



Environmental Protection Operations Directorate  
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Whitehorse, Yukon Y1A 5B7

March 10, 2007

Ms. Judi White, Manager  
Yukon Water Board  
Suite 106, 419 Range Road  
Whitehorse, Yukon Y1A 3V1

Dear Judi:

**Re: QZ04-063 – Ketz River Holdings, Cache Creek**

Thank you for referring the above noted application to this office for review. The following attachment provides Environment Canada's intervention comments concerning Water Licence Application QZ04-063. Environment Canada underlines that, for the project as described in the licence application, the general provisions of the *Fisheries Act* apply to this site: notably with respect to habitat destruction and to deposit of deleterious substances into waters frequented by fish.

DOE is not requesting a hearing on this licence submission; however we would be pleased to attend a hearing if one is called. Please contact the undersigned at (867) 667-3410 if you have any questions regarding this intervention or otherwise seek clarification upon any related matter.

Sincerely,

Eric Soprovich, B.Sc. (geol.). MNRM  
Head, Pollution Prevention

cc:    KRH – Graham Dixon  
      RRDC – Chief Jack Caesar  
      DFO /... / YTG – Water Resources  
      DIAND – Michelle Edwards



## **Environment Canada**

### **Brief to Yukon Water Board**

**Re: Ketza River Holdings  
Ketza River Mine  
“Care & Maintenance” Project  
Water Licence Application QZ04-063**

#### **Introduction**

Environment Canada, Environmental Protection Operations (EC) has completed a review of Ketza River Holdings' (KRH, a subsidiary of YGC) application for a water licence, to replace a lapsed Type A water licence previously held by KRH, for: interim care and maintenance type activities for a period of approximately two years, under cessation of activities following the previous water use licence issued for this project (re: IN90-001). Most importantly, the application requests reinstatement of an authority to discharge waste effluent to Cache Creek and thenceforth to Ketza River. Our understanding regarding at least one portion of the application is that it is presented in order to deal with waste water stored within a tailings impoundment located at the headwaters of the Cache Creek drainage, to undertake general care and maintenance activities: the present application will not form the basis for long-term site management nor for the final decommissioned condition. Environment Canada has some specific recommendations with respect to the licence application.

#### **Mandate**

Environment Canada is mandated under the Fisheries Act in a shared capacity with Department of Fisheries and Oceans (DFO). By Prime Ministerial instruction, Environment Canada is responsible for administration of Section 36 of the Fisheries Act. This section of the Act prohibits the deposit of deleterious substances into waters frequented by fish, or deposit to any place where those deleterious substances may then report to fish-bearing waters. The overall objective of the two departments is to protect and conserve fish, ensure that water quality is not impaired, and that healthy fish habitat is maintained.

#### **Fisheries Resources**

The Mine infrastructure is mainly situated within the Cache Creek watershed: a high-energy, high-gradient tributary to Ketza River. Parts of the previous mining and exploratory footprint is also located within Peel Creek drainage and Misery Creek drainage – both of which report to the larger Cache Creek, and subsequently Ketza River.

Fish surveys have demonstrated that Slimy Sculpin, Round Whitefish, and Arctic Grayling utilize Cache Creek. Members of Ross River Dena Council have stated their past use of Ketz River and Cache Creek for salmon and grayling harvesting. Fisheries and Oceans Canada has indicated that there is expected use by Chinook Salmon of the lower reaches of Ketz River for rearing and some spawning possibilities; however to our understanding there is no other evidence of salmon use in Cache Creek.

### **Specific Licence Recommendations**

**Recommendation 1 – Prohibition from mining/milling during term of two-year licence.**

**Recommended Clause:** *The Licencee is prohibited from mining ore or from processing (milling) ore at the Ketz River Mine property during the term of this licence.*

#### **RATIONALE**

*The project description has developed through a series of iterations over a two-year period, resulting with some confusion regarding the full nature or the proposal. Nevertheless, the overall concept is that the project is presented with the understanding that mining and milling activities do not form a part of the project scope. Although the initial licence application (schedule 4) suggested “reopening”; it has since been clarified that this does not include mining and milling, which would lead to production of a commodity and likewise production of additional waste. It is with this understanding in mind that the project has been reviewed by Regulators, risks of the project over the two-year term assessed, and recommendations developed for the Board to consider. For these stated reasons, EC feels it is necessary that the Board underline to the Licencee those limited activities applicable to the present licence application – activities the Licencee would be allowed to pursue during the two-year licence term.*

**Recommendation 2 – Prohibition from lowering tailings pond below elevation 1310.2 m (2.0 m below spillway invert). Notification to the Board 14 days in advance of any surface discharge from the tailings pond, including discharge of treated tailings pond water.**

**Recommended Clause:** *The Licencee is prohibited from actively lowering the tailings pond level to below 1310.2 m elevation a.s.l. (2.0 m below spillway invert) during the term of this licence. The Board shall be notified within 14 days prior to any planned surface discharge of effluent from the tailings pond, including discharge of treated*

***effluent. The Licencee shall notify the Board immediately of any unplanned surface discharge from the tailings pond.***

## RATIONALE

*The Licencee indicates in their application the desire to continue to “manage” the geotechnical instability of the tailings dam by reducing the tailings pond elevation via what appears to be direct discharge to Cache Creek. An authorization for this activity was previously granted to the licencee on an “emergency” basis, as a result of one of several recommendations contained within a geotechnical report commissioned to address then-exigent geotechnical concerns regarding the Ketzta tailings dam in 2005 (Exhibit 1.5.3; SRK 2005). That report recommended a then-immediate response of lowering the tailings pond water to within an elevation range of 1310.7 to 1310.2 m a.s.l. (1.5 - 2.0 m below the spillway elevation) in order to provide a suitable factor of safety for dam stability. Other recommendations were also made in that report for stabilizing the dam and improving the factor of safety for that facility. EC understands that these other recommendations would reduce or abate reliance upon what presently appears to be a primary response of tailings pond water withdrawal. Lowering of the pond water level should only be considered as a temporary measure until longer term mitigation measures are implemented to provide for the geotechnical stability of the tailings containment system.*

*The lowering of the Ketzta River tailings pond has resulted with the exposure of arsenic-rich oxide tailings over a large area mainly adjacent to the inside face of the tailings dam. Previous testing of Ketzta tailings by EC has confirmed the presence of iron-calcium arsenates as one of several arsenic-bearing minerals present in the tailings – it is understood that these materials can be expected to dominate arsenic release from the site for a long term (hundreds or thousands of years). Several researchers have observed the long-term instability of iron arsenates and calcium arsenates when exposed to the atmosphere in moist systems. Thus proper management, for at least some of those minerals contained in the Ketzta tailings, may be to inhibit tailings exposure to air and water. This long-term objective runs counter to the present tailings pond management.*

*If the Licencee were to lower the pond level to a lower elevation; this would result with exposure of additional oxide tailings at the Ketzta tailings facility. Considering that the previous allowance was made to provide for dam stability based upon recommendations of the geotechnical engineer; it cannot also be said that further lowering the tailings pond level will provide any additional benefit to the tailings dam without possibly inducing other (eg. geochemical) risks to the tailings system, and to the receiving environment. Elevation 1310.2 m a.s.l is the lower end for the recommended tailings pond draindown elevation as recommended by the geotechnical consultant to address stability issues in the very short term. Any further draindown, below the recommended level, via direct release of contaminated water as most recently practiced, does not provide the correct management approach.*

**Recommendation 3 – Previous licence to be referred to (eg. as a “template”) for deliberations concerning the current licence, recognizing however the need for updating to reflect current realities including:**

- **Limitation to term of licence;**
- **Allowable uses of water (eg. prohibition from mining and milling activities);**
- **Changes to relevant legislation and licence references to applicable legislation/regulations;**
- **Advances to scientific understanding of toxicity of arsenic and other contaminants and thus protection of the aquatic environment and humans;**
- **Updated understanding of current level of environmental risk and liability, and of future liabilities and risk.**

#### RATIONALE

*The previous water licence was developed in consideration of development plans for the Ketzka River Mine, and thus was intended to reflect the mine condition during and as a result of operation, and those resulting requirements for monitoring environmental impact from water use – including deposits of waste to the affected watersheds. No new project has been advanced in respect of the Ketzka River Mine site: the Ketzka River Mine can be considered to have been in a state of mining cessation since about 1992. In addition there is little new information which has been presented to Regulators and to the Board as a result of the current application for a water licence. Those matters relevant to the present development of the site, presented at Water Board hearings in the past to form the most previous water licence, have already been openly discussed with the Board and thus many of those arguments can be considered to be valid today – for a currently-described project which does not propose expansion of activities or of the environmental footprint beyond the previous project.*

*There are realities to consider in forming a new water licence, however, from an administrative aspect with respect to changes in legislation since the most previous licence was issued; and from the aspect of the evolving scientific and technical understanding of environmental risk and liability in the short-term (licence term) and longer-term (site closure). These new aspects are germane to the current discussion and thereby central to the Board’s present consideration. Previous licences, however, provide a handy reference or tool to use in the course of deliberation for understanding how the site has evolved and issues were considered previously, for the design of a new licence to cover the next two-year period.*

**Recommendation 4 – Water Quality Objectives met in the receiving environment:**

- ❖ **0.02 mg/L Total Arsenic at KR-8 Cache Creek below Oxo (interim objective)**
- ❖ **0.005 mg/L Total Arsenic at KR-12 Ketzka River CCME (long-term objective) for the protection of aquatic life.**

## RATIONALE

*Based upon the concept from the previous licence (IN90-001, s.3 Waste Discharge Standards), and past licence discussion/deliberation; the Water Board has previously requested that water quality below the confluence of Cache Creek and Oxo Creek should not exceed the water quality objective of 0.05 mg/L dissolved arsenic. The CCME guideline value for protection of aquatic life in 1987 was 0.05 mg/L. In 1999, the CCME updated its information and found that phosphorous uptake by algae was impaired by a concentration of 0.05mg/L arsenic. The CCME guidelines use a safety factor of 0.1 for contaminants that do not bioaccumulate in order to provide protection at all times for aquatic species. CCME suggests that water quality be monitored based upon total chemical analysis to maintain conservatism.*

*Cache Creek below Oxo Creek possesses fisheries resources (arctic grayling, sculpin, and whitefish), benthic invertebrates, and attached algae. Station KR-8 is suggested for an interim water quality objective of 0.02 mg/L measured as total arsenic. We have noticed that within the system between KR-8 and those nearest d/s stations which we have monitored there appears to be fractioning of the total and dissolved arsenic load in water: with total arsenic measured at below 0.02 mg/L (T. As), and the dissolved fraction in water measured near or below 0.005 mg/L (D. As). What appears to be a relationship between the total and dissolved load is limited to few observations, however, therefore the suggested objective should be utilized as an interim objective until the observed relationship is better established. We have also highlighted that it is the dissolved fraction which is bioavailable to the most sensitive species. The above recommendation, with respect to the guideline value at KR-8, is also determined relative to our present understanding of fish value and utilization for this reach of Cache Creek; and relative to some uncertainty regarding applicable reference background water quality conditions for an “un-impacted” Cache Creek.*

*Station KR-12 should receive the full protection afforded by the CCME guideline. Ketzka River has known fish utilization and fish value. There has been limited development in the Ketzka River mainstem, and as such there is expected to be very little to not-significant degree of cumulative impacts which should be reporting to this valued system.*

**Recommendation 5 – At a minimum: discharge standards at least consistent with previous licence. Highlighted maximum arsenic discharge limit, and changes to Total Suspended Solids and pH. Highlight the non-toxicity requirement.**

### **Recommended Partial Clause:**

*No waste discharge from seepage points KR-4 and KR-5 shall exceed the following limits (maximum concentration for any grab sample):*

<i>Total Arsenic</i>	<i>0.05 mg/L</i>
<i>Total Suspended Solids</i>	<i>not greater than 15 mg/L</i>

*pH* *equal to or greater than 6.5 pH units and not greater than 9.5 pH units*

*No waste discharge from the tailings pond shall exceed the following effluent quality standard (maximum concentration for any grab sample):*

<i>Total Arsenic</i>	<i>0.3 mg/L</i>
<i>Total Suspended Solids</i>	<i>not greater than 15 mg/L</i>
<i>pH</i>	<i>equal to or greater than 6.5 pH units and not greater than 9.5 pH units</i>

*Any discharge from the project shall meet the non-toxicity requirement defined by a 96 hour LC<sub>50</sub> bioassay of 100%, using rainbow trout.*

**RATIONALE**

*The previous licence provides a starting point from which to open discussion with respect to discharge limits. That licence reflected the proposed development project as originally envisaged, and provides a modicum of comfort for the interim two-year period. It is recognized that there may be the possibility now or in the future for referring to additional discharge points from the various parts of the present development, and as such the Licencee should ensure that no site component is allowed to discharge water uncontrolled at concentrations which may exceed the above standards.*

*We are highlighting arsenic as the main metal (metalloid) contaminant of concern, for the interim two-year period, recognizing that arsenic is likewise the most likely contaminant to focus upon at this time since it is present in some key Ketzka mine wastes at high concentrations and because arsenic is mobile under many environmental conditions. While a strong argument is possible for reducing the arsenic discharge standard (tailings pond), we are presently deferring to the previous licence. We are also highlighting an arsenic standard (vesus other metals of concern) because the Licencee has proposed relaxing the arsenic discharge standard from previous licences yet has not provided adequate rationale for why a higher discharge limit should be necessary – the request seems to be based upon a recent “emergency” situation to release water in order to stabilize the tailings dam. Continued reliance upon directly discharging high-concentration arsenic-bearing wastewater to Cache Creek cannot be described as approaching pro-active management at the site.*

*While EC is deferring to the previous discharge standard as an interim standard for arsenic for the present licence application and term: we have not highlighted discharge*

*levels for the other metal contaminants of concern and as such leave that to the Board's discernment. EC suggests the Board refer to the previous licence and licence deliberations. A different project description for this site with a different proposed licence term would entail a larger technical presentation from EC in this matter. That being said: there may be an argument to reduce maximum release concentrations for all the metals, especially in consideration of the long-term condition, once more is known about the presence of each of these metals in current mine wastes and in reflection to known mobility factors for each.*

*The suggested discharge standard for total suspended solids of 15 mg/L is reduced from that required of the previous licence in reflection of the lower TSS limit suggested of other, similar industrial operations. An upper limit for pH is suggested for inclusion to the new water licence in order to reflect the fact that environmental impacts to receiving waters can occur due to discharge of not only low (acidic) pH conditions but also via discharge of alkaline wastewaters. The non-toxicity requirement is a standard test as observed relevant to the Fisheries Act. For clarity, and enforceability, all waste discharge standards should be based upon a grab sample.*

**Recommendation 6 – Incorporate monitoring according to suggested surveillance plan presented in Table 1 of Exhibit 1.7 (EBA; 29 August 2006) with the following changes/additions and/or clarifications:**

- **Add station KR-2 – Well Water Supply (minimum Q when in use)**
- **Add station KR-3 – (Underground) Mine Settling Pond Overflow / (Underground) Mine Seepage Discharge (minimum Q)**
- **Add station KR-9a – Tailings Pond if Discharging (minimum D/W)**
- **Add station Tarn Lake Outflow – Background Station (minimum M during open water)**
- **Add Gully Pit – Gully Pit Mine Water (ponded water / discharge – minimum M during open water season)**
- **Add stations P89-1, P89-3, P89-4, P89-5, P89-6A, P89-6B – 7/8 inch ID piezometers (for Static Water Level only, minimum Q)**
- **Add requirement for Continuous Flow Recording at station KR-8**
- **Clarify “Physical Parameters” for surface water stations to include as a minimum: Flow Rate (Pond Elevation for station KR-9); Field Temperature; Field pH; Field Conductivity; Field Specific Cond.**
- **Clarify “Physical Parameters” for groundwater stations to include as a minimum: Static Water Level; Purge Volume; Purge Rate, Purge Time, Sample Time, Field Temperature; Field pH; Field Conductivity; Field Specific Cond.**
- **Clarify “Chemical Parameter” for surface water stations to include as a minimum: Total Metals (ICP multi-element metal scan – low/trace level method detection limit) plus Hardness; Total Suspended Solids; Total Sulphate; Total Alkalinity; Total Acidity; Ammonia (as N);**
- **Clarify “Chemical Parameter” for surface water stations KR-9, KR-9a, KR-4, KR-5 to also include as a minimum: Nitrate-N; Nitrite-N**

- **Clarify “Chemical Parameter” for surface water stations Tarn Lake Outflow, KR-1, KR-8, KR-12, KR-14 at minimum to also include Dissolved Metals (ICP multi-element metal scan – low/trace level method detection limit) in addition to the other noted parameters**
- **Clarify “Chemical Parameter” for groundwater stations to include as a minimum: Dissolved Metals (ICP multi-element metal scan – low/trace level method detection limit); Total Sulphate; Total Alkalinity; Total Acidity; Ammonia (as N); Nitrate-N; Nitrite-N**

## RATIONALE

*The application presents an array of possible monitoring points and schedules: Table 1 of Exhibit 1.7 has been most-recently supplied by the Licencee as a compendium of monitoring points, parameters, and periods. The above recommendation seeks to clarify aspects of that table’s contents and to provide for additional coverage where there appear to be gaps in the monitoring scheme. Additional coverage comes about as a result of loss of monitoring stations from the previous licence, plus assessment of additional needs from an evolved understanding of the state of project development and resulting site conditions since the last water licence was formed over 15 years ago. In essence:*

- *Station KR-2 was in the previous licence and provides a check on water quality for the health of workers at the site. This would be monitored so long as the water supply well is being used;*
- *Station KR-3 was in the previous licence and provides a monitoring check on water quality from the underground mine workings, mainly, and thus an indication of the geochemical evolution of underground water-rock condition. EC’s understanding is that this discharge flow is seasonal, and when present should report to the tailings pond;*
- *Station KR-9a is a new station, essentially the surface discharge from the tailings pond, and is suggested here to clarify this monitoring point as being separate from the pond itself (ie. KR-9). EC suggests monitoring this point if a discharge occurs (daily for physical parameters, and additionally weekly for chemical parameters);*
- *Station Tarn Lake Outflow is suggested as a background station for the site given that KR-1 does not reflect true background conditions (being downgradient and influenced by previous mining and both previous and present exploration activities). Tarn Lake is a preferred background-type station since it is in the mainstem of Cache Creek upgradient of known disturbance and since it is expected to maintain a large component of influence (eg. flow) upon Cache Creek throughout the year. EC realizes that access to Tarn Lake is likely limited during parts of the year, and as such KR-14 (Oxo Creek) may be a reasonable alternate station (depending upon development in the Oxo Creek watershed and other factors) and is more accessible throughout the year;*
- *Station Gully Pit is suggested as an additional sampling point since previous monitoring demonstrates that active ARD processes are occurring in this mined area with resulting mobilization of metal contaminants (ML processes). This is*

- one of the known pit areas for which management will have to be developed, especially for the long-term (closure), therefore it is important to gain an understanding of the geochemical evolution through monitoring as one component of that investigation;*
- o Stations P89-1, P89-3, P89-4, P89-5, P89-6A, P89-6B have been monitored in the past and are suggested here for measuring static water level only to complement the physical hydrogeological interpretation for the tailings area;*
  - o Continuous flow recording was a requirement of the previous licence and is an important monitoring parameter to aid in the understanding of the physical aspect (flow) of receiving water conditions. The present installation would need to be refurbished, or an alternate, improved monitoring station installed at KR-8;*
  - o Clarification is necessary in order to include the suggested parameters at a very minimum, since there is little firm indication in the application of what “physical parameters” and “chemical parameter” are being proposed for the monitoring program. We highlight that the suggested parameter sets suggested above comprise only a minimum acceptable surveillance program, and as such it is reasonable to expect that other parameters of interest should also be monitored at the various sites in order to fully understand site conditions, characterize discharge effluents, and understand potential impacts of the current project.*

**Recommendation 7 – Sediment analysis, periphyton composition, and invertebrate monitoring program to be conducted once per the two-year term of the licence.**

**Recommended Clause:** *The Licencee shall, within the term of this licence, conduct a receiving water monitoring program to include: sediment analysis; periphyton composition; and benthic monitoring. The following stations, at a minimum, will comprise the monitoring stations employed from such a program: KR-1, KR-8, KR-10, KR-11, KR-12, and KR-14 (Oxo Creek above Cache Creek). The monitoring program described herein shall be conducted in concurrence with a water quality sampling campaign. Details of the relevant monitoring programs, including parameters are contained in the schedules to this licence. Results from this monitoring program shall be reported along with the results of other programs in an Annual Report filed to the Board.*

**RATIONALE**

*The Licencee should provide information to the Board in regard to the health of aquatic systems which are associated with, and as a result may be impacted by, the project and project area. The sediment monitoring program provides a good temporal and spatial tracking of contaminants in the aquatic system. A monitoring program which is directed as well at periphyton organisms and benthic invertebrates provides information related to health for the aquatic components that are most directly-sensitive to the controlled contaminants.*

**Recommendation 8 – The Licencee conduct a seep survey program to monitor seeps from, and ponded water associated with, mine components (underground workings, open pits, waste rock dumps). A seep survey program should be conducted twice during the first year (spring and late summer) and once more during the second year of the licence term. Relevant parameters for such a seep survey program would include, at a minimum: geo-referenced location; flow/volume; field temperature; field pH; field conductivity, field specific cond.; total suspended solids; total and dissolved (field-filtered) metals; total alkalinity; total acidity; total sulphate.**

#### RATIONALE

*The Ketzka River Mine property has a fairly extensive footprint comprising activities in the Cache Creek, Peel Creek, and Misery Creek watersheds. Peel Creek and Misery Creek report to Cache Creek downstream of KR-8. Developed features in these watersheds, from previous project development include: underground adits/portals and associated waste rock dumps near adit/portal entranceways; open pits and related waste rock dumps, access roads, exploration trenching and pads, rock lay-down / ore stockpiles near the mill, and other site features. Previously reported water quality during 1995 (post-mining) for water discharging from the 1430 portal has returned total arsenic up to almost 1.5 mg/L and dissolved arsenic to about .5 mg/L (SRK. 1995. Report W103103, Ketzka River Mine Tailings Testing Report. Report prepared for YGC Resources Ltd.). Elevated arsenic has been reported for standing water in Tarn Pit, while Gully Pit which is located in the Peel Creek drainage has exhibited classic ARD/ML geochemical reactions (eg. low pH water of 2.74 mg/L; and high concentrations of total sulphate, arsenic, copper, nickel, and zinc). The above recommendation to monitor seepage and other water from pits, underground development, waste rock dumps and other notable site features would better enable an understanding of site geochemistry property-wide (for specific features) and potential for impact to the receiving environment. Information from this monitoring program would be useful for input to an understanding of the closure conditions for the site*

**Recommendation 9 – Requirement to submit a Final Reclamation Plan within the term of this licence, and to reapply for a water licence at the time of submission to incorporate the plan. The final detailed Decommissioning and Reclamation Plan should result with a project area which is geochemically and geotechnically stable; respecting the long-term requirement for CCME receiving environment objectives in Cache Creek and Ketzka River, and ensuring that any remaining structures are designed and built for long-term physical stability (eg. PMF and MCE standard).**

**Recommended Clause: *The Licencee shall, within the term of this licence, submit to the Board a water licence amendment application to incorporate: a final detailed Decommissioning and Reclamation Plan which is consistent with the recommendations of the Yukon Environmental Assessment Act (YEAA) final screening report, and which covers all the current site components relevant to the present***

*development (eg. depleted open pits and underground workings, waste tailings, waste rock dumps, other infrastructure related to the mine project footprint), and related mitigations recommended within the YEAA final screening report, into that licence.*

#### RATIONALE

*DOE cannot emphasize enough the importance of bringing this requirement into the present licence. The Ketz River Mine ceased production in 1990 and has remained relatively unattended since. There is currently slightly more than 324 Thousand tonnes of oxide tailings composed of 4% by weight of arsenic contained behind the north and south dams at Ketz River Mine – this arsenic is readily mobile and monitoring indicates what appears to be breakthrough of dissolved arsenic reporting to groundwater downgradient of the tailings pond. Seepage water reporting at the dam toe has degraded in quality with respect to arsenic concentrations. There are also geotechnical concerns associated with the tailings dam and associated diversion structures. A number of underground mine openings, open pits, waste rock dumps and other related features were developed to feed the mill: some of these components exhibit aspects of geochemical and geotechnical instability. A technically defensible closure plan, including one which incorporates all the mine features, has not been produced for Ketz River Mine.*

*Environment Canada feels that given the continuing evolution in contaminant generation and degrading physical conditions at the project site, in light of the long-time absence of an acceptable and comprehensive site closure plan, it is necessary to address this issue sooner rather than later – within the short time-frame afforded by the current licence term applied-for. While EC recognizes there may be further plans for the site which may require production of a “compartmentalized plan” – with some portions developed better than others – the present operator should nonetheless be in a position to identify those presently-developed features for which no further development is likely and thus can be isolated for closure planning purposes. These considerations said: Environment Canada wishes the Board to consider incorporating into the Applicant’s water licence, the requirement to file a final and comprehensive reclamation and decommissioning plan which is consistent with the recommendations made in the EAA final screening report. The licence requirement will provide certainty with respect to allowing an opportunity for regulatory review of the plan, including financial security required for reclamation. This present forum appears to be the appropriate means by which to expedite the requirement.*

**Recommendation 10 – Proponent to perform site monitoring using documented and validated methods in accordance with generally-accepted standards of good scientific practice. Reference to ASTM/Standard Methods/others as appropriate.**

#### RATIONALE

*Site monitoring should be conducted according to generally accepted methodologies which are scientifically-defensible in order to provide critical information of reasonable*

*accuracy. Highlighting this requirement, along with examples of applicable sources detailing proper scientific/technical procedure, promotes collection of quality data necessary to understand the project site and how it fits within the surrounding environment. One example of an applicable scientific reference for site monitoring of groundwater is: Standard Guide for Sampling Ground-Water Monitoring Wells, ASTM D4448-01, ASTM International, PA, USA.*

## **Appendix to Brief**

### **Example Schedules:**

#### **Sediment Monitoring Program**

- a) The Licencee shall conduct a sediment monitoring program on a bi-annual basis during summer low flow, which is generally July/August.
- b) The sediment shall be collected as follows:
  - i. Sediment samples shall be collected in replicates of three from within the active channel, directly into high density plastic sample jars, using an aluminum or Teflon scoop.
  - ii. The samples will be dried and screened, using sieves at ASTM mesh numbers 10, 20, 40, 60, 100, 140 and 270 (ASTM-E11-61) and the fraction weights shall be recorded.
  - iii. A sub-sample composed of material passing through the 100 mesh number sieve shall be analyzed for metals by a 33 element ICP scan. Loss on ignition (LOI) shall also be determined by heating the sample to 600 degrees C.
- c) The sediment sample locations shall be at the following monitoring stations, which are described in the Surveillance Network Program of this licence: (insert stations here).
- d) Data analysis shall include an evaluation of the information against baseline information, where it exists.

#### **Benthic Invertebrate Monitoring Program**

- a) The benthic invertebrate monitoring program shall be conducted bi-annually, during July/August as follows:
  - i. Three replicate samples will be taken by a circular Hess sampler (0.0934 m<sup>2</sup>) or Waters and Knapp sampler (0.089 m<sup>2</sup>) equipped with a 250 um mesh net.
  - ii. Samples will be preserved with 10% formalin solution, and identified to the lowest possible taxon (usually genus) and counted.
  - iii. Stream information collected at the time of benthos collection will include: velocity, depth, temperature, substrate conditions and riparian conditions.
  - iv. Routine water quality sampling will be collected at the start and finish of the benthic invertebrate sampling program.
- b) The benthic invertebrate sampling locations shall be at the following monitoring stations, which are described in the Surveillance Network Program of this licence: (insert stations here).

### **Periphyton Monitoring program**

- a) The licensee shall conduct a periphyton monitoring program on a bi-annual basis during the summer low flow period as follows:
  - i. Periphyton samples shall be collected from rock by surface scraping ( 3 or more rocks combined) – the total surface area of rock scraped at that station shall be recorded.
  - ii. Each sample shall be preserved with Lugols solution.
  - iii. Each sample shall be submitted for enumeration and identification to the lowest taxonomic level
- b) Periphyton sampling locations shall be at the following monitoring stations, which are described in the Surveillance Network Program of this licence: ( insert stations here)
- c) The results from the periphyton monitoring program shall include: date of completion, company performing the identification, enumerations and identifications per stations, method used to perform sorting and analysis of the data, and resource materials used for identifications.