armoured to limit the exposure and transport of contaminants	· Cover in place.	· Resilience of armouring.	· Refinement on volumes · Development of an Environmental Management Plan addressing earthworks factors.
	· The existing water treatment plant	· Construct new water	· Water Licence requirements	· Modelling of discharge

Site water management	will be replaced. The new plant will be developed to operate year-round, the outflow from which will be redirected to Back Bay from the current seasonal discharge into Baker Creek.	treatment plant. · Direct all contaminated water to the mine for collection and treatment. · Treat contaminated water and discharge to Great Slave Lake. · Manage treatment by-products on site. · Water table remains locally depressed through pumping to maintain site capture of water.	· Control of leaching from treatment sludge landfill · Water temperature within the mixing zone · Health Canada's Guidelines for Canadian Drinking Water Quality · Canadian Water Quality Guidelines for Protection of Freshwater Aquatic Life (CWQG-FAL) · Human Health and Ecological Risk Assessment findings · Metal Mine Effluent Regulations · The degree to which groundwater flows may result in contaminant migration to areas beyond the SSA · Whether a change may result in groundwater flows being more representative of natural conditions	to assess potential impacts on ice thickness in the region of discharge · Detailed design of the WTP and outfall/diffuser. · Development of an Environmental Management Plan addressing the operation of the Water Treatment Plant and diffuser.
Baker Creek	· Treated water discharges will no longer flow into Baker Creek. Where necessary portions of the creek will be diverted to reduce the risk of flooding to underground mine workings. Additional channel works will occur to improve the hydraulic performance of the creek and to enhance habitat and manage contaminated sediments.	· Divert portions of creek to reduce risk of flooding of underground workings. · Improve hydraulic performance. · Enhance biological habitat. · Managing	· Quantity (i.e., area) and quality of fish habitat (i.e., function and relative productivity with respect to the aquatic ecosystem) · Comparison of condition in Baker Creek to reference site. · Capacity of new channel to contain high flow events.	· Ongoing assessments of habitat and species health. · Ongoing characterisation of flood risks · Ongoing characterisation of

	· Maintaining the quality and quantity of habitat and where appropriate and feasible enhance habitat	contaminated sediments.	· CCME Interim Sediment Quality Guidelines (ISQGs) · CCME Probable Effects Levels (PELs) · Human Health and Ecological Risk Assessment findings · Implementation of measure to optimize the aquatic habitat of the creek (as opposed to mitigating potentially adverse effects). The Baker Creek rehabilitation concept will, therefore, include a series of "in-design" hydrological features to promote habitat creation. · Examples of the features under consideration include: · 1. Construction of stream channel sections at slopes that create stream flow velocities that encourage fish passage (e.g., grayling); and · 2. Creation of diverse flow regimes and habitat features that enhance conditions for multiple life stages of aquatic species, such as Arctic grayling which spawns in the creek.	sediment contamination · Detailed design Preparation of an Environmental Management Plan
Quarries, borrow pits, and overburden piles	· Quarries, borrow pits and overburden piles will be resloped for improved drainage and stability. Where appropriate they may be further rehabilitated.	· Re-slope for improved drainage and stability;. · Rehabilitate.	· Management of archaeological artefacts or sites determined to have heritage value to avoid loss or displacement consistent with the MVLUR	· Archaeological Assessment · Permafrost Assessment

			· Minimising permafrost and terrestrial habitat loss.	
Contaminated soils	· Contaminated soils will be excavated and backfilled into the zone to be frozen in the B1 pit.	· Excavate and backfill into frozen zone in B1 Pit or treat on surface.	· Site Remediation Criteria for Arsenic in the Yellowknife Area CCME Soil Quality Guidelines (Industrial Criteria) · Removal of PHC contaminated soils · Human Health and Ecological Risk Assessment findings	· Refinement of volumes
Buildings and infrastructure	· Identified buildings cleaned of hazardous material and demolished.	· Remove all hazardous materials and demolish buildings.	· Existing and future use and development of land (impact on present and planned land use) · Impact on views and vistas (based on sensitivity of the vantage point; extent of obstruction, distance from mine site and duration of view) · Degree of retention of built heritage features	· Migratory bird and species at risk studies · Ongoing risk characterisation · Development of Environmental Management Plan addressing decontamination factors.

ROUND TWO INFORMATION REQUEST (IR) RESPONSE

EA No: 0809-001 **Information Request No: Yellowknives Dene First Nation IR #04**

Date Received

December 2, 2011

Linkage to Other IRs (Round II)

Alternative North IR #10

Date of this Response

February 17, 2012

Request

Preamble

The effluent water discharged through the diffuser could have temperatures warmer than the lake. The warmer water can result in thinner ice in the vicinity of the diffuser, or potentially no ice cover. The winter shoulder seasons may be more susceptible to this effect.

YKDFN is concerned about public safety in the vicinity of the outlet diffuser during periods of ice-cover. The public can gain access to the diffuser location by foot or snowmobile when the ice cover is of sufficient strength. However, if there was thinning ice in the vicinity of the diffuser, the ice may not be sufficiently supportive. There is a serious risk for people falling through the ice as a result.

AANDC has previous indicated that signs and public service announcements can be implemented to warm people of the dangers. YKDFN appreciates this effort, but respectfully disagrees with the effectiveness to warn people of the potential dangers.

Question

1. AANDC to provide any information regarding ice thinning in the vicinity of the diffuser in the winter "shoulder" (Freeze up, Spring Thaw) seasons, as well as, in normal winter conditions.

2. AANDC to detail a robust method to ensure public safety due to thinning (and weaker) ice in the vicinity of the effluent diffuser. Efforts beyond previously noted signs and public announcements should be the focus of the discussion.

Reference to DAR (relevant DAR Sections)

s. 6.8.6 Outfall and Diffuser

Reference to the EA Terms of Reference

s.3.2.3 (5) Description of Existing Environment

Response 1

A key to the diffuser design is safety in winter and the ice thickness during the winter operation of the diffuser. The preliminary design indicates that the diffuser will not significantly impact the ice thickness in the winter, however it is important to collect data on ice thickness in the bay in late fall and late spring in addition to the normal monitoring program performed by the City of Yellowknife before snow machines start to use the frozen bay for access across the bay or up the Yellowknife River. The monitoring in the early fall and in the late spring is to confirm the ice is as thick in the diffuser area as in other parts of the bay and would be part of a normal site specific safety monitoring effort.

At present the water temperature in the mine is understood to vary from 2 to 11^{0}C with an average in the range of 8^{0}C. The water temperature in the water treatment plant would be set in the same range to achieve efficient treatment of the mine water before release. The temperature used in the modelling was 9^{0}C or just above the anticipated average water temperature. There is currently limited data on the water temperature in the bay during the fall, winter or spring. Thus, a key to the next stage of the diffuser design is to obtain the information on ice thickness and water temperature over several winter seasons at some 8 to 10 locations in the overall bay area. This information would be used in detailed modeling of the diffuser. The detailed design would consider the water temperature at the discharge point from the water treatment plant, the effect of the water passing along 1 km of pipe buried approximately 1 to 1.5 m below ground surface in cool to cold soil and 1 km along the bay bottom and subject to cooling by the water in the bay. This would be included in the modelling and used to predict the temperature of the water at the diffuser. The diffuser nozzles would also be adjusted in the final design to maximize the mixing at depth and reduce potential effects on the water temperature near the ice cover in the fall and winter.

A water temperature monitoring program would be established to monitor the treated water as it leaves the water treatment plant to confirm the temperature range required to achieve low temperature difference at the end of pipe. To confirm performance, the water temperature would be monitored at the edge of the bay as the water enters the submerged portion of the pipeline to confirm the water temperature prior to discharge.

Response 2

The preliminary design for the diffuser indicates that based on the available data; there should be no measureable thinning of the ice above the diffuser in the winter. There is however a need to monitor the ice to confirm the model results. If monitoring indicates that thinning and weaker ice is an issue as a

result of the effluent diffuser operation, then a robust program to ensure public safety will be implemented and a review of operational requirements would be evaluated. At this point in the preliminary diffuser design, as addressed in question 1, information regarding ice thickness remains outstanding. Once obtained, appropriate public safety measures will be developed and implemented. A plan to monitor the water temperature as the treated mine water leaves the water treatment plant would be key to such a public safety program. Also, regular monitoring in the fall and spring as part of a normal practice in Yellowknife would inform the public of the ice thickness. Monitoring would be based on the City of Yellowknife guidelines for access to Yellowknife Bay in the fall, winter and spring. The monitoring program would be tied to the overall health and safety plan for the Giant Mine Remediation Project.

ROUND TWO INFORMATION REQUEST (IR) RESPONSE

EA No: 0809-001 **Information Request No: Yellowknives Dene First Nation IR #05**

Date Received

December 2, 2011

Linkage to Other IRs (Round II)

Alternatives North IR #01

Linkage to Other IRs (from Round I)

Yellowknives Dene First Nation IR #05, #13, #18, #26
Alternatives North IR #02, #19, #20, #22
Review Board IR #11
Environment Canada IR #02, #15

Date of this Response

February 17, 2012

Request

Preamble

YKDFN advocate the necessity for reporting the performance of reclamation to be a public process. For example, public reporting is critical to understand:

- If reclamation activities are being completed on schedule
- Reclamation of mine components are being conducted as designed/planned
- If there are deviations in reclamation planning as a result of new information
- Results of reclamation monitoring with comparison to predictions
- Comparison of residual effects to predictions
- When mine components are successfully reclaimed and by what standard
- Results of internal and 3rd party audits

There is a general impression that the Federal Government has been moving towards limiting public access to data. A move towards increased secrecy is concerning as was the Projects admission that data would be held from the public.

Question

1. AANDC to summarize the information (i.e., reports, documents) that will be available to the public throughout the reclamation duration of Giant mine. Without limitation, the response should focus on public reporting that details the performance of reclamation, with consideration to the items listed above.

2. AADNC to summarize the information (i.e., reports, documents) that will not be made public. Without limitation, the response should focus on public reporting that details the performance of reclamation, with consideration to the items listed above.

Reference to DAR (relevant DAR Sections)

s.14.1.4 Access to Monitoring Data

Reference to the EA Terms of Reference

s.3.2.5 Accidents and Malfunctions

Summary

The Giant Mine Remediation Project Team (Project Team) acknowledges the importance of facilitating access to records in its care by making every effort to assist the public and ensure a high standard of guardianship for records under its control. In the response to the Alternatives North Round 1 Information Request (IR) #19, it was also noted that the Project Team is bound by the requirements of the *Access to Information and Privacy Act* (*ATIP*), its Regulations, and its related policy instruments.

With respect to reporting on the performance of the remediation of Giant Mine, the Project Team's main vehicle for reporting on the monitoring programs will be the Annual and State of Environment Reports (every three years) to the Mackenzie Valley Land and Water Board (MVLWB). The type and frequency of collection and provision of information will be better defined through finalization of the Environmental Management System (EMS) and the individual Environmental Management Plans (EMPs). As stated in the response to Alternatives North Round 1 IR #20, the Project Team commits to working with the Parties to determine what additional information can be reported to the MVLWB.

In terms of monitoring and remediation information (i.e., reports, documents) that may not be made public this will be determined through application of the *Access to Information and Privacy Act (ATIP)*.

Response 1

As stated in earlier IR responses and at the October 2011 Technical Sessions, the Project Team acknowledges the importance of facilitating access to records in its care by making every effort to assist the public and ensure a high standard of guardianship for records under its control. In the response to

Alternatives North Round 1 IR #19, it was also noted that the Project Team is bound by the requirements of the *Access to Information and Privacy Act* (*ATIP*), its Regulations, and its related policy instruments.

With respect to reporting on the performance of the remediation of Giant Mine, the Project Team agrees that it is critical for the public to be able to access the information in a timely manner in order to understand the state of remediation. The main vehicle for reporting on the monitoring programs will be the Annual and State of Environment Reports to the MVLWB. In more detail, the following information will be available to the public throughout the remediation of the Giant Mine site:

- Annual Report
- State of the Environment Reports (produced every 3 years)
- Subject to any limitations set out in the ATIP, all final research and data regarding monitoring, environmental management plans and spills
- Any information required by legislation, regulation, policy and guidelines
- Monitoring data from Surveillance Network Programs (as requested)
- Summaries of public consultation including issues raised and responses

For specific contents of the Annual and State of the Environment Reports please refer to the response to Alternatives North Round I IR #02.

Response 2

In terms of information (i.e., reports, documents) that will regularly be made public this will include the Annual and State of Environment Reports to the MVLWB as noted above. The type and frequency of collection and provision of information will be better defined through finalization of the EMS and the individual EMPs. As the Project Team committed in the previous Round of IRs, Parties will be engaged in the development of the EMS and will be engaged in determining the type of information collected and provided. For a listing of previously-made commitments please refer to section 15.3 of the Developers Assessment Report. For commitments from Round I of the IRs and the October 2011Technical Session, the reader is referred to the response to Alternatives North Round 2 IR #01.

In terms of monitoring and remediation information (i.e., reports, documents) that may not be made public this will be determined through application of the *Access to Information and Privacy Act (ATIP)*.