Stantec Consulting Ltd.
845 Prospect Street
Fredericton, NB E3B 2T7
Tel: (506) 452-7000
Fax: (506) 452-0112

July 29, 2013
File: 121810356

Kim Allen, MEM, P.Ag.
Project Manager, Environmental Assessment Section
New Brunswick Department of Environment and Local Government
P.O. Box 6000
Fredericton, NB E3B 5H1

and

Joanne Weiss Reid, MES, MPlan
Project Manager, Atlantic Region
Canadian Environmental Assessment Agency
1801 Hollis Street, Suite 200
Halifax, NS B3J 3N4

Dear Ms. Allen and Ms. Weiss Reid,

RE: RESPONSES TO COMMENTS RECEIVED FROM PROVINCIAL AND FEDERAL REGULATORY AGENCIES ON THE SISSON BASELINE TECHNICAL REPORTS

On behalf of Northcliff Resources, Stantec respectfully submits this response to comments received from provincial and federal regulatory agencies on the various Baseline Technical Reports for the Sisson Project. Specifically, responses are provided for:

- Comments from Environment Canada on the Baseline Vegetated and Wetland Environments Technical Report, the Baseline Wildlife and Wildlife Habitat Technical Report, and the Baseline Aquatic Environment Technical Report, received via email to John Boyle on July 30, 2012;
- Comments from the Technical Review Committee (TRC) on the Baseline Aquatic Environment Technical Report, received via letter from the New Brunswick Department of Environment and Local Government, Environmental Assessment Section, dated September 4, 2012;
- Comments from the Technical Review Committee (TRC) on the Baseline Vegetated and Wetland Environments Technical Report, received via letter from the New Brunswick Department of Environment and Local Government, Environmental Assessment Section, dated September 12, 2012; and
- Comments from Health Canada on the Baseline Metal Concentrations in Soil and Biota Technical Report, the Baseline Ambient Air Quality Technical Report, and the Baseline Sound Quality Technical Report, received via letter addressed to Joanne Weiss Reid dated October 10, 2012.

Responses are provided in Tables 1 through 6, Attachment A. A separate table is provided for each report for which comments were received.

RE: RESPONSES TO COMMENTS RECEIVED FROM PROVINCIAL AND FEDERAL REGULATORY AGENCIES ON THE SISSON BASELINE TECHNICAL REPORTS

In addition to these, Stantec, on behalf of Northcliff Resources, has previously submitted a response to the Fisheries and Oceans Canada Science Review of the Baseline Aquatic Environment Technical Report on November 14, 2012. This response is included as Attachment B.

The Baseline Aquatic Environment Technical Report has been revised as a result of the comments that were received, as outlined in Table 4, Attachment A.

The Baseline Heritage Resources Technical Report has also been revised to reflect the results of interviews with First Nations knowledge holders, and to provide additional clarity to existing text.

The revised Baseline Aquatic Environment Technical Report and Baseline Heritage Resources Technical Report will be included with other baseline technical reports on the FTP site to be used to transmit the EIA Report to the federal and provincial governments. They will also be included on a CDROM with the printed copies of the EIA Report.

We trust these responses and revised reports will be acceptable to provincial and federal regulators, and that they will be useful in the EIA review process.

Sincerely,

STANTEC CONSULTING LTD.

Denis L. Marquis, M.Sc.E., P.Eng.
Principal, Environmental Services
Project Manager for Sisson Project EIA
(06) 452-7000 ext. 3215
denis.marquis@stantec.com

Attachment A: Responses to Comments Received from Provincial and Federal Regulatory Agencies on the Sisson Baseline Technical Reports, Tables 1-6

Attachment B: Response to the DFO Science Review of the Baseline Aquatic Environment Technical Report for the Sisson Project

c. John Boyle, B.Ap.Sc., MNRM, PhD – Northcliff Resources Ltd.

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Attachment A

Responses to Comments Received from Provincial and Federal Regulatory Agencies on the Sisson Baseline Technical Reports, Tables 1-6

Table 1 Comments and Responses Regarding the Baseline Ambient Air Quality Technical Report

Reference Number	Comment	Response
Comments Received from Health Canada on June 28 and September 10, 2012		
1.	The proponent should specify the Chemical Abstracts Service (CAS) numbers for all substances in the document. When discussing a substance that may be confused with another, the CAS number and substance name should be provided. For example, in Table 2.1 (Summary of Ambient Air Quality Objectives, Standards and Criteria) it is unclear whether Chromium is total Chromium or Chromium VI, and for mercury, whether it is Mercury or mercury (as Hg)-alkyl compounds. This information is relevant in order to evaluate the estimated exposure and risk to human health relative to ambient air quality criteria.	In Table 2.1 the compounds referred to are as per the referenced 2008 Ontario Ambient Air Quality Criteria, which provide CAS numbers. CAS numbers for compounds referred to in Table 2.1 are provided as follows. For further clarity on the two compounds specifically mentioned, the mercury standard provided in Table 2.1 is for Mercury (Hg) while the OMOE also lists a standard for alkyl compounds of 0.5 µg/m^3 for 24 Hour average. Chromium referred to is for di- and trivalent forms. The values in Table 2.1 were chosen as published criteria for evaluation of ambient air quality, not exposure and risk to human health which was reviewed through the HHERA. Antimony (Sb) - 7440-36-0 Arsenic (As) -7440-38-2 Barium (Ba) -7440-39-3 Beryllium (Be) -7440-41-7 Cadmium (Cd) -7440-43-9 Chromium (Cr) -7440-47-3 Cobalt (Co) –7440-48-4 Copper (Cu) –7440-50-8 Lead (Pb) - 7439-92-1 Manganese (Mn) -7439-96-5 Mercury (Hg) -7439-97-6 Molybdenum (Mo) -7439-98-7 Nickel (Ni) -7440-02-0 Selenium (Se) -7782-49-2 Vanadium (V) -7440-62-2 Zinc (Zn)- 7440-66-6 No revision to the technical report is required.

Table 1 Comments and Responses Regarding the Baseline Ambient Air Quality Technical Report

Reference Number	Comment	Response
2.	Table 2.1 (Summary of Ambient Air Quality Objectives, Standards and Criteria) – The proponent should provide the particulate matter (PM) size fraction in which the metals were measured. This information is important in order to evaluate estimated exposure and risk to human health relative to ambient air quality criteria.	Table 2.1 lists only the criteria to be compared to ambient measured data. These values are based on published criteria as referenced in the footnote of the table. That stated, the PM fraction relevant for analysis of trace metals is for total particulate matter. The criteria doesn't specify a smaller fraction. No revision to the technical report is required.
3.	Section 2.1.2 Ambient Air Quality, page 5 – The report states that "*Ambient air quality in New Brunswick can generally be characterized as good most of the time, with few exceedances of the provincial ambient air quality objectives or Canada-wide Standards*." The proponent should provide more details including the substances referred to and the frequency and magnitude of exceedances above provincial ambient air quality objectives and/or Canada-wide Standards.	Section 2.1.2 is intended to be a high level overview of ambient air quality in the region, therefore some of the specific details mentioned in the comment are not included but are provided in the report. The reader is referred to the NBDELG ambient air quality report for further specific details. Following this statement in Section 2.1.2 referred to in the comment, the frequency of exceedance is provided as follows: "Based on the most recently available data from the NBDELG, compliance with the ambient air quality objectives is greater than 98% for the contaminants measured at the monitoring sites in the provincial network in 2009 (NBENV 2011). Additionally, a gradual improvement in air quality has been observed in the province in recent years when compared to historical levels, with 2009 having the highest levels of compliance with the provincial objectives on record." Specific substances monitored and recorded magnitudes are provided in Section 2.2.2 for existing stations near the Project. No further detail is believed to be required to support these statements. No revision to the technical report is required.

Table 2 Comments and Responses Regarding the Baseline Sound Quality Technical Report

Reference Number	Comment	Response
Comments Received from Health Canada on June 28 and September 10, 2012		
1.	Section 2.2 (Monitoring Locations) – The report indicates that "*the collected data include cumulative contributions from traffic and any other substantive sources of noise… including those that are natural*". When establishing a worst-case baseline, Health Canada advises that the sounds of nature be excluded from the measurements in order to ensure a more accurate baseline noise level.	Although it is agreed that exclusion of sounds of nature would provide a conservatively low baseline and a conservative basis for a baseline percent highly annoyed in comparison to % highly annoyed with the project, in terms of evaluating an absolute noise limit (such as 55 dB_A during the night and 65 dB_A during daytime), a higher baseline is more conservative for the assessment. There is no way to exclude sounds of nature from the sound pressure level monitoring conducted. As discussed in Section 2.3, an absolute limit was chosen for this project, therefore including all existing noise sources in the baseline is considered the conservative approach. A higher baseline has a greater cumulative contribution to the total predicted sound pressure levels following implementation of the project. No revision to the technical report is required.

Table 3 Comments and Responses Regarding the Baseline Soil and Biota Technical Report

Reference Number	Comment	Response
Comments Received from Health Canada on June 28 and September 10, 2012		
1.	Section 2.5.1 (Soil) indicates that the maximum depth from which a soil sample was collected was approximately 30 cm. The actual depths that these samples were collected were not presented in the report. For human exposure to soil via dermal contact/ingestion and inhalation of dust, soil should be collected within the top 5 cm of soil (Health Canada, 2010a). For country foods contamination, the most important soil layer will vary depending on the type of plant. For shallow-rooted plants, soil samples should be collected from 0.15 to 0.3 m below ground surface, and for larger plants, such as trees or tall bushes, soil samples could be collected up to 1 m below ground surface (HC, 2010c).	As identified in the Health Canada comment, there are a number of considerations when selecting a sampling depth for soil, since the precise definition of surface soil will vary from site to site and may be represented by depths ranging from ≤ 5 cm to 1.5 m (Health Canada 2010a). For this HHERA, there were no specific activities that would lead one to expect the upper 5 cm of mineral soil to have a higher concentration than the underlying 25 cm of soil. The soil sampling program was designed to accommodate not only human exposures via dermal contact/ingestion and inhalation of dust, but also to be used for assessment of direct ecological receptor exposures, and for predicting future concentrations of COPC in plants and soil invertebrates. As such, sampling depths of up to 30 cm are considered appropriate for the purposes of the HHERA. No revision to the technical report is required.

Table 3 Comments and Responses Regarding the Baseline Soil and Biota Technical Report

Reference Number	Comment	Response
Comments Received from Health Canada on June 28 and September 10, 2012		
2.	Section 3.2 (Soil) - In addition to presenting the metals concentrations and organic content, other soil properties are relevant from a human health risk assessment perspective as they may have an impact on the fate, transport and/or availability of contaminants. Additional characteristics should include soil type, particle size, texture, stratigraphy, porosity, and soil properties such as moisture content, bulk density and pH (Health Canada, 2010b). For example, particle-size range of soil is an important factor to control in sampling and chemical analysis because both the concentration and bioavailability of a contaminant may increase as particle size decreases. See Section 3.4.1.1 of Health Canada (2010b) for more information.	We agree that to complete detailed fate and transport modeling of COPCs in soil (*e.g.,* vapour transport, soil leaching), the model results are very sensitive of the soil properties. For this HHERA, the COPCs are metals, and soils are assumed to be affected by atmospheric deposition that will result from the Project. As such, it was conservatively assumed that all metals deposited onto the soil were mixed into the upper 10 cm of soil (*i.e.,* no mass loss due to surface runoff or leaching). Although soil properties may affect bioavailability, the uptake factors used to predict concentrations in biota (plants, soil invertebrates) are not dependent on the soil properties, and oral bioavailability to receptors (both human and ecological) were conservatively assumed to be 1.0. As such, further characterization of the soil properties would not change the conclusions of the HHERA. No revision to the technical report is required.

Table 3 Comments and Responses Regarding the Baseline Soil and Biota Technical Report

Reference Number	Comment	Response
Comments Received from Health Canada on June 28 and September 10, 2012		
3.	Section 3.5 (Small Mammals) and Section 3.8 (Wild Berries) – The metals concentrations presented in the report are provided in mg/kg. For human exposure, consumption rates provided by Health Canada and other sources are presented on a wet-weight basis. When conducting the human health risk assessment (HHRA) it is essential that any values presented on a dry-weight basis (*e.g*. ug/contaminant /g dry weight of the food item) be converted from dry weight to wet weight. See Health Canada (2010c) for the applicable equation to convert from dry weight to wet weight.	The conversion to wet weight will be completed as part of the HHERA conducted in support of the EIA Report. No revision to the technical report is required.
4.	Section 3.8 (Wild Berries) – Although the report indicates that berries were not abundant in the study area at the time of sampling, it is important to ensure that the berries collected and analysed are representative of the types of berries (and the ripeness) that would be collected and consumed by local people.	The vegetation sampling program encompassed baseline conditions for both human and ecological receptors and, for the purposes of establishing Baseline Conditions, are considered appropriate. No revision to the technical report is required.
5.	Section 2.3.3 (Sample Media of Interest) – The report indicates that "*soil*", "*wild berries*" and "*fish (brook trout)*" data will be evaluated for human receptors in the HHRA. There is no discussion about the use of other vegetation data such as "*forage*" or "*browse*" to evaluate human exposure via ingestion of traditional/medicinal plants or the use of "*small mammals*" data to evaluate human exposure via consumption of small and/or large terrestrial fauna. The proponent should provide a discussion about whether or not wild game and/or other non-fruit-bearing plants are to be evaluated in the HHRA.	This comment is in relation to the methodology for the HHERA, and not the establishment of baseline conditions, which is the subject of the baseline report. The EIA Report will provide details on how the exposure concentrations for the HHERA are to be determined. No revision to the technical report is required.

Table 4 Comments and Responses Regarding the Baseline Aquatic Environment Technical Report

Reference Number	Comment	Response
Comments Received from Environment Canada On September 4, 2012		
1.	Sec. 4.6.1 Brook Trout, p.119. "YOY (age 0+ years) brook trout were found to be less than **80** mm in length in September, brook trout between **80** mm and **9.5** mm were considered immature (age 1+ years), and brook trout over 9.5 mm were considered mature (age 2+ years and older)" Should this be 95 mm instead of 9.5 mm?	This should be 95 mm, and not 9,5 mm. The text has been corrected in the report. We apologize for the error.
2.	Sec. 4.6 Fish Environmental Effects Monitoring, pp. 117 to 152. This section could be used by EEM officer(s) for its relevance when reviewing any study designs required as per the Metal Mining Effluent Regulations.	No response required.
3.	Sec. 4.6.1 Brook Trout, p. 120. "A target of 40 (*i.e.,* 20 male and 20 female) brook trout over **9.0** mm in length was set for collection at each station. Reproductive maturity was further confirmed by lethally sampling brook trout smaller than **9.0** mm (Appendix E)." Should this be 90 mm?	This should be 90 mm, and not 9.0 mm. The text has been corrected in the report. We apologize for the error.
4.	Sec. 5.0 Summary pp. 154. "This Baseline Aquatic Environment Technical Report was prepared as background information for the Environmental Impact Assessment (EIA) for the Sisson Project (the Project). The purpose of this report was to describe the existing baseline conditions of the Aquatic Environment within the Project Development Area (PDA) and Study Area for the Project, with a particular focus on fish and fish habitat as defined in the Fisheries Act, and in addition with attention to technical guidance provided for aquatic Environmental Effects Monitoring (EEM) studies carried out pursuant to the *Metal Mining Effluent Regulations* annexed to the *Fisheries Act."* It is noted that the purpose of this baseline study is to be used when reviewing the EIS expected in the fall of this year.	No response required.

Table 4 Comments and Responses Regarding the Baseline Aquatic Environment Technical Report

Reference Number	Comment	Response
Comments Received from the New Brunswick Department of Environment On September 4, 2012		
5.	Section 2.3, Page 15. There is currently no open season for Atlantic salmon angling in the Nashwaak River watershed.	Thank you. Section 2.3 has been revised to clarify that there is no open angling season for Atlantic Salmon within the Lower Saint John Recreational Fishery area.
6.	Section 2.3, Page 15. Brown bullhead should be added to the list of non-sport fish.	Brown bullhead was added to the list of non-sport fish in the report..
7.	Section 2.9, Page 25. The report states "As a conservation measure, limited recreational catch and release for Atlantic salmon is permitted on sections of the Nashwaak River, but not on its tributaries Napadogan Brook (including Bird and Sisson Brook) or McBean Brook (NBDNR 2011)." There is currently no open season for Atlantic salmon angling in the Nashwaak watershed.	The text referred to in the comment has been deleted from the report, and replaced with the following: "There is currently no open season for Atlantic salmon within the Nashwaak watershed."
8.	Section 4.1.1.4, Page 56. The report describes a channel form of "steady flow". Please provide a description.	This can also be referred to as a glide or a flat, defined as a section of stream that has little or no turbulence, not deep enough to be a pool. No revision to the technical report is necessary.
9.	Section 4.1.1.4, Page 56. The values of water quality parameters described in the paragraph for tributaries to McBean Brook are the same values as described for tributaries to the West Branch Napadogan Brook in Section 4.1.1.3.	The text in this section has been revised to accurately reflect the water quality parameters for tributaries to McBean Brook.
10.	Table 4.6, Page 59. This table only shows 2 of the Quantitative sites as being in the PDA.	The intention of the quantitative sites was to gather data on existing conditions, and to provide baseline for comparison in future. The majority of the sites were selected to be outside the PDA (as those within will no longer exist) but still within the potential influence of the project (*i.e.,* downstream of the PDA). No revision to the technical report is required.
11.	Section 4.2.1.1, Page 60. The report states "Station S3A3 provides fair representation of typical 2nd order Sisson Brook habitat." Should that be 3rd 'order'?	This should say 3rd order, and the text has been corrected in the report.
12.	Table 4.8, Page 61. There appears to be errors related to station S3A3. Is the quantitative site S3A3 or S3A2? (see also Table 4.18 and Table 4.19)	Tables 4.18 and 4.19 should include S3A3, and the report has been revised accordingly.

Table 4 Comments and Responses Regarding the Baseline Aquatic Environment Technical Report

Reference Number	Comment	Response
13.	Section 4.2.1.5, Page 66. If three stations on the East Br. Napadogan were intended as reference stations, why was quantitative work only undertaken at EBNB1? Does this mean that there is only one reference station representing brook trout habitat (the primary habitat in the project area)? Given the magnitude of the project, are two reference stations adequate?	EBNB1, NRC, W4A17, are all outside the potential influence of the Project and were intended as reference stations. It was hoped that sufficient fish would be present to use these stations as EEM monitoring stations, but this was not the case. Additional work conducted in 2012 focused on identifying and establishing locations suitable for baseline EEM using a non-lethal approach. No revision to the technical report is required.
14.	Is the purpose of the 7 remaining quantitative sites for long term monitoring?	It is assumed that the seven remaining sites referred to in the comment are M3C3, S2A2, B3A9, W4A21, W4A31, B2A2, and W4A21. The purpose of the quantitative sites was to quantify and characterize the habitat and aquatic populations within the potentially affected watercourses and act as potential EEM stations. The five remaining sites will be downstream of the potential project influence and could be used as exposure sites for *MMER*. Station W4A17 will be outside the potential project influence and could be used for monitoring and B2A2 and S2A2 would be lost due to the construction of the Mine. As noted in response to comment 13, further work was undertaken in 2012 to find suitable reference and exposure locations that meet the requirements of for long term monitoring under *MMER* (*i.e.*, sufficient numbers of sentinel species present). No revision to the technical report is required.

Table 4 Comments and Responses Regarding the Baseline Aquatic Environment Technical Report

Reference Number	Comment	Response
15.	The focus seems to be on quantifying the physical habitat that will be lost such that HADD compensation can be determined. What mechanism exists to consider the complete loss of the resident fish populations and the ecological function of these streams, including temperature, flows, food & nutrient inputs? The field studies clearly show that Bird Brook and Sisson Brook, two streams that will be essentially eliminated from the landscape, are predominantly undisturbed brook trout habitat with important cold water refugia. This habitat cannot be replaced.	Additional work in 2012 has demonstrated that there is a large amount of undisturbed brook trout habitat with cold water refugia outside of the PDA, within the Napadogan and Nashwaak watersheds. Fish population, benthic macroinvertebrate population data, flow and discharge data, periphyton data, water quality data and temperature data have been collected and would allow for the consideration of the loss of ecological function if required. No revision to the technical report is required.
16.	Section 4.2.1.5, Page 67. The report states in referring to the Nashwaak River station "The DO concentration (9.4 mg/L) is just under the CCME recommended minimum value of 9.5 mg/L for early life stages at two stations, and is acceptable for other life stages in every station." Was there more than one station on the Nashwaak River?	The sentence has been revised in the report as follows: "The DO concentration (9.4 mg/L) is just under the CCME recommended minimum value of 9.5 mg/L for early life stages at two stations, and is acceptable for other life stages in every station." There was only one station on the Nashwaak River (NRC) in 2011.
17.	Table 4.17, Page 69. It should be noted that the only sites that did not result in the capture of brook trout were sites in which minnow traps were utilized. Minnow traps are not very effective at capturing salmonids and would not indicate with certainty the absence of brook trout in those sites.	The sites where minnow traps were used were unsuitable (unsafe) for electrofishing. Table 4.17 is simply intended to show what was collected at the time of the survey. In fact *in situ* water temperatures suggest that these locations would be suitable for brook trout. No revision to the technical report is required.
18.	Table 4.18, Page 71. There is a great deal of variability in both the length of sites and electrofishing effort expended between sites. How was the length of site or amount of electrofishing effort decided?	The purpose of the qualitative electrofishing surveys was to determine what fish species were present within the given station. Effort was based on the professional judgment of the lead Aquatic Biologist as to whether an adequate sampling of the fish community had been achieved. The length of sites and the amount of electrofishing effort also reflects the size, habitat conditions and flow. Increased effort would be required for a heterogeneous site (riffle run and pool) as opposed to a homogeneous site (just run). No revision to the technical report is required.

Table 4 Comments and Responses Regarding the Baseline Aquatic Environment Technical Report

Reference Number	Comment	Response
19.	Table 3.21, Page 75. There is a great deal of variability in the areas electrofished in these 10 sites. Please explain the reasoning behind the size of the areas fished both inside the barrier nets and outside the barrier nets for these sites.	The target site area for between the barrier nets was 100 m^2. This was paced out in the field in some cases resulting in sites larger than 100 m^2. Site size also varies due in part to stream width. Effort (CPUE) was standardized to 100 m^2 to determine and compare densities. Electrofishing effort outside the barrier net was conducted to collect large brook trout for lethal sampling; effort is variable because in some cases these trout were easier to catch or were more plentiful. No revision to the technical report is required.
20.	Section 4.5.1, Page 100. A lack of large fish resulted in combining smaller fish for a pool sample. Since mercury bioaccumulates in fish, would this procedure result in an artificially low mercury concentration in those pooled samples?	Only fish of similar size are pooled, and this occurs only with small fish, where tissue quantities are potentially too small for chemical analysis. Larger fish are not subject to pooling. The majority of pooled fish were <10 cm in length. No revision to the technical report is required.
21.	Section 4.5.1, Page 105. Of the 82 samples analyzed for mercury, how many would have been of a size that anglers would retain (*i.e.* > 15 cm)?	There were 11 fish that were greater than 15 cm. They ranged in size from 15.7 cm to 18.6 cm. No revision to the technical report is required.
22.	Section 4.5.1, Page 105. FYI – NB Health also publishes a mercury advisory. However, there are no concentration levels identified.	No response required.
23.	Section 4.6.1, Page 118. The report indicates that during qualitative electrofishing, 0+ fish were <7 cm, 1+ fish were 7-11 cm and 2++ fish were > 11 cm. The next paragraph indicates that during quantitative electrofishing, 0+ fish were <80 mm, 1+ fish were 80-95 mm and 2++ fish were greater than 95 mm. Please explain the difference in length distribution between the two sampling periods. Additionally, on several occasions 9.5 mm is reported when it should be 95 mm.	Qualitative work was conducted in late July early August, and quantitative work was conducted in September. The difference in length reflects the growth of the brook trout during the month of August. Instances where 9.5 mm was reported instead of 95 mm have been corrected in the text.
24.	Section 4.6.1, Page 119 & 120. There are several errors related to decimals when discussing fish length at age	Text has been revised to reflect this correction.
25.	Section 4.6.1, Page 120. The report indicates "…all brook trout greater than 90 mm long were aged 2+ years or greater." However, Table 4.31 indicates 5 fish >90 mm in length that were aged as 1+. Please explain.	Age estimates in the text were based on weight-length distributions for the total brook trout captured. Ages in Table 4.31 reflect ages determined by aging scales for specific fish. No revision to the technical report is required.

Table 4 Comments and Responses Regarding the Baseline Aquatic Environment Technical Report

Reference Number	Comment	Response
26.	Table 4.30, Page 120. Why does "total Brook trout captured" column not match any other summary of brook trout captured (Table 4.22 or Table 4.24)	Table 4.30 summarizes the quantity of brook trout that were lethally sampled only. Tables 4.22 and 4.24 summarize the total quantities of brook trout captured during the qualitative survey, inclusive of the lethally sampled brook trout. No changes to the text are required.
27.	Section 4.6.3, Page 129. Is there sufficient baseline information to pursue the alternative EEM approach?	Six sites were selected in 2012 outside the PDA based on a BACI statistical design. Non-lethal sampling that met the requirements of *MMER* was conducted and focused on Atlantic salmon and brook trout. Stantec will develop alternative EEM approaches in consultation with Environment Canada as well as other stakeholders. No revision to the technical report is required.
28.	Summary, Page 157. The baseline studies made it evident that the proposed study design of EEM will likely not be successful for this project and that an alternative methodology will likely have to be used. What additional baseline data will be required for the alternative methodology and when will that data be collected?	See response to Comment 27 above. No revision to the technical report is required.

Table 5 Comments and Responses Regarding the Baseline Wildlife and Wildlife Habitat Technical Report

Reference Number	Comment	Response
Comments Received from Environment Canada On September 4, 2012		
1.	Figure 2.2. The forest habitat types are very difficult to distinguish in this figure as they are all different shades of green. Another map should be provided for just forest types, and using more distinguishing colors for hardwood and softwood and different age classes.	The colours and shading for the figure were well thought out. There are only three quite different shades of green, representing the older developmental stages (Immature-old = light green; Mature = medium green, and overmature = dark green). Therefore, the older forest stands can be noted at a glance. The difference between composition is noted by three hatch patterns: hardwood-dominated is solid (no hatching); softwood-dominated is vertical hatching; and mixedwood is crosshatched. The remaining developmental stages are notably different, with brown for immature-young, cream for sapling, and pink for regenerating. The non-forest habitat is easily distinguished as wetlands, watercourses and waterbodies in shades of blue, with a pattern for wetlands. There is very little area of other habitat types, left blank. No revision to the technical report is required.
2.	Sections 2.3.3, 3.1.4. The report should provide additional detail on how point count locations were chosen forest habitat. It should be clarified whether points were chosen differently in the PDA 500 m area versus the broader study area. The proponent should outline in greater detail how the modified stratified random approach worked. It should be clarified how the clumping of points came about. It should be clarified whether points were stratified based on accessibility/logistics as well as habitat. And it should also be clarified how a site was deemed to be inaccessible.	Proposed point count locations were originally selected by first assigning a habitat type to each stand based on developmental stage and proportion of hardwood and softwood species (*i.e.,* hardwood, softwood and mixedwood) and dissolving boundaries of adjacent stand types. Stands that met a minimum size criteria, to allow for a minimum of 1 point count circle (100 m radius) to be placed in the stand and for the centre to be 100 m from another habitat, were assigned a number. Stands were selected using a random number generator tool within ArcGIS software. Clustering occurred when additional points were selected from nearby suitable stands, to enable efficient surveying of groups of points. Points were dropped where it was determined points were not accessible, due to the lack of roads traversable by 4X4 vehicle or RUV, and known barriers such as washed out bridges and beaver dams. Areas where it was expected to take more than an hour to get to a cluster of points were excluded. Survey sites that would be difficult to access and would have fewer than 6 points total that could be surveyed efficiently were also dropped. The

Table 5 Comments and Responses Regarding the Baseline Wildlife and Wildlife Habitat Technical Report

Reference Number	Comment	Response
		distribution of stand types was determined, to determine the proportion of points that would be surveyed of a particular stand type. Following the initial selection of potential points, additional points were selected in accessible areas near previously selected sites, for under-represented habitats. This process was conducted separately for within 500 m of the PDA identified at the time of the surveys, and in the greater Study Area. No revision to the technical report is required,
3.	Sections 2.3.4, 3.2.8. Common Loon (Family Gaviidae) and Pied-billed Grebe (Family Podicipedidae) are not waterfowl (Family Anatidae) and should not be referred to as such. These species can be referred to as waterbirds.	Noted. This will be corrected, where necessary, in the EIA Report. No revision to the technical report is required.
4.	Sec. 2.5. Species listed as Special Concern under Schedule 1 of the *Species at Risk Act (SARA)* should be considered Species at Risk in environmental assessment documents, as Section 79 requirements of SARA apply to these species.	Noted. This change will be made when dealing with species at risk in the EIA Report. No revision to the technical report is required.
5.	Sec. 2.5. Eastern Wood-Pewee and Bank Swallow will be assessed by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) this fall. Belted Kingfisher and Evening Grosbeak are on the COSEWIC candidate list for future assessment. At this point, these species should be considered species of conservation concern and results discussed in a similar fashion to other such species. Eastern Wood-Pewee is the only forest bird in this category for which the proponent's forest bird point count data could be used in this discussion. Others can be discussed in light of desktop survey results and potential habitat present in the study area.	These species will be considered as species of conservation concern in the EIA Report. No revision to the technical report is required.

Table 5 Comments and Responses Regarding the Baseline Wildlife and Wildlife Habitat Technical Report

Reference Number	Comment	Response
Comments Received from Environment Canada on July 30, 2012		
6.	Sec. 3.2.5. The report indicates that surveys were conducted by two experienced bird surveyors, both of whom conducted nearly an equal number of surveys. The proponent should elaborate on how the two surveyors split up the point counts. It should be clarified whether they each conducted equal surveys within and outside of the PDA. It should be clarified whether there is any chance that the differences seen between point counts conducted within and outside of the PDA could be due to observer effects. If not, a discussion of some other possible reasons for these differences should be provided.	It was not feasible to attempt to schedule surveys between observers to address all potential variables associated with point counts. While the two observers completed a similar number of point counts, they were not distributed equally among habitat types, or between in the PDA and outside the PDA. It is likely that observer differences account at least in part for the differences between point counts within and outside the PDA. However, due to high variability within and between habitat types, it is difficult to determine if there truly are differences between populations within and outside the PDA. For example, while staff member "HF" completed 103 surveys and staff member "TW" completed 105, HF completed 67% of the points outside the PDA, and TW completed 76% of the points near the PDA. The distribution of habitat types between observers was also not even. In general, TW tended to have higher densities than HF, both overall and within habitat types with sufficient numbers, however due to high variability, the difference is not likely statistically significant. Between planning and completion of the technical study report, the PDA was adjusted, as was the assignment of points to a category. The PDA has been updated again, and therefore analysis of data between near and outside the PDA will be updated in the EIA. No revision to the technical report is required.
7.	If possible, a paper copy of the updated report should be provided in addition to an electronic version.	As an environmental measure, only electronic copies of the technical reports are being provided. A paper copy of the technical report can be provided upon request.

Table 6 Comments and Responses Regarding the Baseline Vegetated and Wetland Environments Technical Report

Reference Number	Comment	Response
Comments Received from Environment Canada On September 4, 2012		
1.	Table 2.1. This table should be labeled Summary of NBDELG Mapped Wetlands Present Within the Study Area.	In future reports, this distinction will be made. No revision to the technical report is required.
2.	Figure 3.4 from the Baseline Aquatic Environment Technical Report should be included prior to Figure 2.2. Figure 3.4 from the Baseline Aquatic Environment Technical Report is a nice topo map.	Figure 3.1 Wetland and Watershed Models shows local topography, thus the addition of another figure is not required. No revision to the technical report is required.
3.	Maps in this document are generally difficult to read. Maps, which show locations of watercourses, wetlands and waterbodies, should be presented in relation to 3 spatial scales: 1. the open pit area, and tailings storage areas; 2. the project development area; and 3. the study area We recommend that the proponent zoom in and have three separate maps at those various spatial scales, as had been done for Figures 3.2, 3.3, and 3.4.	Maps in this report were specifically created to present specific information over specific spatial distribution. The Project area and Project components are shown where applicable. It is not clear what specifically the commenter finds difficult to read on the maps, however the maps can be viewed under various levels of “zoom”, both on computer screen and in printed form. No revision to the technical report is required.
4.	Figure 2.2. The figure does not show the tailings areas. This should be corrected.	This figure does not show the majority of Project components to minimize clutter. The open pit is shown for reference. There are many other figures that show the locations of Project components. No revision to the technical report is required.
5.	Figure 3.1. This figure includes too much information on it (e.g. contours could be omitted), and needs to be zoomed in. It is also not clear on this map where wetlands are in relation to tailings ponds. This should be corrected.	This map is intended to illustrate the wetlands and watersheds in the PDA and surrounding region, not show wetlands with respect to project components. The open pit is simply included for reference. If the map were zoomed in, the reader would not be able to understand how watersheds in the vicinity of the PDA are oriented with respect to each other. No revision to the technical report is required.

Table 6 Comments and Responses Regarding the Baseline Vegetated and Wetland Environments Technical Report

Reference Number	Comment	Response
6.	Figures 3.3 and 3.4. The proponent should start with an unclassified photo and then add successive layers in successive maps, as the maps as presented are difficult to read and not intuitive. Separate maps should be presented for vegetation communities and for wetlands.	Although these maps contain a fair amount of information, as it is all explained in the legend, this is preferable to requiring the reader to flip through multiple maps to fully understand the habitats within the Study Area. Wetlands are presented as types of vegetation communities themselves within the report. Accordingly, changes to the figures are not required.
7.	Table 3.2. It should be clarified whether the number of wetland polygons equates to the number of wetlands.	The wetlands in the vicinity of the study area include many large contiguous complexes that are composed of many wetland types. It is therefore not meaningful to refer to specific numbers of wetlands, as this number would be arbitrary. The most important metric with regards to wetlands in this region is the total area, which is presented in this table and the accompanying discussion. No revision to the technical report is required.
8.	Table 3.2 and Figures 3.3 and 3.4. Information should be presented in a manner where reviewers could look at Table 3.2 and Figures 3.3 and 3.4 and see where the wetlands are spatially located in relation to hydrologic features.	As the various wetland types are part of larger complexes and are distributed throughout the Study Area, this is not something that can be summarized clearly in a table. However, Figures 3.3 and 3.4 do illustrate which wetlands are proximal to watercourses and waterbodies (see the legend for an explanation of wetland types shown on the figures). No revision to the technical report is required.
9.	Sec. 4.2 Results. In the results section, the concepts of wetland ecological functions and 'value to society' have been mixed. For a baseline characterization, it is especially important to keep them separate. The report should present data on Water Chemistry versus Water Quality, because water coming from bogs does not meet water quality guidelines. It will be important to understand the water chemistry of these wetlands in order to understand the processes and fate of metals, nutrients, and minerals, in these aquatic systems.	Water quality will be considered as part of the assessment of the aquatic environment in the EIA report. Water quality is summarized in the Baseline Aquatic Environment Technical Report. No revision to the Baseline Vegetated and Wetland Environments Technical Report is required.
10.	Sec. 4.2.1.3, p. 58. Further information on the water sampling program is needed to understand the meaning of the results presented (e.g. number of samples, locations, seasonality etc,).	The water quality information presented, from major watercourses within and downstream of the Study Area, is from the Baseline Aquatic Environment Technical Report, which summarizes the water sampling program. No revision to the Baseline Vegetated and Wetland Environments Technical Report is required.

Table 6 Comments and Responses Regarding the Baseline Vegetated and Wetland Environments Technical Report

Reference Number	Comment	Response
11.	Sec. 4.2.1.4, p. 58. These are values associated with wetland functions and no quantitative information is presented to support the conclusions. Further details should be provided.	Sociological values are by their nature not feasible to quantify. No revision to the technical report is required.
12.	Appendix C. Maps should be provided showing the locations of the Wetland Sampling Points. Furthermore, each map should be given a unique identifier on the map and on the field sheet, such that reviewers are able to put the field data sheets into context.	Wetlands in which Wetland Sampling Points were conducted are illustrated on Figures 3.3 and 3.4. If the reviewers wish to visit specific locations, GPS coordinates are provided on sampling data sheets. No revision to the technical report is required.
13.	Table B1. According to Table B1, Black Ash was found during surveys in and around the study area. Black Ash is a plant important to aboriginal peoples. It should be clarified whether this plant was found in areas where it will be affected by the proposed project. If so, further details regarding the numbers of plants affected, locations, etc, should be provided.	This is outside of the scope of this baseline report. The Traditional Knowledge Study will provide information on the importance of the area to First Nations, and current use of land and resources for traditional purposes by Aboriginal persons will be assessed in the EIA report. No revision to the technical report is required.
14.	Species listed as Special Concern under Schedule 1 of the Species at Risk Act (SARA) should be considered Species at Risk in environmental assessment documents, as Section 79 requirements of SARA apply to these species.	No species at risk were encountered. This comment will be considered in future work, if species at risk are found. No revision to the technical report is required.
15.	If possible, a hard copy of the updated report should be provided in addition to an electronic version.	As an environmental measure, only electronic copies of the technical reports are being provided. No updates to the report are required, as per the responses provided in this table.
Comments Received from the New Brunswick Department of Environment and Local Government on September 12, 2012		
16.	In general, references to “NBDELG mapped wetlands” or “NBDELG wetland mapping” should be changed to “GeoNB mapped wetlands”. These wetlands are regulated by NBDELG, not mapped by NBDELG;	In future reports, this distinction will be made.
17.	Page 14. Table 2.1 should be labeled as GeoNB Mapped Wetlands	In future reports, this distinction will be made. No revision to the technical report is required.
18.	Page 55. Functional Assessments: It is understood that all GeoNB mapped wetlands and their associated complexes were assessed for functions, and then this data was used to generally describe the wetland functions for all of the wetlands that are found on the ground within the study area. Please confirm that this is correct.	This data was used in conjunction with additional observations on function made in non-GeoNB mapped wetlands. No revision to the technical report is required.

Table 6 Comments and Responses Regarding the Baseline Vegetated and Wetland Environments Technical Report

Reference Number	Comment	Response
19.	Appendix C Page 110. The map(s) should show the locations of the Wetland Sampling Points, and give each wetland a unique identifier on the map and the field sheet. This puts the field data sheets into context and allows the reader to where the data was collected on the ground in relation to functional assessments, delineation, etc.	See the response to comment 12. No revision to the technical report is required.

Stantec

Attachment B

Response to the DFO Science Review of the
Baseline Aquatic Environment Technical Report for the Sisson Project

Stantec Consulting Ltd.
845 Prospect Street
Fredericton, NB E3B 2T7
Tel: (506) 452-7000
Fax: (506) 452-0112

November 14, 2012
File No. 121810356

Mr. Edward V. Parker, M.Sc.
Fisheries and Oceans Canada
1 Challenger Drive
P.O. Box 1006
Dartmouth, NS B2Y 4A2

Dear Mr. Parker:

RE: RESPONSE TO THE DFO SCIENCE REVIEW OF THE BASELINE AQUATIC ENVIRONMENT TECHNICAL REPORT FOR THE SISSON PROJECT

Further to your request to Dr. John Boyle on November 7, 2012, Stantec Consulting Ltd. (Stantec) respectfully submits this response to the Fisheries and Oceans Canada (DFO) Science Review of the Baseline Aquatic Environment Technical Report for the Sisson Project, on behalf of our client, Northcliff Resources Ltd. (Northcliff), for your consideration.

This response is provided to the document entitled "Review of the Sisson Project Baseline Aquatic Environment Technical Report", prepared by the Canadian Science Advisory Secretariat (Maritimes Region) of Fisheries and Oceans Canada, dated July 2012.

We trust these responses will be acceptable to DFO, and will be useful in finalizing DFO's input to the Sisson Project on this work. Please contact the undersigned if you have any questions or require any clarification on the attached.

Sincerely,

STANTEC CONSULTING LTD.

Malcolm Stephenson, Ph.D.
Principal, Senior Aquatic Scientist
Tel: (506) 452-7000 x 3623
Fax: (506) 452-0112
malcolm.stephenson@stantec.com

Denis L. Marquis, M.Sc.E., P.Eng.
Principal, Project Manager
Tel: (506) 452-7000 x 3215
Fax: (506) 452-0112
denis.marquis@stantec.com

Attachment A: Response to the DFO Science Review of the Baseline Aquatic Environment Technical Report for the Sisson Project

cc. John Boyle, B.Ap.Sc., MNRM, PhD – Hunter Dickinson Inc.

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Attachment A

Response to the DFO Science Review of the Baseline Aquatic Environment Technical Report for the Sisson Project

Response to the DFO Science Review of the Baseline Aquatic Environment Technical Report for the Sisson Project

The following is the response of Stantec to the comments raised by DFO in its review of the Baseline Aquatic Environment Technical Report for the Sisson Project, as outlined in the document "Review of the Sisson Project Baseline Aquatic Environment Technical Report", prepared by the Canadian Science Advisory Secretariat (Maritimes Region) of Fisheries and Oceans Canada, dated July 2012.

Reference Number	Comment from DFO Canadian Science Advisory Secretariat	Stantec's Response
1.	Fisheries and Oceans Canada's (DFO) Habitat Management Division, Maritimes Region, is reviewing a Baseline Aquatic Environment Technical Report as background information for the Environmental Impact Assessment (EIA) of the Sisson Mine Project to determine if the project is likely to result in negative impacts to fish and fish habitat. The project consists of a conventional open pit tungsten and molybdenum mine, an ore processing plant, and associated facilities and infrastructure located approximately 10 km southwest of the community of Napadogan, New Brunswick.	Introductory context. No response required.
2.	The specific questions from Habitat Management to DFO Science were: • Are the baseline studies complete and in particular is there a need for additional surveys to be completed; • Is there additional information available that should be included / considered in the document; and • Are the methodologies used to describe the existing environment appropriate to assess the effects of a mine development on the aquatic environment?	These do not appear to be review comments, but rather questions internal to DFO to guide their Science Review. Nonetheless, the following additional context is provided: • Additional baseline information was conducted over the summer of 2012. The data collected focused on fish community structure, and weight and length measures of Atlantic salmon and/or brook trout. Blacknose dace were also non-lethally sampled at some locations where salmon were not present as a potential second sentinel species, along with brook trout. • Additional studies will be included in the EIA document that will consider brook trout habitat availability inside and outside the Project Development Area (PDA), as well as potential changes in habitat due to flow reduction. • Methods used for collection of baseline information were based in part on requirements and technical guidance of the *Metal Mining Effluent Regulations* (*MMER*) under the *Fisheries Act*, requirements outlined in the terms of reference and technical guidelines for the Project, as well as the judgement and

Reference Number	Comment from DFO Canadian Science Advisory Secretariat	Stantec's Response
		professional experience of Stantec's aquatic biologists. The proposed data collection methods were presented to regulatory agencies and stakeholders, including scientists associated with the Canadian Rivers Institute, prior to the start of the 2011 and 2012 field studies, to obtain their feedback on the proposed methods.
3.	As Habitat Management routinely addresses many aspects of the questions identified for this review and given the relatively quick turnaround for this review, DFO Science sector is focusing this review on non-routine aspects of these questions where credible, timely advice can be provided. In addition, as aspects of this technical report pertain to the mandate of other federal government departments already engaged in the review process, this review focuses on questions relevant to DFO's mandate. As the Baseline Aquatic Environment Technical Report is being prepared as background information for a forthcoming EIA, the DFO Science review of this report is likely the first part of the ongoing review process. Thus, additional sections of this draft Science Special Response (SSR) may be completed when the proposed Environmental Assessment is finalized. The purpose of the Baseline Aquatic Environment Technical Report is to characterize the aquatic environment presently existing within the Project Development Area (PDA) and in the broader study area and gather baseline data to support the development of a long-term environmental effects monitoring program for the aquatic environment, as may be required to meet follow-up or monitoring commitments. The technical report summarizes the data and other information collected as part of the baseline aquatic environment work carried out for the project. Further analysis and interpretation of the data will be presented in the subsequent EIA Report. The Canadian Environmental Assessment Registry (project number 63169) includes more information on the proposed development project.	No response required.

Reference Number	Comment from DFO Canadian Science Advisory Secretariat	Stantec's Response
4.	**ANALYSIS AND RESPONSE** **Fish Presence/Absence and Abundance Studies** With respect to fish presence/absence and abundance studies, there was good spatial coverage with appropriate consideration given to the various habitat types within each of the affected watersheds. The methodologies and calculations used to estimate fish abundance were scientifically sound. The report was very inclusive as the field sheets were also included in the appendices	Thank you.
5.	There is one additional report that could be added to the "Information" section for DFO: *Francis, A.A. 1980. Densities of juvenile Atlantic salmon and other species, and related data from electroseining studies in the Saint John River system, 1968-78. Can. Data Rep. Fish. Aquat. Sci. No. 178. 102 p.*	Thank you. This report has been obtained and will be included in the EIA report as applicable.
6.	**Sampling Sites** There seem to be some discrepancies with respect to the location of some sampling sites. Figures 3.3 and 3.4 do not have the same location for the sampling site EBNB. It is possible that the labelling on Figure 3.4 should be site EBNB3 rather than site EBNB1. Figures 3.2 and 3.3 do not have the same location for site B1A5. It is possible that site S3A3 in Figures 3.3 and 3.4 should be labelled as site S3A2 relative to its position in Figure 3.2.	Noted. There was indeed a labeling error on Figure 3.3, such that EBNB3 should be EBNB1, and vice-versa. These labels will be corrected in the EIA report. Figure 3.2 shows the start of the reach called B1A5 that starts at the labeled point and ends with B1A6. Figure 3.3 shows the habitat survey station that was located within the reach B1A5. The habitat survey station S3A3 is located in close proximity to the reach break between S3A2 and S3A3. The labeling is correct; however, the resolution of the map may make it appear as if the actual S3A3 location is within the S3A2 reach. All survey stations were geo-referenced using global positioning systems (GPS) which may not be reflected in the maps due to the amount of detail and scale. The geo-referenced coordinates can be found elsewhere in the report.

Reference Number	Comment from DFO Canadian Science Advisory Secretariat	Stantec's Response
7.	**Surface Water and Sediment Quality, Fish Tissue Analysis** The toxicity of metals depends on the form they are present in. If a salt, they are soluble in water, but if under the form of unionized metal (referred to as metal below), they are nearly insoluble. Because this information is widely known, toxicity tests are performed using the more water soluble salts and consider the worst case scenario. All sample analyses tend to be performed by inductively coupled plasma mass spectrometry (ICPMS) because it is relatively cheap, and a series of results can be obtained for numerous metals; however, this approach does not provide any information on the state of ionization of the metals. This makes the interpretation of concentrations provided in studies difficult to explain and can result in some discrepancies between expectations and observations.	This is a generalization; however, under the conditions prevailing in the vicinity of the (very soft water), it is likely that most of the reported metals concentrations represent dissolved metals, rather than particulate metal. The data collected through the baseline water quality monitoring program generally support this assumption. Separation of metals concentrations into dissolved and particulate fractions may be of some help for some metals; however, metal speciation can be extremely complex and costly to determine, and is subject to change during sampling and determination of speciation. However, the baseline report contains no predictions, and therefore there are no discrepancies between prediction and observation that require explanation. As the present report presents only baseline (*i.e.,* natural) conditions that currently exist in the Project area, the concern expressed by DFO Science about metal speciation is not warranted. In the event that the speciation or bioavailability of metals in mine effluent becomes a matter of concern (when the mine is operational), straightforward bioaccumulation testing using an organism such as the amphipod *Hyalella azteca* could be used to screen metals for which an investigation of speciation might be worthwhile.
8.	There is a limited body of literature on the toxicity of molybdenum and tungsten. Whiting et al. (1994) studied molybdenum and cyanide drained from a mine and found that the levels were not high enough to affect the invertebrate benthic community. Taxa tended to be dominated by pollution tolerant species, being slightly higher in richness and density than at the control site. Sites at 1.5 km were less affected than closer ones. In another study, 10 species were exposed to sodium molybdate and either growth, reproduction or survival examined as an endpoint (2 to 34 days tests) where the 5% effects level was extrapolated from the data and was represented by 38 mg/L. Fish were more	The referenced study by Whiting is not helpful, as it is unclear what specific component or components of mine effluent might affect downstream benthic communities. The Canadian Council of Ministers of the Environment (CCME 1999) has adopted a water quality guideline for molybdenum (Mo, 73 µg/L) for the protection of freshwater aquatic life. However, Stantec does not believe that this value should be considered reliable, based on new information. Molybdenum is a comparatively rare element that is commonly found in combination with sulphur, oxygen, tungsten, lead, uranium, iron, or other metals in the natural environment. The ores of greatest economic importance are molybdenite (MoS_2), jordisite

Reference Number	Comment from DFO Canadian Science Advisory Secretariat	Stantec's Response
	sensitive than invertebrates and plants (De Schamphelaere *et al.* 2010).	(amorphous MoS_2), and ferrimolybdate ($FeMoO_3$•H2O) (Eisler 1989). After being mined and processed through a tailings impoundment, the most likely form of dissolved molybdenum in mine effluent would be forms of the molybdate anion (MoO_4^{2-}). At high pH (>10), MoO_4^{2-} would be expected to predominate. Under oxidizing conditions at lower pH, the species $HMoO_4^-$ would be expected to predominate, with a small stability field for MoO_2^+ at low pH (generally <4) (Brookins 1987). Molybdenum can be quite soluble in water under oxidized conditions, and mine tailings require monitoring to ensure that molybdenum is not released (Brookins 1987). The CCME guideline value is based critically upon a single "grey literature" (not peer-reviewed or published in a recognized scientific journal) report that showed toxicity to eyed eggs of rainbow trout exposed to molybdenum (as Na_2MoO_4) in a 28-day test that resulted in an LC50 value of 0.73 mg/L, and which is subsequently assigned a safety factor of 10 to derive the guideline value. The source document for this data value (Birge 1978) provides toxicity values for rainbow trout (0.73 mg/L), goldfish (60 mg/L), and narrow-mouthed toad (0.96 mg/L). The low values reported by Birge (1978) have not been reproduced by other workers. For example, Pyle (2000) studied the toxicity of molybdenum (as Na_2MoO_4•$2H_2O$) to fish, including early life stages of fathead minnow, rainbow trout, northern pike and white sucker in the context of mining operations in northern Saskatchewan. Endpoints studied by Pyle included egg hatchability, time to hatch, mortality, growth (fathead minnow and white sucker), mortality and growth (northern pike) and mortality (rainbow trout alevin and rainbow trout juvenile) and followed ASTM and Environment Canada protocols, and analytical measurement of the actual molybdenum concentrations in test solutions. Test durations ranged from 72 hours to 528 hours. Molybdenum caused no significant toxic effect to any life stage or fish species tested, even at concentrations as high as 2,000 mg Mo/L.

Reference Number	Comment from DFO Canadian Science Advisory Secretariat	Stantec's Response
		A more recent study (Davies *et al.* 2005) specifically challenged the Birge (1978) results. A duplication of the previous study using similar water chemistry along with the standard bioassay protocol demonstrated that molybdenum was not acutely toxic to the early life stages of rainbow trout over 32 days up to a maximum molybdenum concentration of 400 mg/L. An additional bioassay following more recent Environment Canada methodology, exposing early life stages of rainbow trout to a maximum molybdenum concentration of 1,500 mg/L for 32 days, did not cause sufficient mortality to allow an LC50 to be calculated. The findings of the Birge (1978) study cannot be reconciled with the more recent, more comprehensive, and better documented findings of Pyle (2000) and Davies *et al.* (2005). Numerous other studies referenced by Pyle likewise indicate that the toxicity of molybdenum to fish, including Chinook salmon, striped bass, and rainbow trout is low. Other aquatic species referenced by CCME also appear to have low sensitivity to molybdenum. CCME (1999) report LC50 values for fathead minnow to be between 70 and 628 mg/L, and that rainbow trout exposed to sodium molybdate had a 96-hour LC50 value of 800 mg/L. For *Daphnia magna*, acute effects concentrations ranging from 34.4 mg/L to >403 mg/L are reported; however, one study that provides primary toxicity endpoints in the CCME guideline derivation identified chronic effects on reproduction and survival at concentrations of 0.93 to 4.5 mg/L (Kimball n.d. in CCME 1999). The Kimball study is also a "grey literature" report that has been widely cited due to the paucity of studies on "lesser known" metals. Kimball (1978) provides a 28-day LC50 value of 0.93 mg/L for Daphnia magna, and a 28-day effect on reproduction at a concentration of 1.15 mg/L. It is notable, however, that effects on reproduction did not occur at a lower concentration than effects on survival, therefore these effects on reproduction occurred in organisms that were already in acute distress due to some cause, but not necessarily molybdenum exposure (see below), and the endpoint should not be considered reliable.

Reference Number	Comment from DFO Canadian Science Advisory Secretariat	Stantec's Response
		The Kimball (1978) report acknowledges (page 2) that "culture of the original shipment of daphnia met with mixed success. A sustained culture was finally maintained using a series of 250 mL beakers each containing 200 mL of water with food introduced at a concentration of 30 mg/L". These statements indicate that the testing laboratory did not routinely perform bioassays with *Daphnia magna*, and in addition are suggestive of selenium deficiency, which is common when culturing this organism in central North America. It is unknown what effect selenium deficiency would have on the toxicology of molybdenum, but both elements form stable anions (selenate and molybdate) in solution, and it is possible that molybdenum could be taken up instead of selenium, exacerbating a selenium deficiency and leading to toxicity (not due to molybdenum exposure but to acute selenium deficiency) in tests of longer duration. Selenium deficiency is characterized by shortened lifespan, and reproductive impairment (Keating and Dagbusan 1984, Lam and Wang 2008). In contrast to the results of Kimball (1978), Naddy (1995 as reported in CCME 1999) gave an 8-day $IC_{12.5}$ value for *Ceriodaphnia dubia* (reproduction as number of young after three broods) of 34 mg Mo/L. Three recent papers are of key importance to the assessment of molybdenum toxicity and risks in the aquatic environment. Regoli *et al.* (2012) evaluated bioconcentration and bioaccumulation of molybdenum as molybdate, finding that bioaccumulation factors are low (generally >1 at toxicologically relevant exposure concentrations). De Schamphelaere *et al.* (2010) measured toxicity of molybdate to 10 aquatic species, finding a lowest EC10 value for fathead minnow in a 34-day dry weight biomass test, and from the overall dataset derived an $HC_{5,50\%}$ value (median hazardous concentration of 38.2 mg/L. Subsequently, Heijerick *et al.* (2012), combining the above referenced bioaccumulation and toxicity results developed a PNEC (probable no effect concentration) value of 12.7 mg Mo/L.

Reference Number	Comment from DFO Canadian Science Advisory Secretariat	Stantec's Response
		The CCME guideline value for molybdenum is therefore based on two studies that are old, "grey literature", did not follow procedures that are now considered to be good practice, and either have been refuted by newer more reliable studies (for rainbow trout), or are potentially compromised by unrecognized methodological limitations or other deficiencies (for *Daphnia magna*). The risk posed to aquatic life by molybdenum is not as severe as would be suggested by the CCME guideline of 0.073 mg/L.
9.	Another relevant study found that a 14 day exposure of earthworms to tungsten at concentration of 6,250 mg/kg arrested reproductive activity (Laura 2006). These animals were chosen because discharged tungsten would be expected to associate with particles and get deposited in sediments, where sediment dwellers would ingest and absorb more material.	It is unclear why DFO considers the reference of Laura (2006) to be the primary relevant study in evaluating the toxicity of tungsten to aquatic life. There is no CCME freshwater aquatic life guideline for tungsten, nor does there appear to be any provincial or US EPA guidelines for tungsten. Few toxicity studies relating to the tungstate anion are available, with the exception of Birge (1978) who reports LC50 values for rainbow trout (15.61 mg/L, 28-day exposure), goldfish (120 mg/L, 7-day exposure) and narrow mouthed toad (2.9 mg/L, 7-day exposure). As noted for molybdenum, however, the data from Birge should be considered suspect and of limited reliability. Strigul *et al.* (2010) provide more recent information on the toxicity of tungsten to fish. Acute toxicity values for guppy (*Poecilia reticulata*) exposed to sodium tungstate ranged from 860 mg W/L (14-day exposure) to 3,880 mg W/L (24-hour exposure). Khangarot and Ray (1989) reported an LC50 value for *Daphnia magna* exposed to sodium tungstate of 89.4 mg/L. Strigul *et al.* (2009) provide LC50 values of 1,700 mg W/L (24 hour exposure) and 344 mg W/L (48-hour exposure) for *Daphnia magna*. On balance, and based upon the available information, the tungstate anion appears to have lower toxicity than the molybdate anion.

Reference Number	Comment from DFO Canadian Science Advisory Secretariat	Stantec's Response
10.	Other than this study, there are no other thresholds for lethal or sub-lethal toxicity effects of molybdenum and tungsten on fish and invertebrates.	See responses to comments #8 and 9 above.
11.	**Surface Water and Sediment Quality** For the water sampled at the 32 qualitative stations, only molybdenum was analyzed, not tungsten. Molybdenum ranged from 0.05 to 23.7 ug/L at M1M2, with some values reaching 6.7, 4.4 and 3.5 ug/L at S2A2, S2A3 and S3A2, respectively. Those 4 sites are within the open pit mine area. Concentrations of 1.9 and 4.4 ug/L were detected at M1N1 and M2E1; these 2 sites are outside the PDA. The rest of the sites ranged from 0.05 to 1 ug/L, with 2 values above 0.4 ug/L and a mean of 0.3 ug/L.	These values are well below the 38 mg/L $HC_{5,50\%}$ value, as well as the 12.7 mg/L (12,700 µg/L) PNEC value described above. See also the data for tungsten as listed by DFO in Comment #12 below. Data collected for the baseline EEM study added tungsten to the analytical suite. These data will inform the EIA.
12.	Within the water sampled at 10 quantitative stations, molybdenum displayed the highest concentrations at S2A2 and S3A3 (2.1 and 2.4 ug/L), with the other 8 stations ranging from 0.05 to 0.8 ug/L, with a mean of 0.3 ug/L. Tungsten is listed at 2.5 ug/L, i.e. not detected (ND) at all stations. There is a 3 fold difference in molybdenum concentrations of S2A2 between the 2 sampling times. This variability could be explained by the presence of more or less particles, as well as changes in the depth of water in the stream. By randomly looking at metals in some water samples, iron level can vary from 0.38 to 10.4 ug/L between 2 sampling times of one station (difference of >30 times), cadmium from 0.01 to 0.05 ug/L (5 times), magnesium from 0.49 to 0.74 ug/L (nearly two times).	See response to comment #11 above. The purpose of the baseline study is to describe baseline conditions, not to systematically account for natural variability.
13.	For the sediment sampled at the 32 qualitative stations, only molybdenum was analyzed, not tungsten. As with the water samples, M1M2 displayed the highest concentration 503 mg/kg followed by S2A3, S2A2, M2E1, M1N1, S3A2 at 31.4, 27.8, 20.5, 13.9, 12.4 mg/kg. The mean of these values is 21.2 mg/kg. M2E1, M1N1 actually fall outside the Project Development Area (PDA). Another 10 sites follow with medium values between 1.8 and 6.5 mg/kg, with a mean of 3.2 mg/kg. Another 16 sites display a mean of 0.4 mg/kg.	Data collected in 2011 for the baseline EEM (quantitative study, 10 stations) added tungsten to the analytical suite. The purpose of the baseline report is to describe baseline (existing) conditions currently present in or near the PDA, not to systematically account for natural variability.

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14.	Within the sediment sampled at the 10 quantitative stations, molybdenum had the highest concentrations at the same 2 stations described for water, S2A2 and S3A3 (17.5 and 6.8 mg/kg). The other 8 sites ranged from 0.05 to 4.7, with a mean of 1.5 mg/kg. Tungsten was at 2.5 mg/kg (ND) at 8 sites and highest at the same 2 sites as above, S2A2 and S3A3, with concentrations of 17 and 20 mg/kg. Values for molybdenum were 15.7 and 19.2 in a duplicate analysis of sediment at S2A2. Among 3 analyses and 2 sampling occasions, sediment concentrations at S2A2 varied by a factor of 2.	The purpose of the baseline report is to describe baseline (existing) conditions currently present in or near the PDA, not to systematically account for natural variability.
15.	Regarding other elements, there seems to be wide variability yet there is no discussion of differences in concentrations observed between sampling times. For example, were the outliers at the same identical site over the 2 sampling times, or observed on one sampling occasion and not the next one? There is also no mention of the usefulness of the Nashwaak River reference site (*i.e.,* NRC). There are no values given for the expected National Institute of Standards and Technology (NIST) reference material versus values provided after the sediment analysis.	The purpose of the baseline report is to describe baseline (existing) conditions currently present in or near the PDA, not to systematically account for natural variability. Metal concentrations in sediment samples are inherently variable as natural winnowing processes in stream sediment cause variable patterns of deposition and resuspension of particles having different grain size and density characteristics.
16.	By just randomly looking at metals in some water samples, iron can vary from 0.38 to 10.4 ug/L (difference of >30 times) between 2 sampling times at one station, cadmium from 0.01 to 0.05 ug/L (5 times), magnesium from 0.49 to 0.74 ug/L (nearly two times). By just randomly looking at metals in some sediments samples, chromium can vary from 251 to 4920 mg/kg (difference of 20 times) between two sampling times at one station, cadmium from 0.55 to 1.38 mg/kg (2-3 times), molybdenum from 6.8 to 27.8 mg/kg (4 times). So, overall there is a lot of variability, either analytical or environmental. Analytical variability is reflected by the duplicate analyses (one sample divided in two on several occasions) and the comparison of NIST reference results (obtained versus expected, not listed).	The purpose of the baseline report is to describe baseline (existing) conditions currently present in or near the PDA, not to systematically account for natural variability.

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17.	In order for the large number of analyzed metals to be useful for further monitoring, there should be at minimum two figures displaying the results in terms of Principal Component Analysis (PCA). The PCA should examine the metal distribution per site for one sampling time, for metals where all levels are above the limit of quantification, with sites labelled in the PCA and two tables with linear regressions between the metals. Because of the high variability, even then, it will be extremely difficult to interpret changes in the concentration of elements other than molybdenum and tungsten in future monitoring.	The purpose of the baseline report is to describe baseline (existing) conditions currently present in or near the PDA, not to systematically account for natural variability. Principal components analysis (PCA) may not be a good tool in this regard, as the components are dominated by elements that contribute strongly to the overall variance inherent in the data set, and trace elements load onto those components in accordance with their correlated presence in the environment. Hence, it can be expected that the first few components for sediment will be dominated by metals such as aluminum, calcium, magnesium and iron. Molybdenum and tungsten will be "lesser metals" and will associate (correlate) with principal components that account for only a small fraction of the overall variance. In effect, they will remain "lost in the noise".
18.	Overall, the results for water and sediment concentrations are sufficient. However, they do not reflect the bioaccessibility and bioavailability of contaminants which will in turn determine potential health effects. However, there is little information on the toxicity of these two elements (Whiting et al. 1994, Laura 2006, De Schamphelaere *et al*. 2010).	The purpose of the baseline report is to describe baseline (existing) conditions currently present in or near the PDA, not to systematically account for natural variability. As the present report presents only baseline (*i.e.,* natural) conditions, the concern expressed by DFO Science about metal speciation is not warranted. In the event that the speciation or bioavailability of metals in mine effluent becomes a matter of concern, if and when the mine is operating, straightforward bioaccumulation testing using an organism such as the amphipod *Hyalella azteca* could be used to screen metals for which an investigation of speciation might be worthwhile. Stantec disagrees with DFO regarding the availability of data on the toxicity of these molybdenum and tungsten (see responses to Comments #8 and 9 above).

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19.	**Fish Tissues** Concentrations of tungsten in liver are mainly 0.01 mg/g. Two composites at B3A9 show 0.1 and 0.5 mg/kg, and fish livers from S2A2 and S3A3 are between 0.01 and 0.06 mg/kg, with one fish liver at 0.11 and another at 0.9 mg/kg (W4A17). Concentrations of molybdenum are between 0.2-0.9 mg/kg and varying between fish of a site, with most samples between 0.2-0.4 mg/kg.	The purpose of the baseline report is to describe baseline (existing) conditions currently present in or near the PDA, not to systematically account for natural variability.
20.	For the carcasses, molybdenum varies between 0.002 and 0.02 mg/kg with a fair amount of variability between fish within sites, with many of these values representing undetected amounts. Tungsten varies between 0.003 and 0.07 mg/kg, with a fair amount of variability between fish within site, with many of these values representing undetected amounts. The high variability is also observed for all the metal concentrations.	The purpose of the baseline report is to describe baseline (existing) conditions currently present in or near the PDA, not to systematically account for natural variability.
21.	Viscera display slightly higher concentrations but with a high variability as well, with molybdenum ranging from 0.02 to 0.7 mg/kg and tungsten from 0.01 to 0.2 mg/kg and two samples at 1.3 and 1.1 mg/kg, each. Hence, the detected molybdenum and tungsten are likely due to the consumption of particles. A PCA analysis of results might indicate a similarity in the fingerprint of the sediment and visceral content. Overall, it can be concluded that the detection of molybdenum and tungsten is likely due to the consumption of particles.	The purpose of the baseline report is to describe baseline (existing) conditions currently present in or near the PDA, not to systematically account for natural variability. However, while Stantec agrees that the higher molybdenum and tungsten concentrations in viscera are likely due to ingestion of mineral grains, we do not believe that a PCA analysis is required as part of this baseline report. PCA would also be confounded in cases where tissue metal concentrations are not detectable. In addition, comments in the likely utility of PCA in evaluating the distribution of molybdenum and tungsten in sediments (see response to Comment #17 above) also apply.
22.	Given that trout are not abundant enough to be used for future monitoring, a thorough analysis of the monitoring results should have been conducted. Concentrations vary with fish size and sex, and the 20 male and 20 female mature fish per site were not obtained for statistical analyses. This watershed has recreational fisheries and, as mentioned in the report, the collection of more fish would not be sustainable, so expecting to collect 100 fish per site at	Based on the data obtained during 2011, Stantec agrees with DFO that the usual EEM fish study design (calling for 20 mature male and 20 mature female fish of two species, per site) is not achievable; and if achievable, it may not be sustainable. For this reason, an alternative non-lethal fish study design was attempted during 2012 (results to follow).

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	either 10 or 32 stations covering a 12 km^2 area is not very realistic. Given the need for meaningful and scientifically defensible baseline monitoring data, an alternate approach should be developed. Examining the abundance and diversity of the benthic community for monitoring purpose is likely environmentally and financially costly and, therefore, undesirable.	Stantec disagrees with DFO that benthic community monitoring is environmentally or financially too costly. On the contrary, testing during 2011 showed that the benthic communities was fully practicable, and this component of EEM under the *MMER* is expected to be undertaken as it would be at most other metal mine sites. Northcliff and Stantec will continue to work with representatives of Environment Canada, the Canadian Rivers Institute, and other stakeholders, to develop appropriate EEM study designs for the Project that meet the objectives and requirements of the *MMER*.
23.	It seems reasonable to suggest that the approach that should be adopted in future monitoring of environmental quality in the vicinity of the Sisson mine is to use three toxicity tests: one of an aquatic plant, one of an invertebrate, and one of a fish species. This should be done with chemical analyses of sediments and biota, if possible. Acquired data would increase the knowledge base and help in additional monitoring. A stepwise approach could be followed with less than 10 stations likely a sufficient sample size.	This comment does not appear to fall within the DFO mandate (as stated in the first paragraph of Reference #3 above), and should be removed from the review. This is an area where Northcliff will consult with Environment Canada for definitive advice and guidance. Stantec notes, however, that the *MMER* requires periodic sub-lethal toxicity testing using fish, invertebrate, plant and algal tests, in addition to more frequent acute toxicity testing using fish (rainbow trout) and invertebrates (*Daphnia magna*). These tests do not provide a substitute for the field-based fish study or benthic invertebrate study.
24.	**Conclusions** With respect to fish presence/absence and abundance studies, there was good spatial coverage with appropriate consideration given to the various habitat types within each of the affected watersheds. The methodologies and calculations used to estimate fish abundance were scientifically sound.	Thank you. No further response necessary.

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25.	A PCA analysis of results might indicate a similarity in the fingerprint of the sediment and visceral content; however, given the extent of the observed variability in results, it may not show a significant difference.	The purpose of the baseline report is to describe baseline (existing) conditions currently present in or near the PDA, not to systematically account for natural variability. PCA is a technique for data reduction (simplification) that helps to identify correlations in large inter-correlated data sets. It does not provide statistical significance tests.
26.	Overall, the results for water and sediment quality are sufficient. However, they do not reflect the bioaccessibility and bioavailability of contaminants which will in turn determine potential health effects.	As the present report presents only baseline (*i.e.,* natural) conditions, the concern expressed by DFO Science about metal speciation is not warranted. In the event that the speciation or bioavailability of metals in mine effluent becomes a matter of concern, if and when the mine is operating, straightforward bioaccumulation testing using an organism such as the amphipod *Hyalella azteca* could be used to screen metals for which an investigation of speciation might be worthwhile.
27.	Given that trout are not abundant enough to be used for future monitoring and the need for meaningful and scientifically defensible baseline monitoring data, an alternate approach to monitoring should be developed. An approach that could be adopted in future monitoring would be to conduct three toxicity tests: one of an aquatic plant, one of an invertebrate, and one of a fish species. This is Environment Canada's area of expertise.	This comment does not appear to fall within the DFO mandate (as stated in the first paragraph of Reference #3 above), and should be removed from the review. This is an area where Northcliff will consult with Environment Canada for definitive advice and guidance. Stantec notes, however, that the *MMER* requires periodic sub-lethal toxicity testing using fish, invertebrate, plant and algal tests, in addition to more frequent acute toxicity testing using fish (rainbow trout) and invertebrate (*Daphnia magna*). These tests do not provide a substitute for the field-based fish study or benthic invertebrate study.

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